

An Introduction to Corporate Foresight



ARUP

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Introduction to foresight

Foresight ≠ forecasting

Foresight refers to a range of practices, methods, tools and techniques that help organisations actively explore, shape and manage the future. This includes understanding key drivers of change, possible projections into the future, and the implications of change on specific businesses, projects or contexts. Foresight activities are not intended to predict the future with complete accuracy. Rather, they enable practitioners to explore plausible futures (plural), informed by current trends and trajectories as well as emergent signals of change.

Foresight utilises a wide variety of methods, ranging from creative (e.g. wildcards or science fiction) to evidence based methods (e.g. modelling and bibliometrics), and from expert based (e.g. technology roadmapping, Delphi surveys) to highly interactive or participatory methods, (e.g. brainstorming, prototyping). A lot of the methods used in foresight originate from disciplines like social-psychology, scientific management, systems theory, probability and game theory.

Foresight supports strategy, risk and innovation processes

Corporate foresight can be applied to a broad range of business contexts. These include strategy, risk and innovation processes as well as the delivery of marketing, design and engineering projects. All of these benefit from a critical exploration of the future. The aim is to ensure that future opportunities are maximised and that risks are minimised. Foresight is also used for organisational change, corporate strategy and in the early stages of assessing financial investments (e.g. in start-ups) and mergers and acquisitions (M&A).



Figure 1: The Foresight Diamond captures the range of knowledge sources used for different foresight approaches. For example, expertise-based methods rely on the skill and knowledge of individuals in a particular subject, while evidence-based methods use data and analysis.¹

A short history of foresight

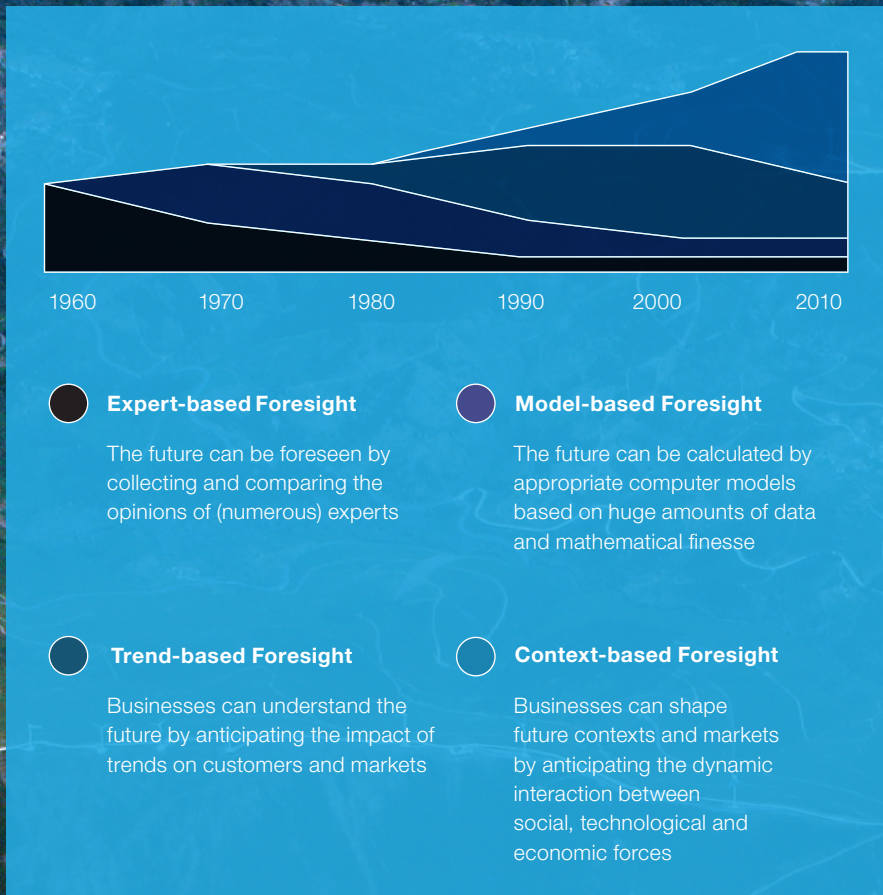


Figure 2: A short history of foresight over time showing the emergence and dominance of different forms of Foresight thinking, from a focus on expert-based foresight in the 1960s to a focus on context-based foresight today.²

The role of foresight in innovation management

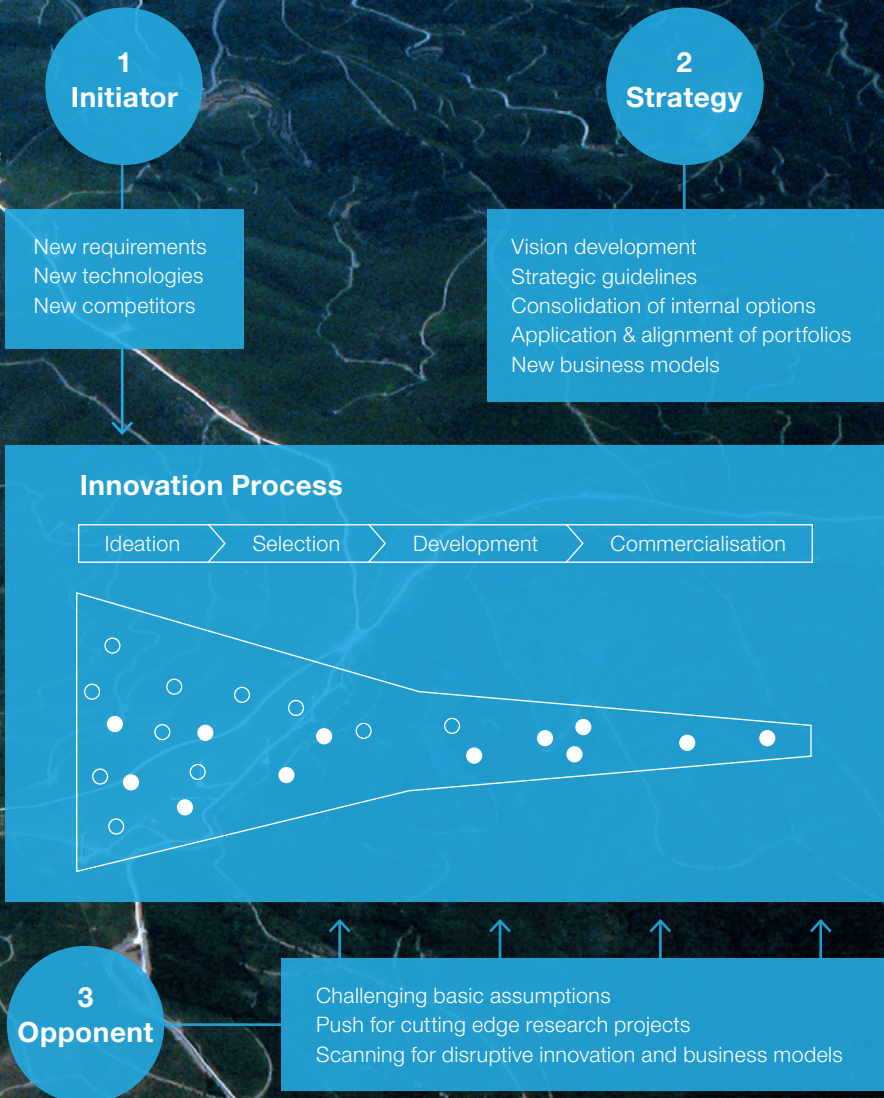


Figure 3: An example of the application of foresight in an innovation process. Strategic foresight combines elements of trend and futures research within strategic development and innovation management. In doing so, foresight aims to:

1. initiate and catalyse (e.g. conversations about emerging technologies and emerging threats)
2. strategise (e.g. stimulate discussions and provide evidence for new business models)
3. challenge (e.g. basic assumptions of what a firm's core business will be in the future).³

The background is a vibrant, isometric illustration of a city. A river flows through the center, with bridges and small boats. The city is filled with various buildings, including modern skyscrapers, older houses, and a large stadium. There are green spaces with trees and parks. The overall style is colorful and detailed, showing a mix of urban development and nature.

*"Can we predict the future?
"No", says the chaos theorist.
"Yes", responds the astrophysicist.
"To an extent", says the economist.
"Usually", says the meteorologist."*

—Pillkahn 2008⁴

Change is constant

The average lifespan of an S&P company has dropped from 67 years in the 1920s to just 15 years today, and it is estimated that 75% of the S&P 500 firms will be replaced by new firms over the next decade. Supporting organisations in “future-proofing” is crucial as the external environment is becoming more complex, uncertain and volatile. The acronym VUCA (volatility, uncertainty, complexity and ambiguity) captures the essence of this development, where every industry and business is subject to massive change and is constantly challenged to understand and adapt to changes in their business environment.

Foresight aims to help organisations actively manage a world where “change is constant”. This includes identifying relevant trends and translating what these mean for a specific context, such as a market, business, project or team. By employing techniques such as horizon scanning and scenario planning, businesses can better identify, explore and utilise change. Scenarios, for example, allow businesses to map out alternative strategies, identify gaps in the products portfolio, and plan for eventualities. Trend research can identify new growth markets and support product innovation and development processes. Overall, these tools can increase the sensitivity of the organisation to external drivers, and support the long-term survival and growth of the firm.

Overcoming “future myopia”

Foresight aims to counter the risk of being short-sighted by developing people, capacity and skills that allow organisations to actively manage future trends and embed corporate foresight into business management, project delivery and strategy processes. Two of the crucial success factors for long-term survival and success in the marketplace are peripheral vision and absorptive capacity.

Being able to widen the business perspective and look for information that is ostensibly unrelated to the current core business and practices of a given organisation is key to identifying signals of change early. Innovation relies on this peripheral visioning capability (“detecting the signals”) as well as on making sense of them by “learning from the future”.

Absorptive capacity refers to the ability of an organisation to make sense of, and learn from, those stimuli. Foresight is thus applied by organisations to increase their chances of adaptation and development.

Corporate foresight in industry

A broad range of companies (mostly in the durable goods and process industries, such as automotive, machinery or chemistry) have dedicated foresight functions. These are set up to better anticipate and manage future change and are often embedded in different parts of an organisation (strategy, innovation, marketing, R&D etc.). The specific application of foresight will depend on the primary objectives of the team and wider organisation.

Shell

In the 1970s, Shell used scenarios to consider how the firm should react to a possible increases in the oil price. In this way, the firm achieved strategic preparedness when the first oil crisis occurred in 1973. Scenario planning has now been in use at Shell for more than 45 years.

BASF

An internal think tank at BASF performs a range of foresight functions to understand change and identify new business opportunities and growth fields. At BASF, foresight is closely linked with innovation processes. The aim is to identify relevant trends in the market and translate these into new opportunities for product and materials innovation.



Volkswagen

In the early 2000s, Volkswagen Group embedded a foresight team into the Group Research function, linking the team with the group's most innovative researchers. With the "dieselgate" scandal the visibility and reputation of the foresight division increased, as some (post-conventional vehicles) concepts had already been scripted by the team.

Frost & Sullivan

A Visionary Innovation service at Frost & Sullivan provides insights on how transformative developments will impact future markets and the world more broadly. It examines global future trends and early warning signals to provide contingency planning for the future.

Foresight methodologies

Foresight is a participative process that involves interaction and knowledge exchange in order to fully benefit from multiple perspectives and areas of expertise. There are a broad range of foresight methodologies which combine both quantitative and qualitative approaches.

Key foresight methodologies include:

Horizon scanning

Horizon scanning refers to the systematic identification, analysis and communication of signals of change relevant to a specific focal area (see figure 4). Horizon scanning is a common foresight technique that feeds into a range of futures work. In essence, horizon scanning helps us identify the trends and issues shaping the future. The activity can be structured by the STEEP analytical framework, covering socio-cultural, technological, economic, environmental and political domains. The framework ensures that all developments and influencing forces are considered comprehensively across a wide spectrum.

Trend research and analysis

A trend can be defined as the tendency of a subject to move in a particular direction over time. Trend research focuses on identifying short- to long-term tendencies in society, technology, economics, environment and

politics. The identification of trends is followed by an analysis of how changes will impact a specific organisational context. This can be the wider market, or a specific business or project.

There are a number of ways to classify trends, including by duration, influence or structure. Trends range from short-term ‘fashion’ trends (colour or style of the season) to megatrends (long-term evolutionary changes that have an impact globally and across all markets). Trend research methodologies and applications vary enormously across sectors and areas of application, depending on the market a company operates in and the relevance of different time horizons. Fast moving consumer goods companies, for example, have short innovation cycles and shorter lead times, leading to a focus on short- to medium-term trends that impact product innovation.

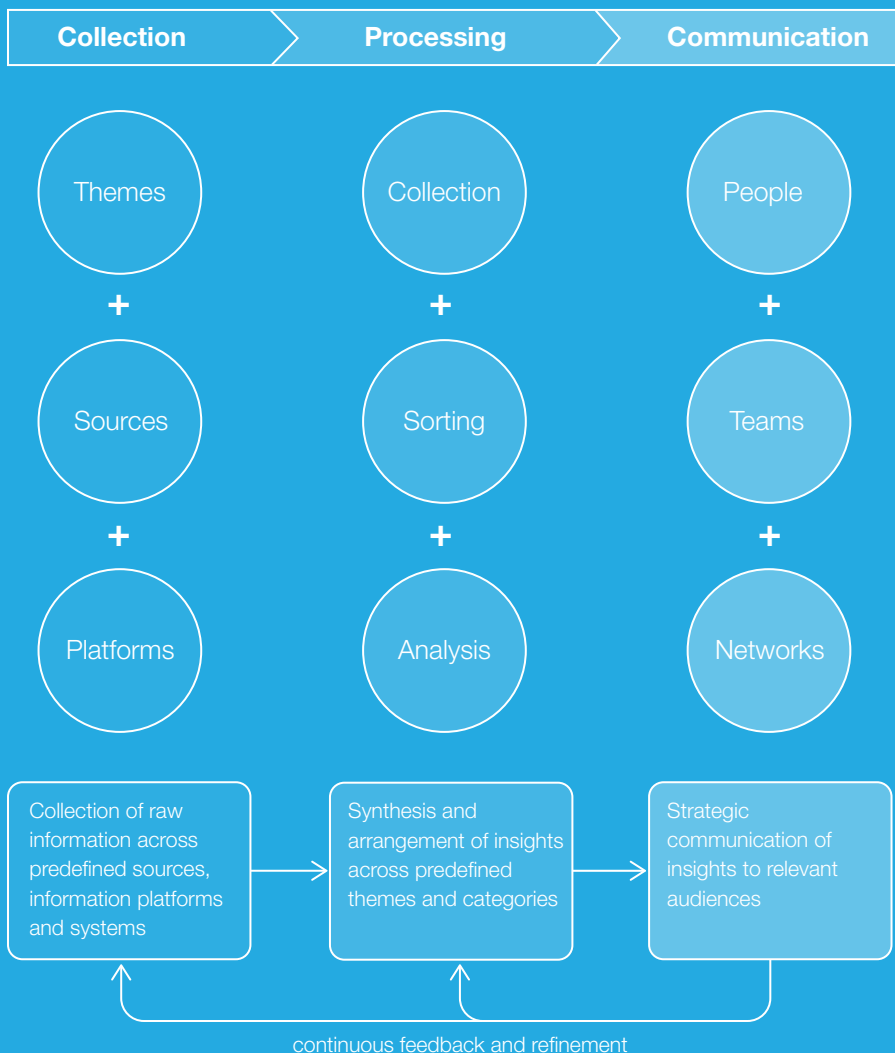


Figure 4: Example of an integrated horizon scanning process. Effective horizon scanning integrates the collection of insights with a strategy for processing insights and effectively communicating outcomes across the organisation.

Future of Manufacturing

This horizon scanning report for the UK Government Office for Science, on the future of manufacturing to 2050, was based on findings from workshops held in Berlin, Singapore and Washington DC. It formed part of the Government Office for Science's two year research programme intended to support a growth strategy for the manufacturing sector in the UK. The workshops explored 75 global drivers shaping the future of manufacturing. The report served as one of 30 evidence papers that underpinned a government paper on the Future of Manufacturing, published in October 2013.

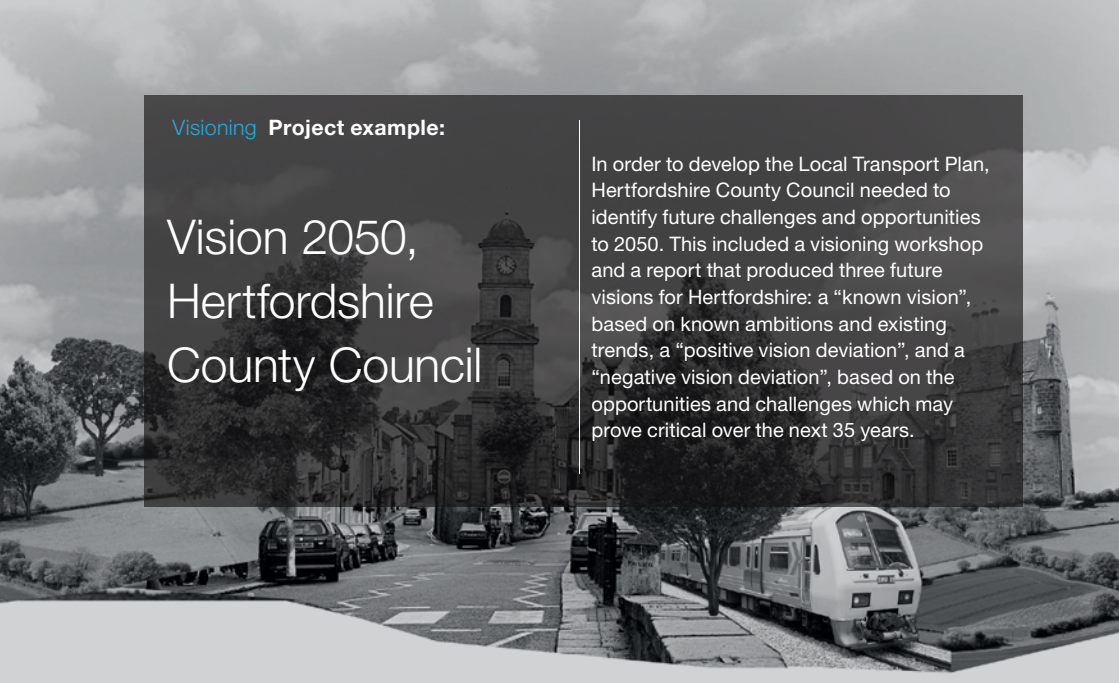
In contrast, companies that invest in infrastructure need to consider the lifecycle of assets over a number of decades, leading to a greater focus on longer-term trends. Large multi-nationals, such as Unilever, have a broad portfolio of interests that span across timescales (e.g. from short-term innovations in product packaging to long-term investments in production infrastructure) and consequently tend to cover the entire spectrum of change. Some examples of common trend classifications include:

- **Weak Signals:** Early signs of directional change which indicate a tendency within a specific theme or domain. Often referred to as “seeds of change”, they can provide advance intelligence or “hints” about potential future trends. New technologies, for example, are often classed as weak signals as they might

offer an intriguing solution, but their true potential and impact remain uncertain.

- **Micro-Trends:** Changes seen in a specific region, industry or business. For example, the trend for people to move into smaller and smaller houses in some cities, or the trend of “mindfulness” that has made its way into homes, schools and boardrooms.
- **Megatrends:** Trends that are far-reaching, sustained and relatively certain. These are macro-evolutionary changes that describe complex interactions between many factors, and that impact a broad range of markets globally. For example, ageing populations or urbanisation.

When looking at trends it is important to also consider countertrends and wildcards. A countertrend might reverse the observable



Visioning Project example:

Vision 2050, Hertfordshire County Council

In order to develop the Local Transport Plan, Hertfordshire County Council needed to identify future challenges and opportunities to 2050. This included a visioning workshop and a report that produced three future visions for Hertfordshire: a “known vision”, based on known ambitions and existing trends, a “positive vision deviation”, and a “negative vision deviation”, based on the opportunities and challenges which may prove critical over the next 35 years.

trend, while a wildcard might derail the trend trajectory. A wildcard is a low probability, high impact event that has the potential to fundamentally change the workings of a specific region or market (for example the impact of the 9/11 terrorist attacks on the aviation industry).

Visioning

A vision is a description of a preferred future state. It describes what a world or organisation should look like in the future, or what a project or initiative should achieve. Organisations and large capital projects should have a common vision in order to ensure that different components and contributors work towards a common goal. Visions can provide the overall direction and framework for a project and support

strategy, collaboration, creative thinking, design innovation and leadership.

Future user journeys

User journeys explore the future through the eyes of the customer or “user”. This people-centred approach ensures that new products, services or experiences are designed around people and their expectations and desires. It ensures that innovation is driven not only by a technology opportunity, but also by creating experiences for people. User journeys allow the analysis and conceptualisation of new innovation opportunities, help communicate and share new ideas, and allow organisations to explore new ideas through a different lens.

Future of Rail 2050

This thought-piece takes a user perspective, bringing future scenarios to life with fictional user journeys in 2050. It focuses on the passenger experience, and sets out a forward-looking, inspiring vision for rail. The user journeys are intended to generate a conversation about the world ahead and provide the big picture context for future planning and decision-making by governments and the rail industry. Each user journey is based on observable trends and emerging solutions.

Expert interviews and literature reviews

Expert interviews and literature reviews are fundamental tools of research, and are commonly used in the practice of foresight. It is useful to talk to experts in the exploratory phase of a project in order to gather opinions around the topic being explored. A literature review is a key part of the scanning process in order to understand what research has already been conducted on the subject, and to help to map the existing evidence base.

Brainstorming and brain-writing

One of the most frequently-applied tools in meetings and workshops is brainstorming. It is a group technique that can be applied to creative problem solving and for generating

ideas. Popularised by advertising executive Alex Faickney Osborn in his 1948 book “Your Creative Power”, brainstorming (properly done!) can make major contributions in creative, forward-looking projects.

Brainstorming works best in smaller groups that already have a certain basic knowledge of a subject. However, as not all people feel comfortable speaking, one can also use “brain-writing”. Each person in a group writes down one idea on the given subject and passes the piece of paper to the next person, who adds some thoughts. This continues until everybody gets his or her original piece of paper back.

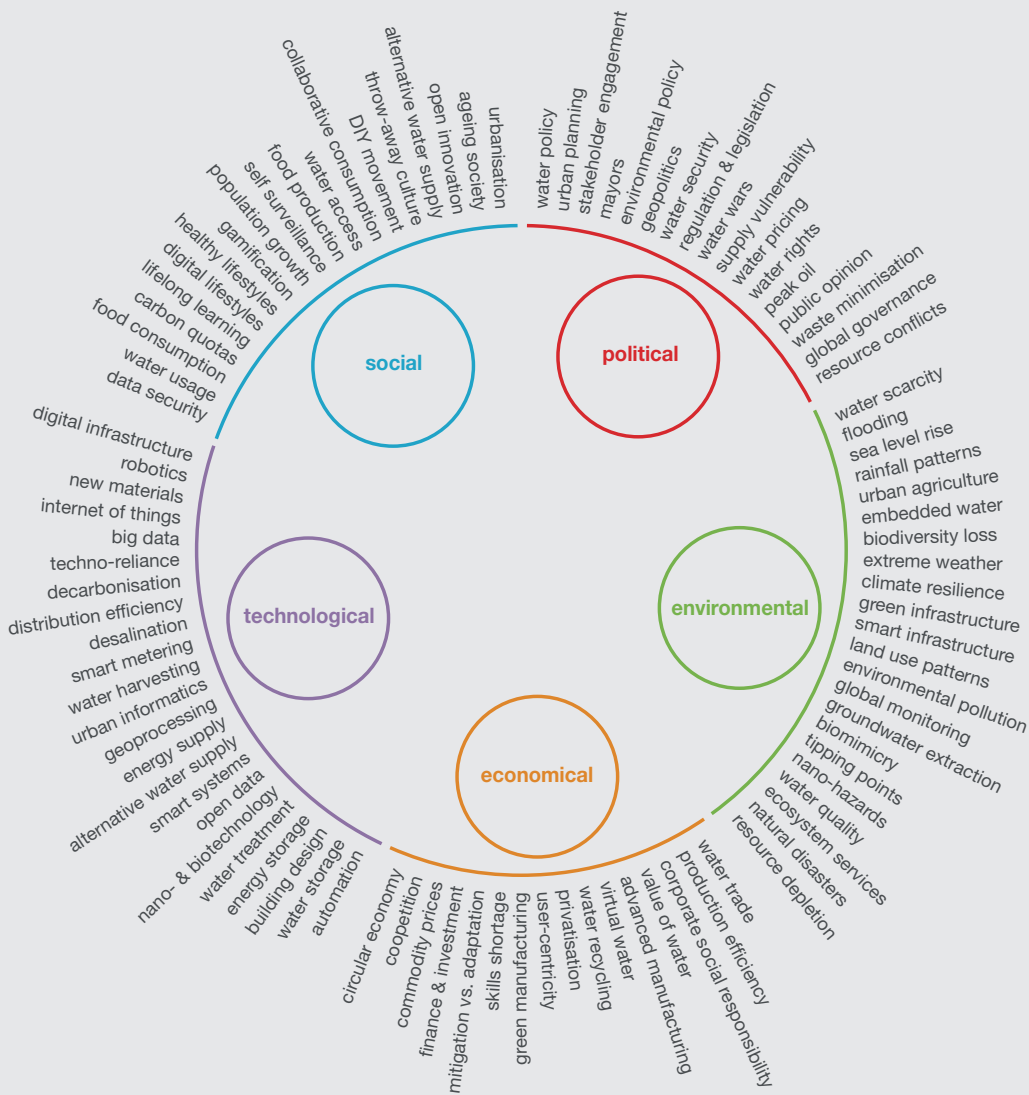


Figure 5: The STEEP framework supports a holistic evaluation of future trends. It ensures that project stakeholders explore the future through a variety of different lenses.⁵



1. One idea at the time



2. Encourage wild ideas



3. Go for quantity



4. Be visual



5. Headline!



6. Build on others' ideas "yes, and"



7. Defer judgement



8. Marking and sifting

Figure 6: Brainstorm rules. Following the basic rules for brainstorming is essential. It is important to withhold criticism and to encourage quantity (instead of quality).⁶



Stakeholder workshops
Project example:

Cultural Heritage research roadmap

The Foresight team, together with Arup's consulting practice, developed a business strategy and research roadmap for Arup's cultural heritage business. A horizon scanning activity identified and communicated a range of trends impacting the future of cultural heritage. These were designed as a card set for use in a workshop with internal staff and a number of key external collaborators, including representatives from Historic England, ICENI, the RSA, University of Reading and University College London. A day-long workshop then considered the current and potential future influences on cultural heritage within the UK, to steer Arup's business focus going forward.

Stakeholder workshops

Workshops are a useful way to bring together a group of experts or stakeholders to explore trends and emerging issues that are most relevant to a particular client. Typically, participants are tasked to collectively identify key trends and collaboratively examine their implications. Workshops often bring together a diverse set of stakeholders with expert knowledge across a range of STEEP domains. Workshop methodologies applied in foresight tend to be adapted to the specific client or context. Customising the approach aims to ensure that the process and outcomes are tailored to the needs and expectations of the client or stakeholder. Standardised workshop approaches are

favoured in the delivery of a series of workshops, where there is interest in comparing and contrasting outcomes across different regions or stakeholder groups.



“Scenarios help the organisation to become more adaptable by expanding their mental models of the business environment and thereby enhancing the perceptual capabilities needed to recognise unexpected events and take proactive action.”

—Kees van der Heijden 2005⁷

A focus on scenarios

Scenarios are hypothetical illustrations of the future that describe a cross-section in an established context. They include qualitative and quantitative elements and are intentionally applied in multiples to show indeterminacy and possible alternatives. Scenarios are plausible descriptions of how the future may develop, based on a coherent set of assumptions about key relationships and driving forces.

Scenarios are neither predictions nor forecasts, but plausible chains of cause and effect; clusters of plausible assumptions and environmental changes and trends, combined to develop a set of alternative, internally consistent future worlds. Scenarios can be based on quantitative, scientific evidence as well as qualitative information and opinions. One of the gurus of scenario planning, Kees van der Heijden, who was part of the senior executive team at Shell that pioneered the approach, calls scenarios an “invitation to strategic dialogue”. Scenario planning is the process by which different, consistent images of the future are developed.

Scenarios are all about understanding complex systems and exploring the way these systems may change and evolve over time. They challenge our tendency to favour the “business as usual” future and not adequately exploring viable alternatives. As scenarios require a considerable effort

to build, it is important to understand when the scenario approach should be used. The main criteria for choosing to develop fully-fledged scenarios are:

- high uncertainty (of the future development of the focal issues)
- high complexity (e.g. a high number of variables, stakeholders, forces and second order effects to be taken into account)
- long time horizon (at least +5-7 years, usually more than +10 years).

Scenarios are used to widen the perspective (to overcome “future myopia”), to start a dialogue about possible futures/events (of which some are considered to be highly unlikely when creating the scenarios) and to start a strategic dialogue on “Plan B”. This is why Hermann Kahn, a military strategist and systems theorist at the RAND Corporation who popularised the term “scenarios” and the method in the post-war US, called scenarios a way of “thinking the unthinkable”.

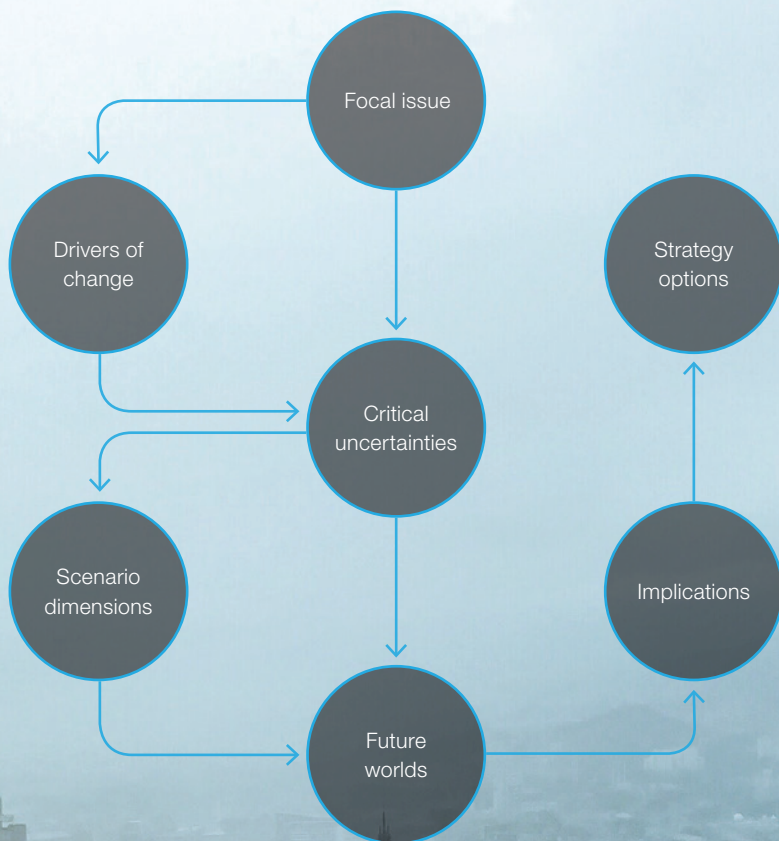


Figure 7: Deductive scenario approach. This highly collaborative process follows a comprehensive, multi-step process to identify axes and develop narratives.

The Future of Urban Water

The Future of Urban Water: Scenarios for Water Utilities in 2040 is the result of a jointly funded collaboration between Arup and Sydney Water. The programme explored trends and four plausible future scenarios for urban water utilities in 2040. These scenarios include Incremental Improvements, which describes a world with little change to existing assets and operations; Better Together which pictures a scenario where industry and utilities better collaborate across a centralised system; Autonomous Communities where households, communities and industry develop independence in water collection, processing and distribution; and Survival of the Fittest which paints a scenario with greater competition for limited resources.

The deductive and participatory approach to building scenarios is one of the most common scenario methods. It uses two orthogonal axes as a framework matrix upon which to build a set of four narratives.

The process builds upon a detailed examination of the factors and forces that are driving change in today's world, with a focus on high impact drivers of change.

Scenario sets can be used to challenge assumptions about the future, and the notion that the future is an extrapolation of the past (or that change will occur only gradually). They can help leaders and decision-makers frame their strategic thinking, and test and refine strategic options. They can also be used as a stakeholder engagement tool to

provide a dynamic context for discussion.

In general it is useful to make a distinction between:

- explorative scenarios
- normative scenarios.

Explorative scenarios are used to derive images of possible and consistent futures. Most of the time, explorative scenarios rely on identifying the most relevant drivers of change/trends for the defined area of interest (e.g. a particular industry, field of application). By extrapolating the (most likely) identified drivers into the future, a "Base Case" scenario is created, that is generally referred to as the "most likely" future as it does not take into account major disruptions (e.g. Wildcards or the reversion of stable trends).

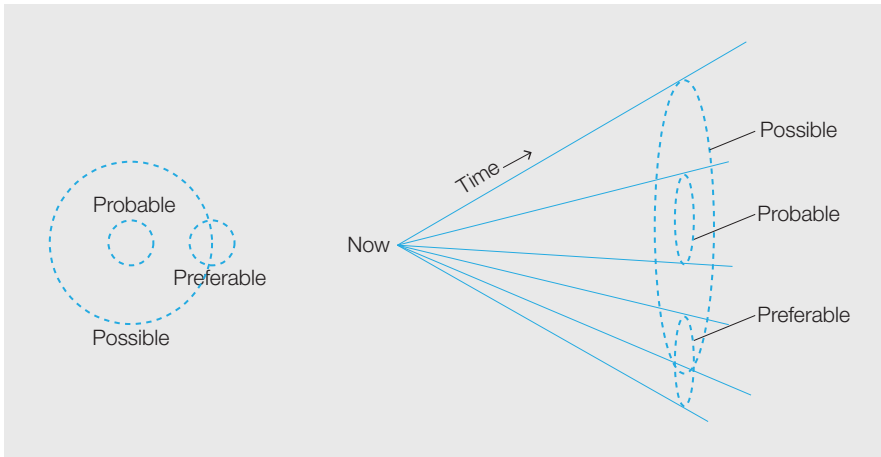
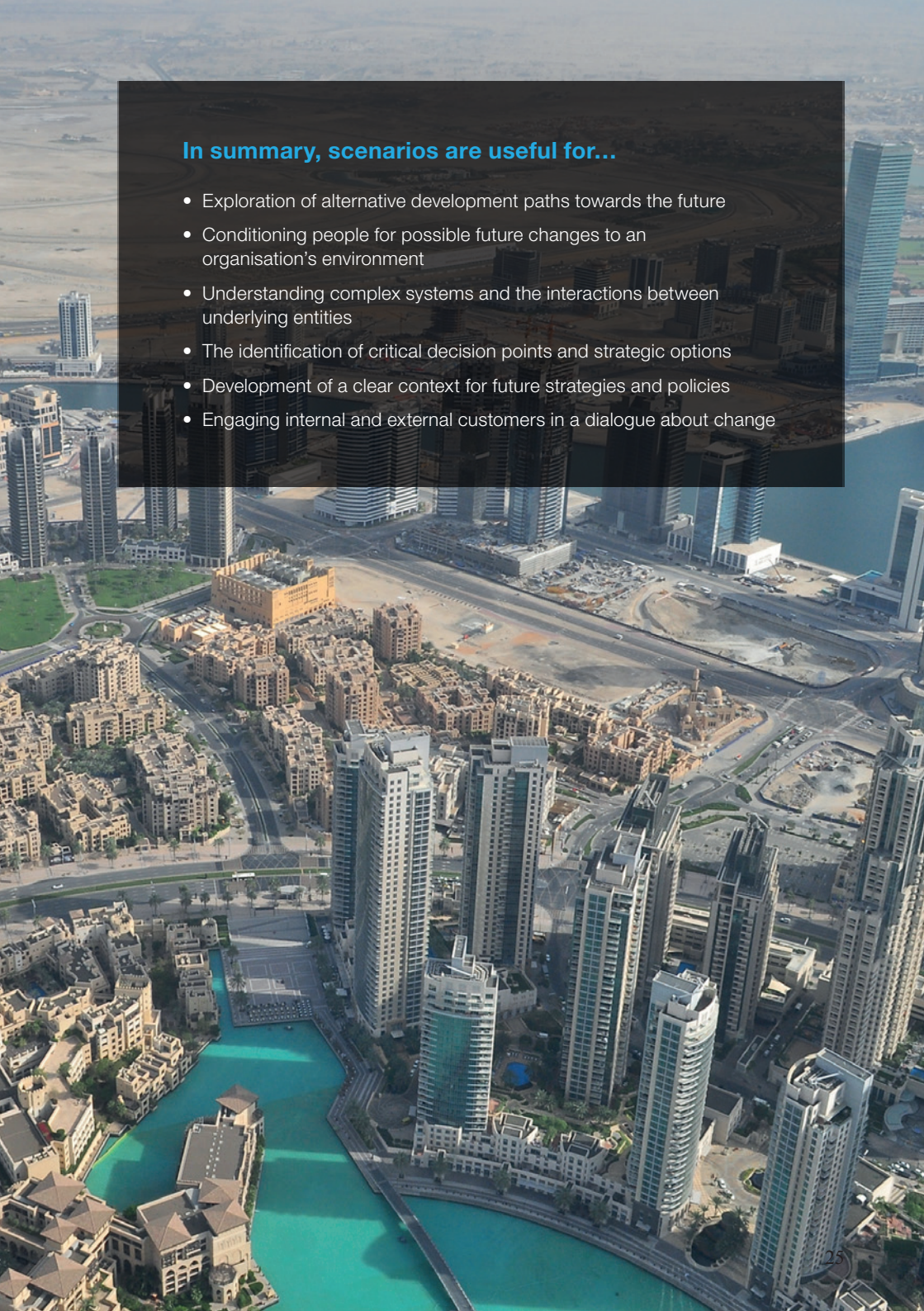


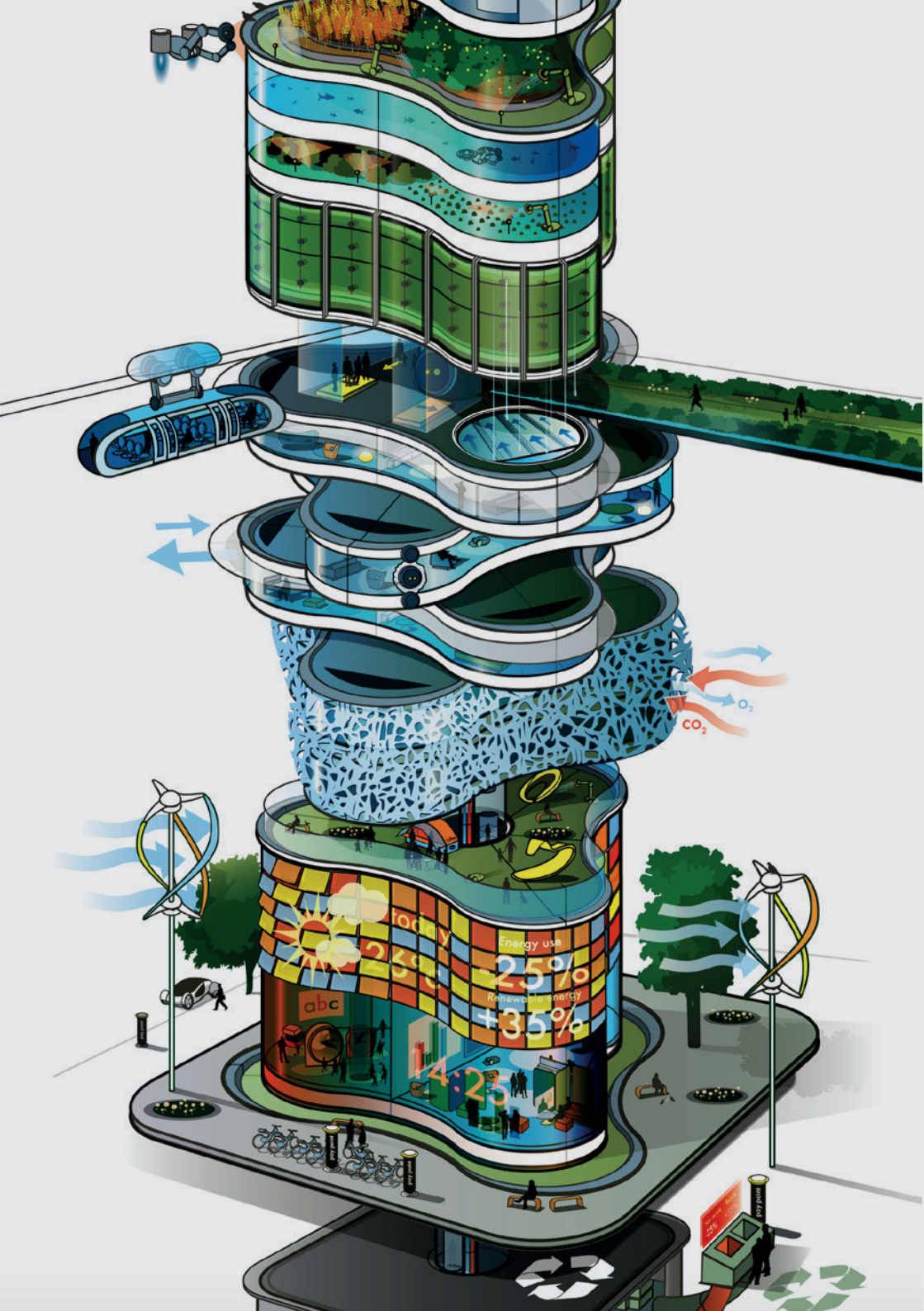
Figure 8: Scenario funnel. The further we look into the future, the greater the range of possibilities and uncertainties.

Normative scenarios create images of preferred (or “wished for”) futures. Preferred futures are often created to provide a vision for a team, organisation or a country to guide a change or development process. The lead question for normative scenarios is “what do we want our future to be like?” as opposed to the question “what will our future (most likely) look like?” when creating explorative scenarios. Distinguishing between “preferred futures”, “possible futures” and “probable futures” is crucial in setting up a scenario process.

An aerial photograph of a modern city, likely Dubai, showing a mix of high-rise skyscrapers and lower-density residential or commercial buildings. A semi-transparent dark rectangular box is overlaid on the upper portion of the image, containing white text. The city features a prominent turquoise-colored canal or artificial waterway in the lower-left quadrant. The background shows a vast, flat desert landscape under a clear sky.

In summary, scenarios are useful for...

- Exploration of alternative development paths towards the future
- Conditioning people for possible future changes to an organisation's environment
- Understanding complex systems and the interactions between underlying entities
- The identification of critical decision points and strategic options
- Development of a clear context for future strategies and policies
- Engaging internal and external customers in a dialogue about change



How to use foresight in your own work

Foresight should be seen as a toolkit of methods that can be applied to a broad range of contexts. Familiarity with the terminology and key methods should provide a good baseline for considering how to apply foresight in your own area of business. The below sections outline areas where foresight is frequently applied in the context of engineering, design and consulting services.

Engineering consulting projects

Foresight can be applied to a broad range of design, engineering and consulting projects to ensure that designs and solutions take account of relevant trends in society, technology, economics, the environment and politics.

The integration of foresight can enable a strategic conversation about the future needs of users, occupants and citizens, and can ensure that project teams deliver a solution that is future-proof and adaptable to change.

For example, Arup examined how a variety of trends may impact HS2 when Phase 1 opens in 2026. New technologies and increasingly digital lifestyles will change the way we live, work and travel, while ageing populations may have an impact on service design.

By providing a common platform for discussion, foresight can act as a key integrator of skills and project stakeholders. Foresight is also a good

differentiator when bidding for work, as it provides a unique selling point that can add value to a project or proposal.

Developing new skills

The delivery of engineering and design services will change substantially in the medium- to long-term future. Higher degrees of automation, a shift to freelance and decentralised task work, and continued industry consolidation are only some of the trends reshaping our industry. It is vital that Arup understands, participates and reacts to these changes, so that we can ensure that we invest in the right people, skills, tools and structures; and that we can deliver services that meet market needs and align with our core values. Foresight can support our professional networks in a strategic dialogue on how our skills and services will and should look like in the future.



Figure 9: Example process for the application of foresight to develop a vision for the future of skills.

For example, an Arup Explores event in London brought together a range of leading thinkers to explore Artificial Intelligence (AI), including sharing of state-of-the-art tools and methods, and its implications for the engineering sector. As AI is already impacting the built environment industry, how we anticipate and prepare our business, skills, research and systems for this change is essential.

Stakeholder engagement

Foresight tools and methods, such as workshops, help to foster dialogue between key stakeholders and decision makers collaboratively. Structured discussions on trends and their implications, threats and opportunities allows us to engage clients and stakeholders in strategic conversations about the future. This helps build consensus on a way forward, and ensures the engagement and consultation of project stakeholders on what future they would like to see.

For example, in collaboration with Sydney Water, Arup developed a set of scenarios for urban water utilities in 2040. Their viability and possible future implications were examined, including the risks, challenges and opportunities of each scenario and future urban water supply in general.

Business and regional strategy development

Foresight helps organisations look beyond their daily operations, to take a long view of their business and understand how it may have to adapt and change over time. This helps business leaders to identify core objectives as well as the strategic actions that must be taken to achieve them. Foresight can support the development of strategies for specific regions and businesses.

Key questions

Many Arup projects take years to reach completion and have a design life of decades. It is therefore important to understand the medium- to long-term timeframe and take a broad view of future change. Here are some key questions to consider during project previews and design reviews, arranged according to the STEEP framework.

Social

- Are societal changes adequately considered? E.g. digital lifestyles, or a generational preference for flexible working
- What societal trends or uncertainties could or should be considered in relation to the operational phase of your project? E.g. wellbeing, literacy, inequality, multi-culturalism, identity, attitudes to privacy, physical and mental health
- How will demographic change impact the project's success over the long-term? E.g. ageing, obesity
- What new needs or behaviours might these and other trends bring about in relation to your project?

Technological

- What existing (in use), emergent (leading edge), forthcoming (bleeding edge) or conceptual technologies should be considered in relation to your project? E.g. drones, autonomous vehicles, artificial intelligence
- What are the social implications of technological advances or disruption, and how do these relate to your project? E.g. machine learning and automation

Economic

- Are new or alternative economic models taken into account? E.g. the sharing economy or circular economy?
- What new business models or ways of working will impact this project?

Environmental

- Is the project resilient to future extreme weather? E.g. drought, flooding
- What are the implications of higher commodity or waste disposal costs?
- Will climate change mitigation measures, such as carbon quotas, affect the choice of energy inputs and outputs?

Political

- What future regulatory or legislative changes might be relevant?
- Have you considered how resilient the project could be in the face of future economic austerity or geo-political instability? E.g. societal inequality, fuel poverty, security and terrorism



*"The future cannot be predicted, but futures
can be invented"*

—Dennis Gabor, winner of the 1971 Nobel Prize in Physics, 1954



Foresight at Arup

Arup has one of the most well-established corporate foresight functions globally. This puts us on par with organisations like Shell, Volkswagen Group, and the World Economic Forum. It sets Arup apart from its competition and creates a strong USP for the Arup brand. Arup started a dedicated foresight team and internal think tank in 2002 to help the firm and our clients better anticipate change. The team still focuses on providing foresight projects and services to the firm, but also provides external foresight consulting services to the marketplace. Close collaboration with Arup's global and regional skills and businesses is key to the success of both internal and external projects.

Foresight at Arup specialises in the future of the built environment. Arup developed the concept of “foresight by design”, combining corporate foresight with Arup's global engineering and consulting expertise to provide Arup and clients with unique insights and strategies for the future of the built environment.

The Foresight team aims to provide tools and knowledge to detect risks and opportunities at an early stage, and to inform decisions relating to the built environment, business strategy or policy. The Foresight team is also responsible for the management and development of Arup's Foresight Skills Network. The mission statement of the Foresight Skills Network is:

“The Foresight Skills Network is a global community of foresight practitioners and enthusiasts. We support the firm by helping to identify the issues, trends and emerging technologies that could affect our clients, our projects and our staff. We enjoy sharing information, building capacity, and developing skills. We are unique to our industry and help Arup differentiate itself in the marketplace.”

Core foresight capabilities

Arup's core foresight capabilities and skills are delivered by a small team of dedicated experts. Team representatives are currently located in Brisbane, Hong Kong, London, Berlin, New York and San Francisco.

Our core skills and capabilities are:

- Horizon scanning, trend research, and trend extrapolation
- Identification and communication of case-studies, benchmarks, and best practice
- Scenario planning and visioning exercises
- Workshop design, facilitation and reporting
- Corporate strategy and business development
- Thought leadership and communication of insights
- Development of tools and platforms for knowledge exchange
- Building relationships and connections to other organisations
- Event design
- Facilitation
- Public speaking.

Our core capabilities are underpinned by research, presentation and design skills. This is supplemented by a high diversity of specialist skills spread across the core team. This includes backgrounds in architecture and engineering, but also art, social science, biology, economics and physics. The diversity of our staff – and our ability to explore the future from a holistic perspective – is one of the core strengths of the team.

Why do we use foresight at Arup?

Arup aims to “Shape a Better World” and the firm's designs tend to last many decades. It is therefore vital that Arup and our clients understand the trends that will influence the way people live, work, travel and interact with the built environment in the future.

This helps clients to:

- evaluate different courses of action and make more informed decisions
- take into account new trends and their implications
- position their business, skill or region to take advantage of emerging opportunities.

Working for Arup

The Foresight team delivers foresight projects and services to the firm. Our work focuses on exploring key themes and trends relevant to Arup or specific skills and business units. This helps the company gain market insights to shape strategy, consider risk and develop our business offering. Examples include the Future of Highways and Future of Rail 2050 reports, which analyse the trends impacting these transport sectors. The reports also imagine a series of future user experiences, which describe a connected, low-carbon future where intelligent mobility solutions put users at the heart of design.

Working with Arup

The Foresight team also collaborates with Arup's regions, skills and businesses to understand the trends shaping our sector and to encourage innovation and thought-leadership activities. An example of

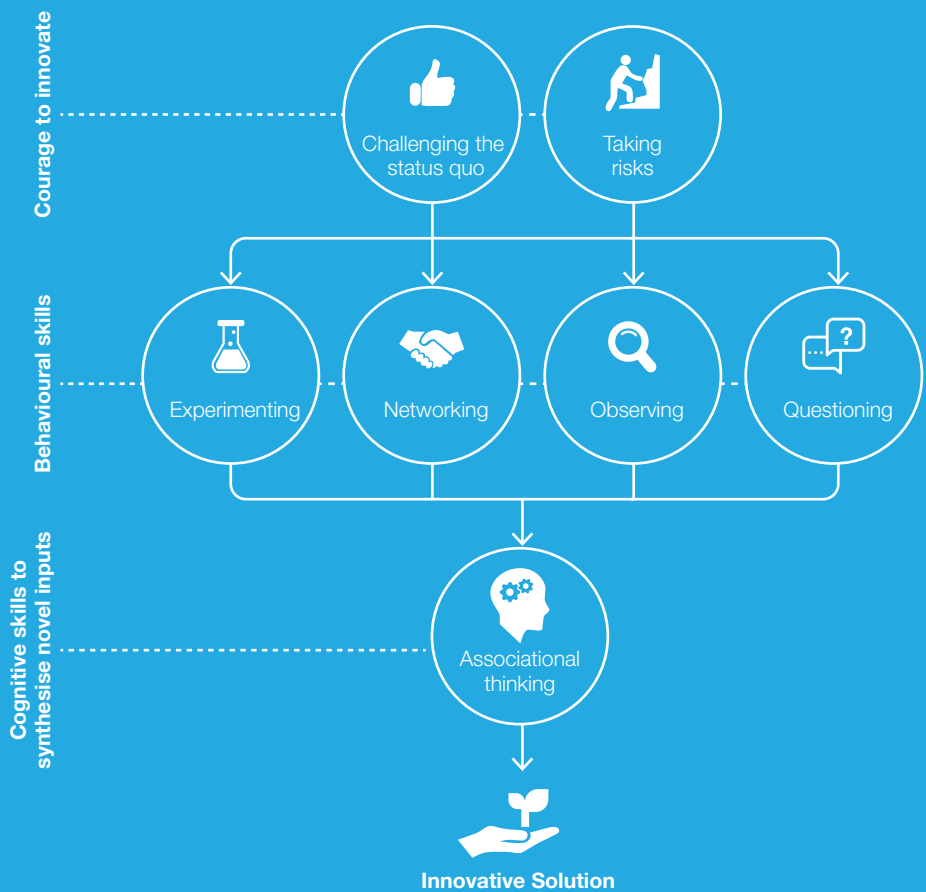


Figure 10: The innovator's DNA⁸

collaboration with other groups is working with Arup's landscape architecture team to produce *Cities Alive*, a report which looks at how we can build nature into our urban systems through new development or by retrofitting existing spaces with innovative green infrastructure design. Another example is collaborating with Arup Lighting on a report titled *Rethinking the Shades of Night*, which explores the future of night-time design and lighting in cities.

External consulting

The Foresight team also provides external consulting services to the marketplace to help clients from a broad range of regions and sectors understand trends, explore new ideas, and consider the future of their businesses. A small sample of our external client projects are highlighted below.

- **Evonik – Future of Marine Economy:**
Trend study for German speciality chemicals company Evonik, which explored emerging trends and growth fields around the topic of the “Marine Economy”.
- **Volkswagen – Rethinking Urban Mobility:**
Research and trend study focused on changing user behaviour and mobility demands and exploring how this will impact the future product and service portfolio of the Volkswagen Group, in particular the design of Volkswagen's MicroCity concept.
- **Ministry of Transport Singapore: Vision and roadmap for an autonomous city.** It focused on the impact of autonomous vehicles on the future of shared people

mobility, logistics and the delivery of public services.

- **BASF – Zero Energy Lifecycle Buildings:**
Research study exploring the future of zero-energy building design. The study provided BASF with a critical knowledge base for understanding trends in new building concepts and how these could lead to new types of product and service innovations for materials in the built environment sectors.
- **Gatwick Airport Ltd: Stakeholder engagement event with Gatwick Airport and partners across the transport sector** to consider key trends and identify ways to drive innovation in surface access. The outputs informed the airport's surface access strategy to 2030.



Key tools we use

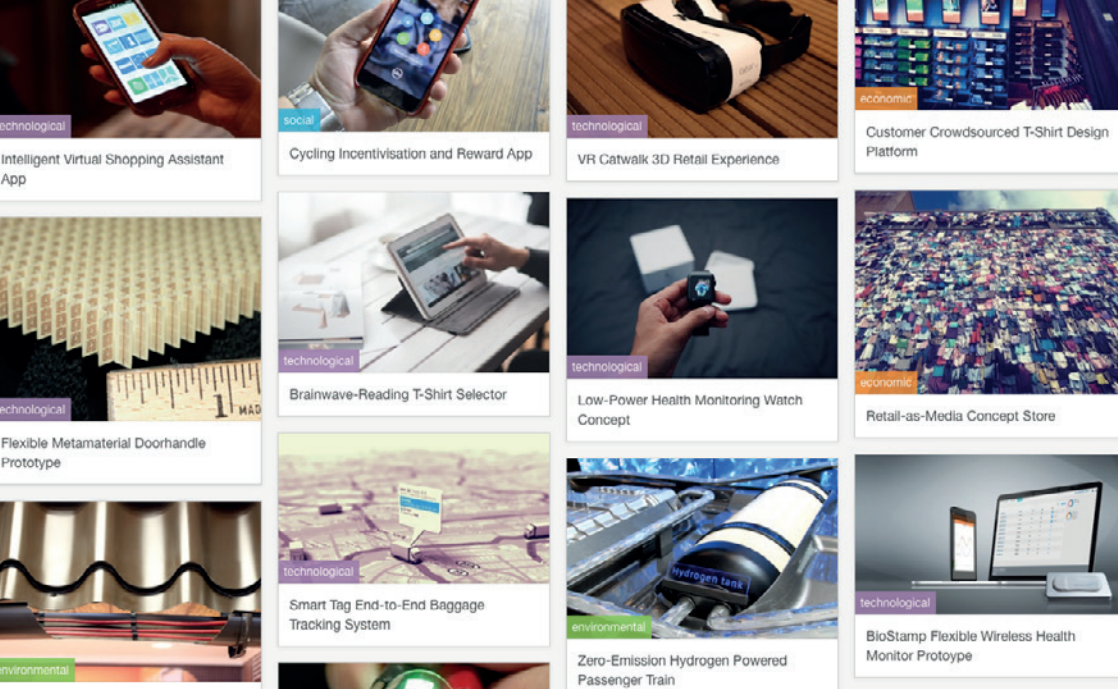
Drivers of Change:

Drivers of Change communicates research, trends, and questions about the future. It was conceived by Arup's Foresight team in the early 2000s to explore the changing contexts of our world. Since then, Drivers of Change has continued to develop and has become the hallmark of our practice, symbolising holistic thinking and high quality research. Global and local priorities evolve over time, yet we all share the singular, common context of planet earth. Our Drivers of Change publication series, consisting of sets of knowledge cards, was designed to facilitate conversation about the trends and issues that are likely to have a significant impact on the built environment and the world at large. Over the years, we have identified different "drivers" or topics that prompt change, with input from a wide variety of stakeholders. These topics have been organised into five categories, or lenses, based on their main area of impact: Social, Technological, Economic, Environmental, and Political, collectively referred to as STEEP. The issues chosen for inclusion in each set of cards were the result of a rigorous

process based upon feedback aggregated from interviews, knowledge gained from research, and hundreds of workshops with thousands of participants across the globe. The interaction with our global network, as well as consultation with Arup's broad spectrum of specialists, has led to the continuous channelling of new information into subsequent iterations. Drivers of Change is an engaging tool for cultivating relevant discussion worldwide about our future.

driversofchange.com/tools/doc

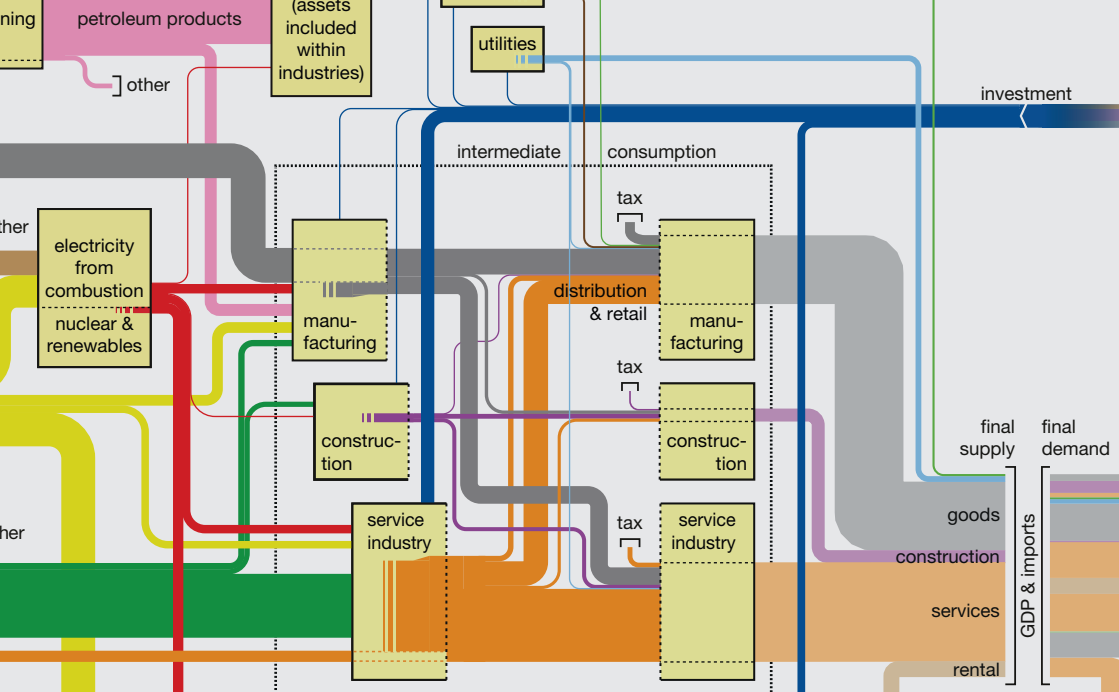




Inspire database

Inspire is a browser-based collection of emerging ideas, case studies and concepts from across the globe. It captures best practice and innovation in the built environment. It can be used as a source of inspiration for corporate foresight, strategy, risk and innovation processes. It gives users easy access to a growing number of compelling case studies that illustrate cutting-edge, innovative thinking across different sectors, markets and themes. Arup analyses and communicates what these trends mean for specific organisations, industries, markets or projects.

inspire.arup.com



7see

7see is a methodology for modelling how an economy will evolve over the next 20 years. It is based on 20 years of historical data and serves as a test bed to evaluate policy ideas. The creation of evidenced-based scenarios enables a deeper understanding of how the economy works by considering resources, the built environment, goods, services, international money transactions and people. By combining socio-economic-energy aspects of a country, it is possible to formulate consistent scenarios into the future. These scenarios are visualised using Sankey diagrams, in which line widths are proportional to the volume of flows, a snapshot illustration of the economy in one year.

driversofchange.com/tools/7see/

References and further reading

1. Popper, R. (2008) Foresight Methodology, in Georghiou, L., Cassingena, J., Keenan, M., Miles, I. and Popper, R. (eds.), *The Handbook of Technology Foresight*, Edward Elgar, Cheltenham, pp. 44-88.
2. Daheim, C. (2006) Corporate Foresight in Europe: Ready for the Next Step? 2nd Int. Seville Seminar on Future-Oriented Technology Analysis (FTA): Impacts on policy and decision Making.
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4. Pillkahn, U. (2008) Using Trends and Scenarios as Tools for Strategy Development. Siemens. Publicis Corporate Publishing
5. Arup and Sydney Water (2014) The Future of Urban Water: Scenarios for Urban Water Utilities in 2040.
6. Adapted from Ideo. Effective Brainstorming Techniques.
7. van der Heijden, K. (2005) Scenarios, The Art of Strategic Conversation.
8. Adapted from Dyer, Gregersen, Christensen (2011) *The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators*.



About Arup Foresight

Arup Foresight specialises in identifying and analysing trends shaping the future of the built environment. Our work combines corporate foresight with Arup's global engineering and consulting expertise. We translate trends into actionable insights that support strategy, design and innovation processes. We act as integrators in our business, supporting the delivery of multidisciplinary design and consulting processes. This includes the design of cities, buildings and spaces; and the processes and experiences that happen within them. Our mission is to help Arup and our clients understand trends, explore new ideas, and create value from future opportunities. We facilitate conversations about change.

About Arup

Arup is an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Through our work, we aim to make a positive difference to different communities.

Arup brings together broad-minded individuals from a wide range of disciplines and encourages them to look beyond the constraints of their own specialisms. This unconventional approach to design springs in part from Arup's ownership structure. The firm is owned in trust on behalf of its staff. The result is an independence of spirit that is reflected in the firm's work, and in its dedicated pursuit of technical excellence.

Foresight refers to a range of practices, methods, tools and techniques that help organisations better prepare for the future. In today's increasingly complex and rapidly changing global environment, the goal of foresight is to explore plausible futures and to make better, more informed decisions in the present, that are underpinned by a robust understanding of the driving forces and factors shaping change. This document provides an introduction to corporate foresight, and covers some of the basic foresight tools and methods that help inform strategic thinking, innovation and project delivery.

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