IFoA/NIC Roundtable: Best-laid plans - managing uncertainty in infrastructure policy

Friday 30 November 2018: 10:00 – 13:00 | Department of Engineering, Trumpington St, Cambridge CB2 1PZ

The event was introduced by Matthew Levine, IFoA Policy Manager. He thanked Professor Middleton for agreeing to chair, Sarah Rae and her colleagues at the NIC for collaborating with the IFoA on the roundtable, and Paul Larcey for securing the venue and Prof Middleton's involvement.

Note of discussion[1]

Introductory speakers

The Chair, Campbell Middleton, is Professor of Construction Engineering at Cambridge University. He welcomed the event as he believes those in the construction community need more help from finance and procurement specialists. In particular, more hard evidence about costs and performance is needed to inform infrastructure policy. He mentioned several initiatives in this area including a Cambridge Masters programme to produce leaders in engineering; use of sensors and smart technology to measure infrastructure performance; and a new think tank for the construction sector that will focus on providing a better evidence base for decision making.

Sarah Rae, Senior Economist at the National Infrastructure Commission, explained that the NIC is responsible for producing a National Infrastructure Assessment (NIA) every five years with recommendations looking 30 years ahead. The NIC's recommendations cover six sectors - transport, energy, water, flood resilience, digital connectivity, and waste. It aims to deal with major uncertainties arising from key drivers of infrastructure in a consistent way across all of these sectors. It identifies the major drivers as the economy, population and demography, technology, and the environment and climate change. The NIA does not analyse which parties in society carry the risks in each sector, but the NIC may study this in future.

In some cases the NIA's recommendations reflect that consideration is given to conflicting scenarios about future developments. For example, prioritising funding of both urban transport and rural broadband means taking scenarios seriously that predict increasing demand for either of these, even though these scenarios are not both going to be correct.

Louise Pryor, Chair of IFoA Resource and Environment Board, discussed the nature of long term financial risks, which are central to traditional areas of actuarial work such as pensions and life assurance. Key areas of risk include mortality risk and investment risk.

Climate change has an impact on these financial risks. Three aspects of climate change risk have been identified:

- Physical – floods, storms etc. Such events are a concern for general insurers and property investors, for example.
- Transitional – this refers either to the costs of moving to a low carbon economy, or the consequences of failing to do so.

[1] The event was held under the Chatham House rule and only speakers named on the agenda are referenced in this note. Views are not necessarily endorsed by the IFoA or the NIC.

- Liability – legal cases are already being brought against organisations for not meeting their duties in relation to climate change. This will lead to insurance claims.

It is important to consider the complex implications of all these climate change risks. We need to devise scenarios when there is not enough data to build full stochastic models. Each scenario is a plausible (though not necessarily likely) narrative about what could occur. Sometimes it is possible to identify certain policies that seem appropriate under a whole range of those scenarios.

Session 1 – Project appraisals

Introduced by Matt Gurden, IFoA Risk Board: In projects such as Front end issues (with the Institution of Civil Engineers) and the Actuarial Risk Principles, the IFoA has emphasised the importance of defining project goals in a thorough manner and doing so right from the start. Goals should also encompass the whole project lifetime:

1. Strategy
2. Which projects will deliver the strategy
3. Construction
4. Delivery
5. Decommissioning

Risks will exist at all stages and they should be continually reassessed.

He described the Actuarial Risk Principles approach, which includes the context for a problem, the system, and scope to use both models and scenarios as appropriate[2]. The system is constantly changing, e.g. in pensions, models used to assume fixed mortality rates but they have adapted to include a forecast of future changes in the rates. A range of case studies show how the Actuarial Risk Principles approach could be implemented in practice and could assist decision makers to understand the implications of different options.

Discussion points

- In theory, we can calculate the probability of failure of an infrastructure project using highly sophisticated mathematical analysis. However, there is a lack of data, especially for extreme events. One answer may be reverse stress testing, in which we ask the question 'What would need to happen for the project to fail?'
- We may doubt that a model has truly captured the way a system behaves. An example was a model that asserted a very extreme ('six sigma') event three days running during the 2008 financial crisis. More recent asset management models describe a range of possible environments. A best-fit approach can be used to determine in which environment current conditions are most likely to sit, but it is important to understand the limitations of any modelling.
- An adaptive approach enables small, incremental steps in construction projects. This makes it easier to make changes to the original plan during the process, and has been used in flood defences, for example. Another advantage of the adaptive approach is that it avoids forced binary decisions which it may be unreasonable to expect project sponsors to make upfront. However, one problem with adaptive construction is that it can increase short-term costs. This

[2] https://www.actuaries.org.uk/news-and-insights/public-affairs-and-policy/evolving-risks-and-future-insurance/actuarial-risk-principles

can make it harder to demonstrate value for money for the overall project, although the result of all the adaptations could indeed provide value for money even if some of the individual stages do not.

- In planning projects, the cost and duration of the construction process is often analysed in a very basic manner, e.g. not exceeding budget by more than a percentage contingency. This contrasts with the sophisticated analysis used for other aspects of the project.
- Project risk ratings from the rating agencies do not take account of construction industry views, and investors often perceive the risks to be greater than they are. This contributes to the infrastructure investment gap.
- Construction firms feel frustration that the Government leaves too much of the risk with them. However, Government feels that it is holding too much of the risk!
- Banks sometimes invest in certain kinds of construction with limited risk (such as renewable energy) because they believe the market is exaggerating the risk. However, pension funds and insurers in the UK are not in a position to do likewise because credit ratings for construction are so low (BBB- is very good). Some overseas institutions such as Canadian pension funds have more leeway.
- It was noted though that capital markets cater for different risk appetites, and pension funds and insurers are able to get infrastructure construction exposure using bonds.

Session 2 – Infrastructure modelling

Introduced by William Usher, Infrastructure Research Transitions Consortium (IRTC): Strategic planning for infrastructure requires a sense of social needs and existing provision. Technology allows us to monitor and evaluate infrastructure.

He highlighted two kinds of uncertainty: natural/inherent variability, for example wind speed or economic markets; and epistemic uncertainty which is about lack of knowledge, where more information can be useful.

Uncertainty is also a feature within models, affecting both the structure of the model and the assumptions used to set parameter values. Sometimes it can be quantified, but if not one approach is to devise scenarios. In the IRTC's strategic long-term planning of national infrastructure systems, uncertainty is managed by assessing robustness of investment strategies under a range of scenarios at the upstream planning stage. This crucial step allows exploration of alternatives, optionality and portfolios without committing resources and before commencing projects.[3]

Discussion points

- Uncertainty can be seen as lack of knowledge. There are degrees of uncertainty and we need to do a focused search for more knowledge.
- To get a good understanding of a model we can't just focus on the central or mean outcome. We need to look at the whole range of outcomes including the more extreme 'tails'.
- Climate scientists are communicating model results largely for an audience of government and international organisations. Although they have information on the full range of outcomes, their projections concentrate on averages. However, they are increasingly focusing on influencing the financial and infrastructure sectors. Reporting averages is not fit for purpose for that context. There is a major opportunity for more and better communication between the two groups.

[3] See www.itrc.org.uk for further details.

- Stakeholders may agree on the mathematical probability of a risk but judge its significance very differently. One example given was that in the climate science community a probability of around 5-10% is considered low. The collapse of the Western Antarctic ice sheet leading to sea levels rising by several metres would be seen by climate scientists as quite a low risk, but given the potential impact other groups would see it as a major one.
- Lack of adaptation to risks is certainly an issue, but over adaptation can also be a problem, and sophisticated information is needed to inform these judgements.
- Probabilities are also very difficult to estimate accurately, and may be higher than assumed. This should be taken into account when considering which possible outcomes decision makers need to think about.
- It is important to understand that where risks are correlated this can have a big impact on the behaviour of the whole system.
- Where risks have a low probability but high impact, there is a tendency within many models to spread the impact over several years. However, in the real world the impact can be large and immediate – one example being the recent bridge collapse in Genoa.
- Resilience is an important factor. How can we assess the level of resilience a project needs? This is related to how much account should be taken of potential impacts. Greater resilience implies increased investment costs.
- Projects involve many different risks, and different parties have different risk appetites. We should consider which party is best placed to take on each of these risks.
- This is especially important in terms of the balance between the government and the private sector. For example, in the Thames Tideway project the Government took on the associated catastrophic insurance risks, e.g. collapse of riverside buildings, which would be difficult for either side to price.
- The more information is available to investors, the more they will be willing to price the risks. If they can't do so, they will either price it at unrealistic levels or refuse to take the risk on.
- Different parties have different ways of assessing the risks – for example, bankers, insurers and equity investors. Bankers' views of risk are often paramount when we are looking at the infrastructure sector. Potentially these differences could be studied with a view to creating a more level playing field where non-banking views are not submerged. However this exercise should not remove the variations in approach, since there could be a danger of groupthink.
- Risk mitigation is a very complex task but can have large benefits. For example, insurers might hold only a small proportion of the risk in a project but this involvement could allow their risk mitigation analysis to be used to reduce risks across the whole project.
- One issue is lack of common articulation between research and finance. The i3P infrastructure innovation platform may offer a way to tackle this.

Session 3 – Project finance

Introduced by Steve Lomas, Infrastructure and Projects Authority: 50% of the £600bn pipeline of planned UK infrastructure over the next ten years will come from private finance. The majority of this will be delivered through regulated assets. The UK government remains committed to private investment playing a key role in investment in the UK.

Currently there is a debate and mixed views around whether there is a need to replace the EIB, though these views may change over time.

PFIs/PF2 have not been used in recent years and will no longer be used as a financing tool following the Budget announcement in October 2018, and the future of PPPs is unclear.

The investors are institutions and investment banks. Pension funds prefer to focus on operational projects while banks are more willing invest in the construction stage of projects.

There is plenty of capital looking for projects, so funding is a problem rather than finance. There is always a key question of whether consumers or government should pay.

In some areas project finance does still play an important role, for example renewable energy projects.

Opportunities for Greenfield projects are limited at present, not only in the UK but in Europe and globally.

Financials models in infrastructure projects have limitations. Projects are more than just financial models. It is also important understand the technical aspects, understand the asset and meet the key individuals involved in a project.

<u>Discussion points</u>

- The infrastructure investment market focuses too much on the short term, and a culture change is needed. The approach of the National Infrastructure Assessment suggests this is beginning to happen.
- Credit risk from contractors is a significant concern to investors. They are worried that the concession holder can be removed suddenly, creating large losses. Examples mentioned were the Genoa disaster and hospital building contracts with Carillion. Investors are therefore looking for improved credit to reduce their risks. Political uncertainty is a significant issue for potential investors.
- However, constructors can argue that procurement terms mean they are being asked to take on too much risk, and that margins are too low.
- Clients are trying to minimise short term costs, but this could lead to higher operational costs and possibly the failure of the project. Short term costs are the wrong measurement, and the industry has to make inefficient compromises to try to achieve such targets.
- A whole life costs approach would be cheaper in the longer term. To make progress towards this goal, such an approach could be tried for some relatively small projects to create an evidence base of case studies. This would need political will but there are already examples of good practice, such as New Zealand, or the Infrastructure Client Group (Project 13) in the UK.
- The process of drawing up commercial contracts tends to be non-mathematical, in contrast to other aspects such as engineering calculations. There is scope to make the procurement process more rigorous.
- Participants had observed that the public sector seemed reluctant to enforce contracts with the private sector. Governments will therefore miss out on potential cost savings because they wish to avoid starting an arbitration process, and private firms are aware of this. Without enforcement, KPIs often fail. A whole life costs approach is pointless without enforcement.
- Where major long-term investment will be needed – for example charging points for cars in homes - the NIC and the Government could look to create revenue streams to attract institutional investors. The estimated cost per household could be around £1,000 but there could be a market to spread this over a long period.

Conclusions – take away points

Projects

- Rethinking procurement – instead of minimising costs for a required output, ask bidders to maximise the quality of output for a given budget
- The contractual process needs to become more sophisticated
- Strategic approaches such as the Actuarial Risk Principles are important
- More focus on resilience is needed
- Enforcement and assessing the risk of not enforcing agreements

Investment

- Find ways to develop the defined contribution infrastructure investment market
- Promote investment in projects that will further the UN Sustainable Development Goals
- Investors are demanding excessive returns. To change this we need to move past discussion to action and 'just do it', and government must be involved
- The construction sector needs to have a greater voice in discussion of risk in finance, e.g. regulatory issues like Solvency II
- New funding models – from both a private sector and government perspective
- Understanding how much extra investment is needed to obtain more robust and adaptable infrastructure

Risk

- Be aware that different stakeholders assess risk in different ways; consider how to use data to accommodate these different approaches
- Understanding different risk appetites and how this relates to available information
- Look at the range of outcomes (including tail risks) not just the means
- It is important to find a common language in the modelling process

Communication

- Different communities need to do more sharing of their methodologies
- Improved communication and engagement, especially to the construction sector and infrastructure owners
- Communicating a complex view of risk to the infrastructure community