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South Africans

Thinking about

Tomorrow

Today

THINKING ABOUT TOMORROW TODAY

An introduction to using Foresight in South Africa

A publication of the Cooperation Framework on Innovation Systems
between Finland and South Africa

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November 2009

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Foresight and its context

1.1 Introduction

"The problems that exist in the world today cannot be solved by the level of thinking that created them."

Attributed to Albert Einstein

In many spheres of life, humanity is finally coming to terms with the fact that our world has changed beyond the reach of our industrial-era ways of thinking. Linear and reductionist approaches to strategy and problem-solving are no longer sufficient for dealing with the realities of our modern world, which are characterised by:

- The certainty of change, not least of all due to technological change and environmental factors such as resource scarcity and global warming;
- The highest rate of change that humanity may ever have experienced;
- Uncertainty about the magnitude and direction of the changes;
- Difficulty of visualising contexts and options in an increasingly complex environment where many of the parts are interdependent, and where the knowledge requirements increasingly transcend traditional disciplines; and
- Serious, and possibly irrevocable, consequences of errors in decision-making.

The ability of humanity to adapt and respond to change, living in sustainable harmony with itself and the biosphere, requires that we use systems thinking to mediate between the need for action and the awareness of complexity. This requires a continuous and adaptive mode of strategy and development, enabling us to shape a better future. These are the marks of the knowledge society, a step up from the old industrial socio-economy (see box).

Knowledge society

A knowledge society is one that is characterised to a high degree by the creation, dissemination and application of knowledge.

- Creating knowledge has to do with extending the knowledge horizon into the unknown by doing research on our most urgent problems—whether they be a new vaccine, a technology that simplifies a manufacturing process, or fresh insight into the human spirit.
- Disseminating knowledge has to do with the rapid distribution and absorption of knowledge amongst the population—in short, learning.
- Applying knowledge has to do with using the knowledge to make a sustained and positive difference to the lives of individuals and communities.

Although some aspects of the knowledge society have long been with us, what is new is that:

- Current technology offers many more possibilities for sharing, archiving, retrieving, combining, and generating new knowledge.
- Knowledge has become the most important capital in the present age, and hence the success of any society lies in harnessing it.

Adapted from Jan Figel (2006)
ec.europa.eu/commission_barroso/figel/speeches/docs/06_02_08_Harvard_Uni_en.pdf

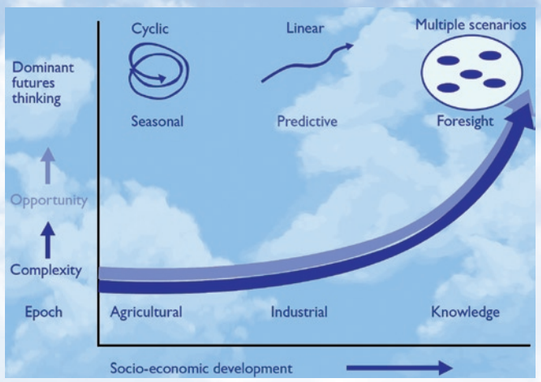


Figure 1: Evolution of futures tools through the ages

Figure 1 illustrates the transformation over time of humankind's approaches to survival strategy and tactics. This went from the cyclical, reactive approach of the agrarian era, through to linear/predictive approaches of the industrial age, and more recently to more holistic systems approaches that recognise complexity and the need to plan change as well as plan for change in the context of multiple possible future scenarios. This significant evolution over the past few decades has required an evolution of our approaches to planning and thinking about the future. In the "knowledge society", it is inadequate and sometimes misleading to rely on traditional predictive models as we become more aware of their inability to deal effectively with the increasing complexity of today's society.

Foresight provides a mechanism for investigating possible futures in a complex knowledge society. It also helps us all, individually and collectively, to anticipate and influence the future that comes to pass.

1.2 A brief history of futures thinking and practice

Our ability to consciously consider our long-term future is one of the characteristics that differentiate humans from all other life forms on Earth. Since earliest times, many individuals and societies have invested significant resources in strategies to improve their futures using prophetic and mystical forms of rite and ritual. The ancient Greek oracle, the Inca priest, the !Xü (Khoisan) shaman, the Maori matakite, and also the fortune teller and astrologer of modern times all offer to make possible a better future, or at least to give warning of what will be in store for us.

However, the fact that futures thinking and practice is not new to humanity does not mean that we have learned to adequately harness this unique capacity. Even in today's most sophisticated societies, most of us do not engage proactively and systematically with our futures, but instead remain caught up in the short-term urgencies of the present.

The long-established way to think about, and try to influence, our futures is to develop strategies. "Strategy" is an ancient concept that was recognised by the Chinese military around 500 BC in Sun Tzu, their military classic, as well as by Ancient Greek philosophers, notably Socrates. Despite its military connotations and origins, much more recently strategic thinking has taken root formally in the business world, attracting explicit attention and investment in management research.

In the 1930s, Alfred Sloan introduced "strategic thinking" to General Motors. In the 1950s, the need to rebuild nations after the Second World War resulted in decision-making being improved by a range of futures activities, such as strategic planning, technological forecasting, and economic analysis. The first use of scenarios for strategic planning was by the US military. Herman Kahn then adapted scenarios for strategic business planning in the 1960s with the aim of identifying and analysing as many futures as possible as a basis for better decision-making.

In the late 1960s, in response to the growing failure of its traditional forecasting techniques, Royal Dutch Shell employed Pierre Wack, who transformed the company's use of scenarios. Wack's scenario approach was to highlight the ways in which the future would not resemble the past. Wack used scenarios to promote "the gentle art of reperceiving", without which decision-makers would easily (and subconsciously) revert to assuming that tomorrow would bring "more of the same". The growth in Shell's success during and following the Wack era is legendary, and in the minds of many people, scenarios and futures thinking have become synonymous.

The 1990s saw dramatic growth in the systematic organisation of several other Foresight tools, in addition to scenarios. For example, some of these methods were combined within large-scale technology Foresight programmes in many parts of the world.

In the past decade, the use of such futures methods has continued to grow, driven in part by increasingly frequent periods of transition and radical change which create uncertainty about the future. For example, scenario methods have become widely used in several European countries in policy-making. Futures methods are being used more often in regional planning and decision-making. In addition, the use of futures methods for companies is becoming more professional and widespread, not only in strategy development, but also in innovation, as well as in marketing and R&D.

1.3 What is Foresight?

Foresight

the disciplined analysis of alternative futures

There are different definitions for Foresight; the terms "Futures" and "Foresight" are often used interchangeably. For the purpose of this booklet, the term is used to refer not only to disciplined thinking about the future, but also to the tools and processes that have been devised to imagine, capture, analyse and act upon a range of possible longer-term futures.

Foresight includes a variety of mechanisms intended to capture the dynamics of change by re-evaluating today's reality within the context of tomorrow's range of possibilities.

- It is inherently proactive, reflecting the belief that the future may be influenced by today's decisions and actions–ie "shaping the future".
- It is not prediction, recognising that addressing the future necessitates the management of uncertainty.
- It examines development trajectories within a range of alternative futures, not just what is currently believed to be most likely or "business as usual".
- It emphasises the human abilities of forethought, creativity, and systems thinking, in addition to our traditional emphasis on analysis and judgement.

The short-term priorities that are driven by consumerism, the interests of shareholders, and the electoral cycle, make it easy for today's decision-makers in both the public and private sectors to neglect longer-term challenges. Yet the limitations of the traditional projections of future trends using past data, as illustrated by the unexpected onset of the economic recession in 2008/09, are raising awareness across the globe of the need to focus on medium to long-term time horizons as the context even for shorter-term responses.

Many decision-makers are realising that Foresight can identify opportunities and risks that would not otherwise have been considered. Foresight helps them to identify strategies that can handle a variety of outcomes. It can also help them to examine the unintended consequences of decision options, and to shape long-term actions.

In many developed countries, Foresight has thus become a reasonably established part of public and private sector strategy, decision-making and advocacy. Being able "to engage the future sooner" is recognised as

An example of relating Foresight and governance

- Anticipatory governance is a system of institutions, rules and norms that provide a way to use Foresight for the purpose of reducing risk, and to increase capacity to respond to events at early rather than later stages of their development.
- The basic elements of anticipatory governance are:
  - a system for generating Foresight in the form of alternative constructs about the future;
  - a system for incorporating Foresight into policy-making and policy execution; and
  - a system to provide feedback connections between results and estimates.
- The need for anticipatory governance exists at every scale, from communal to global.

Foresight and Anticipatory Governance, 2009
Leon Fuerth, www.forwardengagement.org

imperative. Hence the extensive use and institutionalisation of Foresight capability by countries and organisations like the USA, Finland, the UK, the EU, the Organisation for Economic Co-operation and Development (OECD), the United Nations, the World Economic Forum, most multi-national corporations and organisations, as well as civil society groupings interested in various issues, for example environmental or technology activism. Evolving concepts such as that of "anticipatory governance" are examples of efforts to highlight the role of Foresight in governance and indeed in government (see box).

Foresight is not intended to replace such well-tried techniques as forecasting and trend analysis. These methods use indicators about past and current trends in order to extrapolate about the most probable, usually shorter-term, futures. Rather, Foresight encompasses and complements these to increase their effectiveness. Used alone, they may provide a dangerously narrow picture of the future, and often give a false impression of certainty about their predictions due to the sophisticated statistical and modelling techniques employed.

Foresight is essential in providing a more balanced approach to and context for short-, medium-, and long-term strategies.

Many of the methods that are commonly associated with Foresight (eg Delphi surveys and Scenario workshops) derive from futures research. Although Foresight continues to gain from such futures research, it is distinct. Whereas futures research can be highly academic, and even abstract, Foresight programmes are designed to be much more practical, intended to influence policy, strategy and decision-making, and to lead to tangible actions and results.

There are several "dimensions" that can be used in classifying different types of Foresight. Two useful ones are:

- Nature of participation; and
- Level of engagement.

Participation:

Approaches to participation in Foresight activities have tended to lie between two poles:

- Expert-driven: where "evidence" (data and research) about the future informs debate on longer-term strategic issues. However, use of expert opinion can lead to images of the future that appear incontestable and downplay the assumptions and uncertainties they are based on. Qualitative dimensions and stakeholder ownership can be weakened at the extreme of this approach.

- Participatory: which are more interactive and more likely to challenge the assumptions of expert knowledge.

They take into account a greater number of views, gather widely distributed knowledge, and place more emphasis on uncertainties and inter-relationships. The participants can include public authorities, business, research organisations, non-governmental organisations, and the wider public. While this increases the legitimacy of, support for, and implementation of the outcomes, it is more time-consuming and complex to organise.

Level:

Although Foresight is often discussed at the level of strategy, it is also often used tactically:

- Strategic level: where Foresight methods are used for big-picture, exploratory analyses about the state of the future at, for example, a selected geo-political or sectoral level. The time horizon and scope for Foresight in strategic planning would typically be longer and wider, respectively.

- Tactical level: where the application is at a unit-planning (eg annual programme planning) or a topical problem-solving level. The time horizon might in this case include shorter-term considerations and dynamics and a more limited consideration of variables or influences.

1.4 Critiques of Foresight

While the introduction so far may seem to suggest that everything about Foresight is unquestionably positive and beneficial all around, there have been relevant critiques of Foresight over the years. While many of these are not fundamental–ie they actually point to the limitations and misuse of the approach rather than challenging the use of Foresight itself–it is useful to acknowledge these in developing an understanding and practice of Foresight.

Key critiques:

- Foresight can become an end in itself: A common criticism of many Foresight activities is that the many tools and processes employed (eg the production of scenarios) can take precedence over implementation and action. Yet Foresight is intended to anticipate plausible future events with the specific aim of feeding insights back into the strategic processes to help decision-makers take better-informed action. This can be a one-off activity, but it is more effective as part of a continual process of challenging both the ends and the means of the strategic process. However, to date, mechanisms are lacking which cycle Foresight thinking back into policy and strategy processes. Examples of tangible actions that can and should result from Foresight activities include: framing policy goals; creating an organisational vision; setting research priorities; building networks; and aiding participants to develop or adjust their own strategy.

- Foresight can be used to legitimise exclusive perspectives: We have mentioned above the possible extremes of participatory versus expert-driven Foresight. In either case, there can be a tendency to value certain information or role-players over others, which can give a false sense of accuracy. This can create over-confidence in the Foresight process and products, thereby falling into the realm of prediction rather than Foresight. Importantly, this selectivity can also tend to exclude marginal and alternative inputs, leaving only conventional wisdom and forecasts. This fundamentally fails to consider genuinely alternative or different futures, and is a flawed process, producing only "tame" (ie within existing mindsets or "blinkered") Foresight.

- Foresight can be used to advocate preconceived agendas: Foresight processes have been accused of handpicking participants for the purpose of cooption or deal-making, rather than for analysis and genuine consideration of challenging alternatives. This is a reputational risk for any Foresight exercise.

- Foresight can consume an inordinate amount of the organisation's time and resources: There have been limited analyses of the duration and costs of conducting Foresight exercises. These are sometimes underestimated, sometimes exaggerated, and at other times not quantified at all. But Foresight exercises do not have to be expensive, lengthy, and elitist. Realistic assessments must be made early in the process about the type of Foresight that best suits the needs of the organisation or exercise.

- There has been a lack of assessment of Foresight: Value of and accountability for any initiative is best determined through evidence. However, the growth in futures activities has not yet been matched by monitoring and evaluation that is both systematic and transparent. More resources need to be devoted to the open evaluation of futures activities to assess, for example, whether objectives have been met and how the exercise was managed, and to define follow-up actions. Evaluation should focus on the contributions made to the achievement of outcomes, such as changes in the behaviour and activities of the people and organisations involved. It must however also be acknowledged that the time horizons to assess full impact may be extended and attribution can be quite difficult.

Again, it is proposed that most of these critiques are not fundamentally about failures of Foresight, but rather failures in the use and design of Foresight activities. They therefore serve as useful pointers towards pitfalls in designing Foresight activity.

Foresight tools: an overview

There is an abundance of Foresight tools, and for the newcomer to Foresight the choice can be bewildering. Consensus has not yet been reached on a way of organising Foresight tools into categories, but there are some commonly used concepts by which to characterise them.

One straightforward characterisation is based on their ***quantitative*** or ***qualitative***[1] nature. A second characterisation is to distinguish Foresight from exploratory Foresight. Normative Foresight has to do with norms and values, and addresses the question: What do we want for the future? On the other hand, in exploratory Foresight, possible futures are explored without reference to what is desirable. Usually, a Foresight tool may be used in either a normative mode or in an exploratory mode, although some tend to be used mainly one way or the other.

Table 1 provides a selection of Foresight tools, annotated with the above characterisations. The table is taken from a publication of the Millennium Project, Futures Research Methodology (FRM)–version 3.0, which provides detailed descriptions of all these tools, as well as pointers for when and how to use them.

Clearly there are far more Foresight tools than can be described in this short booklet. Instead, we describe five of the more commonly used tools, which we have found effective. We first give summary descriptions of what are arguably the best-known tools:

- Scenarios;
- Environmental Scanning; and
- The Delphi Method.

We then give detailed instructions for implementing two further tools which we consider can be particularly useful:

- Futures Wheels; and
- Technology Roadmaps.

For more information about these and other tools, see the recommended reading list at the end of this booklet.

[1] Quantitative means characterised by numbers; qualitative means characterised by non-numeric qualities.

Tool	Quantitive	Qualitative	Normative	Exploratory
Agent Modelling		•		•
Causal Layered Analysis		•		•
Cross-Impact Analysis	•			•
Decision Modelling	•			•
Delphi Techniques		•	•	•
Economics and Statistical Modelling	•			•
Environmental Scanning		•		•
Fiels Anomaly Relaxation		•		•
Futures Wheel		•	•	•
Genius Forecasting, Vision and Intuition		•	•	•
Interactive Scenarios		•	•	•
Multiple Perspective		•	•	•
Participatory Methods		•	•	
Relevance Trees and Morphological Analysis		•	•	
Road Mapping		•	•	•
Scenarios	•	•	•	•
Simulation-Gaming		•		•
State of the Future Index	•	•	•	•
Structure Analysis	•	•		•
Systems Modelling	•			•
Technological Sequence Analysis		•	•	
Text Mining		•	•	•
Trend Impact Analysis	•			•

Table 1: Foresight tools

2.1 Scenarios

A scenario is a story that relates how the present "reality" evolves into a state or condition set in the future (the time horizon). The story highlights decision points and external events, and the cause and effect linkages that lead to consequences of the decisions and external events. Usually the story is about a specific subject with a clear time horizon, eg "Innovation in South Africa in 2040".

A scenario contains a large amount of information about the future. The challenges and opportunities presented by the situations and environment in the story are intended to capture readers' imagination and enhance their understanding. Usually several scenarios are developed around a particular subject, so that alternative futures may be explored based on different key issues.

A scenario may be judged to be a good one, not because of the likelihood of its being realised, but based on being:

- **Plausible:** presenting a rational route for the present to evolve into the depicted future, making decision points and causal processes explicit;
- **Internally consistent:** displaying consistency within the story, and across alternative scenarios; and
- **Engaging:** being sufficiently interesting to provoke the imagination and thus improve decisions made now.

Thus, a scenario is not a prediction or forecast of what will come to pass. It is not designed to be "probable", as the probability of a particular scenario being realised in toto is almost zero.

Scenarios are an effective means of presenting complex information to decision-makers and others in a way that is relatively easily absorbed, and makes the future options appear to be "real". A set of scenarios allows for different possibilities to be thought through and the implications understood. They can therefore assist in the development of plans that are robust across a wide range of possible futures.

A weakness of scenarios is that they can be easily misunderstood to represent the only possible options, and on that basis, thinking may be constrained. Alternatively, the scenarios may be rejected out of hand as being highly unlikely to materialise. They also require considerable and persistent creative inspiration and energy to develop.

2.2 Environmental Scanning

Environmental Scanning is a Foresight tool that can provide basic inputs to both longer-term futures exercises and strategic planning exercises. Four steps may be identified:

1. Scan the horizon of the current and planned domains of operation, and related areas, to identify potential issues that may emerge in the future;
2. For each issue identified, investigate its background, future, and potential impact;
3. Evaluate the issues identified and prioritise them for pre-emptive action; and
4. Develop strategies to address the prioritised issues.

Several techniques may be used to scan the environment, including expert panels, review of the literature (typically using electronic databases), searching the web, and commissioning essays by experts.

2.3 The Delphi Method

The Delphi Method is based on the assumption that when experts agree on something in their field of expertise, they are more likely to be correct than are non-experts. The method aims to reach consensus of as high a quality as possible by minimising distortions due to personal interactions that can be introduced when experts are together in a room. Such distortions can arise due to rhetoric, peer pressure, unwillingness to lose face, etc. Thus the Delphi Method is designed to encourage a true debate, independent of personalities. One way that this is achieved is through anonymity, in the sense that no one knows who else is participating.

A Delphi exercise involves several rounds of questions and feedback, all conducted using written communication. The facilitator will pose questions to the experts related to the issue being investigated, along with feedback from

the previous round. The experts will typically be asked to review their position on the issue being investigated, based on the feedback. To eliminate the force of rhetoric and pedagogy, the reasons given for extreme opinions are synthesised by the facilitator, to give them all equal "weight", before being fed back to the group as a whole for further analysis.

A primary strength of the Delphi Method is its ability to explore, rationally and calmly, a contentious issue that requires judgement. A weakness is that all participants may not, in fact, have the required expertise. A further weakness is the time that it takes to run a Delphi exercise, typically a few months, which includes the time for the preparation of questionnaires, and for processing feedback. The length of time can be reduced by using a real-time Delphi Method that makes use of specialised software.

Next, we provide information for two Foresight tools in sufficient detail to encourage their use.

2.4 Futures Wheels

The Futures Wheel is one of the easiest and speediest to use of the Foresight tools. It facilitates structured brainstorming about a particular aspect of the future by providing a way for ideas, issues and questions to be loosely and flexibly organised. In its original form (the technique was first published in the early 1970s) an event or trend is named by writing it in the middle of a large piece of paper. Small spokes are then drawn wheel-like from the centre and primary consequences, results or impacts are written at the end of each spoke. Next, the secondary impacts of each primary impact form a second ring of the wheel. This knock-on effect continues until a useful picture of the implications of the event or trend becomes clear (see Figure 2).

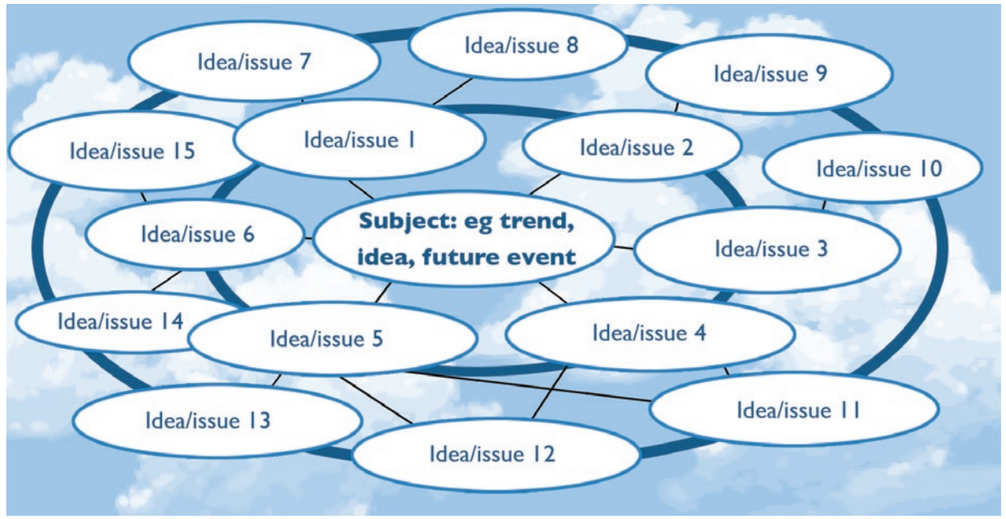


Figure 2: Futures Wheel (original process) – adapted from FRM v3.0, Millennium Project

The Futures Wheel is well suited to:

- Introducing a group to thinking together about the future;
- Developing ideas related to the initial concept of the trend or event; and
- Organising thoughts and ideas about future events, issues or trends.

Since its invention it has been adapted in various ways for use in a range of contexts. The adaptation that is presented below, in which, for example, the distinction between primary and secondary impacts is not made, is simpler and more widely applicable than the original approach, especially in the developing-world context. The output of this adapted process no longer has a "wheel" appearance, but for historical reasons it is still referred to as a (modified) Futures Wheel process.

The Futures Wheel process

A group has the task of generating a Futures Wheel around a particular topic, issue or event that is set some time in the future. Usually the timeframe is at least 10 or 15 years in the future, and often it is several decades hence. The size of the group is important: too few participants can result in a rather narrow or restricted Futures Wheel, while too many participants may mean that the group dynamics result in just a few people in the group being active participants. Usually a group of between three and seven participants (including a facilitator) is ideal.

In the version of the Futures Wheel process now presented, there are three steps:

- Brainstorming;
- Clustering; and
- Prioritisation.

Each of these is now described in turn.

- **Brainstorming**
  The facilitator writes the subject of the Futures Wheel in the middle of a large piece of paper (at least A1 in size) and draws an oval around it. Digital tools may of course be used instead of paper for this purpose (eg computer and projector).

  The facilitator then invites the group to identify consequences, issues, factors, etc that would be associated with the subject. Each item identified is written on the paper inside its own oval. To facilitate later processing, items that immediately appear to be related may be written in proximity to each other, but this is not essential, and no time should be spent deliberating on where to place an item. It is more important to capture the item and allow the process to continue and gain momentum. It should be emphasised to participants that during this stage the mode of thinking required is creative "brainstorming". Participants must be free to come up with any ideas of what things might be related to the subject, without critiquing, evaluating or filtering others' (or even their own) suggestions. It is more important to generate a large collection of issues or factors, even if it appears at first sight that some are of dubious value. A prioritising and filtering exercise at a later stage of the process will ensure a quality output.

  The brainstorming process may continue as long as seems appropriate, which may be influenced by the point at which participants appear to run out of new ideas (or by the paper filling up!). However, usually at least 45 minutes should be allowed for the process to run.

- **Clustering**
  Following the brainstorming stage, a grouping or clustering phase commences. In this phase, items on the page that appear to be similar or related are grouped together by drawing an enclosing line around them, or by marking each related item with a distinctive mark. The best judgement of the group should be used during this phase, based on consensus as far as possible. It may be necessary for certain of the items in the ovals to be explained more clearly, and short notes may be made in the ovals to capture these clarifications.

  Figure 3 provides an example of a Futures Wheel generated by this adapted process. The clustering of the items is apparent, depicted by the use of different colours.

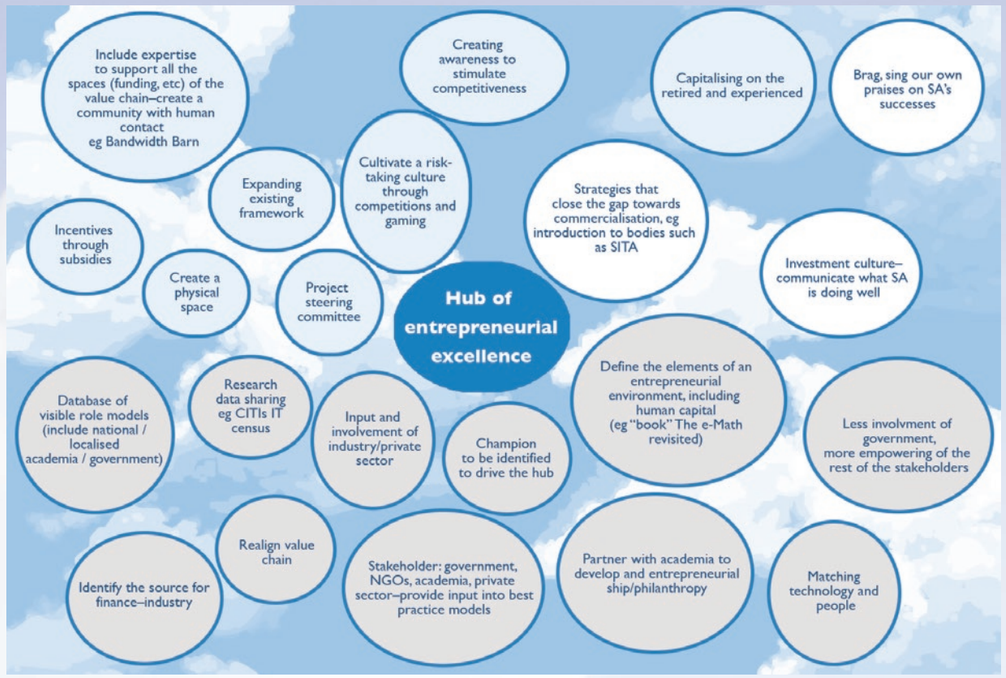


Figure 3: Example of a Futures Wheel (adapted process)

- **Prioritisation**
  Once the clustering exercise is completed, the prioritisation phase commences. The purpose is to identify the most important or significant of the grouped items from the whole collection (termed item-groups). The number of "most important" item-groups, and the criteria for determining which are deemed to be most important, will depend on the purpose for which the Futures Wheel is being developed. These factors should be discussed with the group prior to commencing with prioritisation.

  The group can take different approaches in order to emerge with the set of top priority item-groups. People often use a voting mechanism, in which each participant has a fixed number of votes. Each participant votes by marking their choice of top-priority item-groups with their own symbol (perhaps their initials). They may mark their symbol the pre-arranged number of times. If desired, they may place their symbol more than once on a particular item-group, but each placement consumes one of their votes. Once all participants have voted, the votes are tallied, and the item-groups with the most votes become the group's top priorities. (A tie between two or more item-groups is decided by consensus amongst the group.)

  The resulting set of top-priority item-groups is then usually an input into the next stage of the Foresight exercise.

Strengths and weaknesses of the Futures Wheel

The Futures Wheel is easy to use, requiring no more than a few pens and a large piece of paper. It helps people to start thinking immediately about the future without having to grasp any complex concepts or processes. No special training is required, nor even an advanced educational background. It enables a group to quickly gel and become productive, especially if someone plays the role of facilitator (although this is not essential, provided the group members are cooperative amongst themselves). The method may be adapted with ease to fit a range of different applications.

Use in combination with other methods

The output of a Futures Wheel is usually used as a basis for further thinking, for more systematic exploration, and for the application of other techniques for probing the future. In other words, the Futures Wheel is a creative tool that generates input to futures thinking. For example, after trends or future events have been identified, a Futures Wheel can help identify the issues and consequences related to the trend or event. It organises information already known, stimulates speculation, guides further exploration, and increases the understanding of the trend or event.

Another use of Futures Wheels is in developing scenarios. Prior to a scenario construction exercise, Futures Wheels can be used to identify the primary driving forces. This can provide rich input for the content of the scenarios (see section 4.3.1).

2.5 Technology Roadmapping

Compared with the Futures Wheel, a Technology Roadmap (TRM) is a much more time-consuming and sophisticated Foresight tool. It is used to help organisations at any level (government, corporate, industry/discipline, cross-industry/national or international) to collaboratively identify future needs, to map them into process, product, service, and technology alternatives, and then to develop plans to ensure that the required technologies, skills and resources will be available when needed.

A TRM brings stakeholders together in a far-reaching planning process, opening the door to collaborative R&D:

- It can play a key role in enhancing innovation.
- It does not predict future breakthroughs in science, but it does forecast and articulate the elements required to address future technological needs.
- It describes a given future, based on the shared vision of the people developing it, and provides a technology-oriented framework for making that future happen.
- It offers only a high-level strategy for developing the technologies. More detailed plans are then needed to specify the actual projects and activities required.

A TRM facilitates better decision-making by identifying science and technology (S&T) areas of high potential or strategic value, and also technology gaps, when these are not clear. TRMs can enhance decisions about which technology alternatives to pursue, and how and when a particular technology will be available. TRMs can also identify when it will be necessary to coordinate the development or acquisition of multiple technologies.

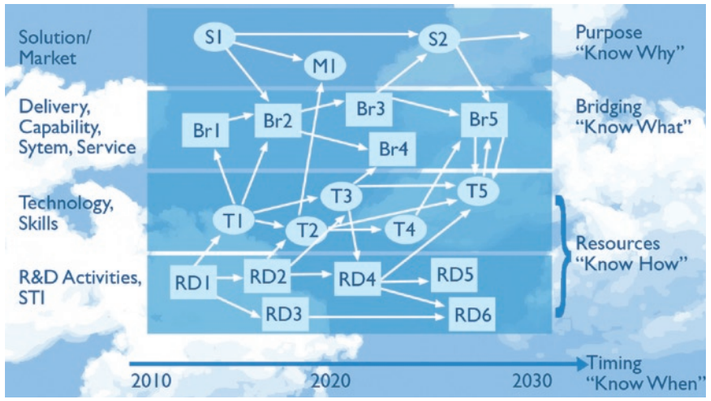


Figure 4: A generic TRM

The most commonly used TRMs have a multi-layer format, as shown in Figure 4:

- The top layer refers to the purpose that is driving the roadmap ("know why").
- The bottom two layers relate to the resources, the science and technology (the "know how") that will be deployed to address the objectives.
- The middle layer provides a bridging/delivery mechanism between the purpose and the resources layers ("know what"). It most often focuses on product development, but services, capabilities, risks, or opportunities are also appropriate for the middle layer, to understand how technology can be delivered to provide benefits to stakeholders.

There are several types of TRM. They share several elements but also differ significantly. The types of roadmaps most commonly in use today are:

- Product TRMs: used by companies to identify the technical processes for development of a specific product or service;
- Corporate TRMs: developed internally by a single company, university, or laboratory as part of their technology planning;
- Industry TRMs: used to assess and extrapolate the direction of needs within an area of technology, and then identify R&D strategies to meet those needs; and
- Emerging TRMs: specifying the timeline and expected performance for a technology currently in early development, and not driven by specific product requirements.

Since "technology" is a central concept for TRMs, it is useful to discuss two types of technology which are particularly relevant: disruptive technologies and emerging technologies.

- **Disruptive technology:** is significantly more advanced than and different from current technologies (and is also termed "revolutionary" by some). A disruptive technology (DT) changes both the market and the way a problem is solved. The technology's new capabilities alter customers' expectations and requirements. Historical examples include the telephone, the motor car, and the Internet.

  Another way of defining a DT is that it is a technology which falls short of satisfying one or more current customer requirements, but will soon overcome this drawback. In most cases, the DT eventually replaces the existing technology. A current example is flash memory.

- **Emerging technology:** is a new technology in early development which promises broad application, but its uses and benefits are not yet fully understood. Investments in emerging technology (ET) tend to be undertaken to obtain good early positioning in a technology that could quickly gain dominance, rather than for short-term return on investment. The development of an ET is too premature for the creation of specific products. Instead, ET development creates core capabilities for the investors. Examples of ETs are lasers in the 1970s and nanotechnology in the 1980s.

The TRM process

In the South African context (as in most developing and emerging economies), many technology areas are characterised by comparatively little established capacity and capability. There is therefore often a need to identify and emphasise the possibilities for emerging technologies and disruptive technologies. A TRM process adapted to this combination has been used successfully in South Africa, and it is this process, dubbed an "Emerging Industry TRM", that is now described in some detail.

TRMs are fairly complex tools, so their development needs hard work and careful management. They are represented by a network of nodes and links. Nodes represent milestones that must be passed, major issues to address, etc, for the destination (or destinations) of the roadmap to be reached. Links are drawn between nodes when there is an important relationship between two nodes that should be captured, such as when one milestone (node) depends on another milestone (node) having been achieved.

The TRM process consists of the following five steps, to be carried out by a working group of three to seven participants. The final output is a TRM along the lines of that depicted in Figure 4.

- Build Futures Wheel
- Categorisation and prioritisation
- Identifying nodes in the roadmap
- Identifying links between nodes
- Adding attributes and criteria

The outputs of the process, such as the Futures Wheel and the TRM itself, are best captured on large sheets of paper. A number of sheets should be available because the process of drawing the TRM is iterative, and usually several versions are produced. In addition, there is supplementary, more detailed information related to the TRM as it is produced, that should be kept separately (perhaps best electronically). This is referred to below as the supplementary text.

- **Build Futures Wheel**
  It is not advisable to attempt to build TRMs for broad technology areas, since their complexity tends to increase exponentially with the size of the subject area. It is best to focus on one theme. An ideal mechanism for this purpose is a Futures Wheel, as described in section 3.4, up to the clustering step.

- **Categorisation and prioritisation**
  Following the development of the Futures Wheel, the working group then categorises each issue in its Futures Wheel into one of four categories that match the four rows of the TRM: Purpose[2], Bridging, Technology, and R&D. This is done by inserting them into the appropriate column in a Categorisation and Prioritisation Table, and labelling them as shown (see Figure 5).

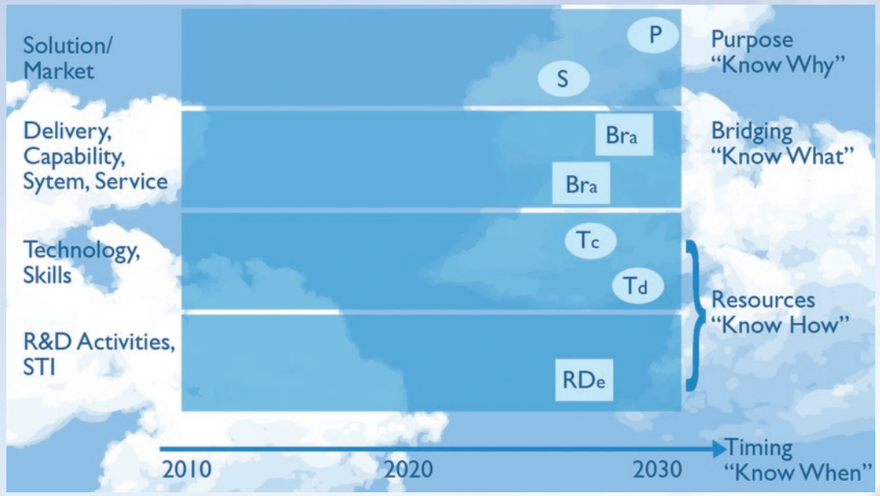
Purpose	Bridging	Technology	R&D
P1-Issue 1	Br1-Issue 3	T1-Issue 5	RD1-Issue 7
P2-Issue 2	Br2-Issue 4	T2-Issue 6	RD2-Issue 8
P3-etc...	Br3-etc...	T3-etc...	RD3-etc...

Figure 5: Prioritisation and Categorisation Table

  The group then uses its judgement to select which of these issues should be the basis of its TRM (it is often, but not always, in the "purpose" column). Usually, a significant subset of the remaining issues in the table will be relevant to the chosen issue (ie the "priority subset" from the Futures Wheel time horizon), and therefore all should be considered for inclusion in the development of the TRM.

- **Identifying nodes in the roadmap**
  The first version of the TRM can now be produced. First, each issue from the priority subset is inserted as a node in the matching row of the TRM, at the time horizon marker (on the extreme right of the TRM), and labelled appropriately (refer to Figure 6, where in this example, the time horizon is 2030). Each node should be labelled uniquely and its full description kept in a table in the supplementary text. A convenient way of labelling nodes is to use the notation: P – Purpose, S – Solution, M – Market, Br – Bridging, T – Technology, and RD – R&D, followed by a subscript letter or number to distinguish between nodes in a row.

[2]If it is helpful, "Purpose" issues can be categorised and labelled more specifically as "Markets" or "Solutions".



Legend:					
P		Purpose	T_c	T_d	Technology
S		Solution	RD_e		R&D
Br_a	Br_b	Bridging			

Figure 6: Placing nodes in the TRM

Then, for each of these nodes, the group works backwards in time from that node (from right to left), and identifies the required (major) steps needed to ensure that the final node can be realised, and inserts them as earlier nodes relative to the timeline. Some of these required nodes may be in the same row, while others may be in one of the three other rows. These nodes should each be labelled appropriately (eg P_6, B_4), and added to the table in the supplementary text, giving their full descriptions.

As a guide to deciding whether or not to insert a node, wherever complexity or uncertainty is high, it is advisable to insert a node that identifies what is required. In other words, for an effective TRM it is best not to avoid difficult issues, but rather to confront them!

- **Identifying links between nodes**
  Once a first pass of inserting nodes for all four rows is complete, the links between nodes need to be identified and inserted, namely where there exists some important relationship between two nodes, such as a producer-consumer relationship or a dependency relationship. Again, each link should be labelled, and a table kept of the link labels with a description of each in the supplementary text.

- **Criteria and attributes**
  Finally, additional criteria and attributes related to any of the nodes or links in the TRM should be added under the appropriate tables in the supplementary text. This additional information is most valuable and important for the nodes and links with the highest levels of uncertainty or complexity.

Although the above steps have been presented as a linear process, in reality they tend to be performed in an iterative cycle, where the group creates an improved TRM with each iteration. This is particularly the case for the steps that involve identifying nodes and identifying links. Thus in practice there are usually several versions of the TRM. In addition, as nodes get inserted, moved and deleted during this iterative process, it is recommended that the nodes be relabelled (in particular, redoing the subscripts, to avoid confusion).

Strengths and weaknesses of TRMs

The TRM tool has many strengths. It is a way of getting a better grasp of the future as well as being a planning technique. It requires collaboration amongst experts and so it acts as an effective means of communication as well as building valuable networks. A TRM displays succinctly the logical, cause-and-effect relationship between actions and milestones, and so it can be used for strategic analysis to identify points of leverage that facilitate maximum influence, and also areas of ignorance. Most importantly, it manages risk and allows progress to be made despite several unknowns being unresolved, by allowing several paths to the future to be pursued in parallel.

TRMs have two major weaknesses. They reflect the expertise of the people who build them, so the best experts must be enlisted for the exercise. Secondly, they can become unmanageably complex.

Foresight and South Africa

Foresight has been used quite extensively in South Africa over the past two decades. This has been in a range of domains, but its public use is particularly notable. In fact, South Africa is credited with being one of the first nations to successfully apply nation-wide scenario-based discourses about its future, mainly through exercises in the late 1980s and early 1990s.

3.1 Foresight capacity

A global survey of government future strategy units that was conducted by the Millennium Project (2008) found that South Africa ranks among the 30 countries in the world which have future-oriented strategy or Foresight units to contribute to their national policy process. In South Africa, this has been the Planning Policy Coordination and Advisory Services section in the Office of the President. This approach of placing the future strategy unit within the office of the Prime Minister or President of the country so as to integrate the futures research from other government sections and external institutions was found to be the most common among the countries studied.

Other South African government departments–such as Foreign Affairs, Defence, Science & Technology, Trade & Industry, and Environment, to name a few–use Foresight directly to create a foundation for their own analyses and strategy, often in relation to bilateral and multilateral initiatives.

A range of South African non-governmental organisations also use Foresight in their strategic engagements on issues ranging from politics, peace and security, to resource management and socio-economic dynamics.

The African Futures Institute (AFI) is an example of a non-governmental organisation which is based in South Africa, and is engaged in the study of prospects in and around the continent. Established in 2004, with headquarters in Pretoria, AFI was initiated as a United Nations Development Programme project in 1992 aimed at assisting African countries to use Foresight in their long-range planning. AFI continues to have perhaps the broadest purpose-built African footprint as a multinational Foresight network.

Finally, most major South African universities offer elements of Foresight courses, chiefly through their business schools.

Table 2 lists some organisations that have Foresight involvement.

Sphere/Type	Organisations involved in Foresight activities
Public	Office of the Presidency National sector departments Council for Scientific and Industrial Research (CSIR) COFISA
Multinational	African Union (AU) / New Partnership for Africa's Development (NEPAD) Southern African Development Community (SADC)
NGO Agencies Quasi-governmental	Institute for Global Dialogue (IGD) South African Institute for International Affairs (SAIIA) Institute for Security Studies (ISS) World Economic Forum (WEF) African Futures Institute African Leadership Institute Various UN agencies: eg UNDP, UNAIDS, UNIDO Development partners such as GTZ, DFID, Rockefeller Foundation
Private/Corporate	Multinationals in sectors such as energy, mining, finance, insurance (eg Shell, Barclays Bank, Anglo American) A range of Foresight researchers, professionals and practitioners
Sectoral	Governance, safety & security, water, health, technology, environment, cross-border parks
Thematic	State of (eg "the environment" or "the future") studies, climate change, migration, shared resource management
Voluntary associations/ Individuals	Millennium Project, with a South Africa Node World Futures Society (WFS), now with a South Africa chapter World Future Studies Federation (WFSF), which has had several South African members over the years

Table 2: South African organisations involved in Foresight

3.2 South African Foresight activities

The Scenario method has dominated South African Foresight activities, so much so that in some people's minds, scenarios are equated (incorrectly) with Foresight. The significance of pioneering public Scenario exercises in South Africa's political history and transition "miracle" is the subject of analysis in the book *Breaking the Mould* (2007), and can be credited with popularising the method ahead of many others.

A scan of Foresight studies carried out in South Africa over the past few decades generates the following indicative listing (Table 3):

Period	Foresight exercise (and champion)
1970s	Institute for Futures Research
1980s	High Road/Low Road scenarios (Anglo American) Scenario exercises by Eskom, the Council for Scientific and Industrial Research (CSIR), Shell South Africa
1990s	Mont Fleur scenarios (ANC/COSATU Alliance) South Africa: Prospects for a Successful Transition (Nedcor-Old Mutual Corporation) Knowledge Intensive Services Business in 2007 (CSIR) NRTF (National Research and Technology Foresight), involving 12 sectors, by Department of Arts, Culture, Science & Technology from 1996-99. The Future of the Unions: The September Scenarios (Congress of South African Trade Unions) PSG/Siphumelele Three Scenarios
2000s	Southern Africa 2015 (South African Institute of International Affairs) Electricity Market Scenarios Study (National Electricity Regulator) Southern African 2020: Five Different Scenarios (Institute for Global Dialogue) Memories of the Future: South African Scenarios to 2014 (South African Presidency) CSIR Strategy 2014 scenarios SADC 2015 Scenarios: CSIR Infrastructure thrust in support of NEPAD (CSIR) Energy Scenarios for Africa (CSIR and Shell) Africa 2025: What Possible Futures for Sub-Saharan Africa? (UNDP and African Futures Institute) South African Benchmark 2020 (Department of Trade & Industry and European Foresight Monitoring Network) Transport Foresight Study (CSIR) AIDS in Africa: Three Scenarios to 2025 (UNAIDS and Shell) South Africa 2020 (UNDP/African Leadership Institute) Technology Roadmapping (DST, CSIR, industry) COFISA Foresight initiatives–provincial innovation, community-level, biotechnology, ICT, etc SA Scenarios 2025: The future we chose? (South Africa Presidency) The Dinokeng Scenarios

Table 3: Foresight exercises in South Africa

This list should not be seen as exhaustive. In particular, a range of specialised and closed Foresight studies will have been carried out in addition to the listed studies, particularly as part of the proprietary strategic planning processes of many corporations, banks, and government departments in South Africa.

Notable from this scan of the use of Foresight in South Africa is that:

- Besides a range of studies that are done within organisations, often facilitated by Foresight consultants, South Africa has had a number of large, multi-stakeholder or participatory Foresight processes sponsored by private, public, or non-governmental role players.
- Numerous examples of Foresight relating to public-interest issues–mainly political or societal–are evident.
- Foresight has been conducted in a mix of sectors (ICT, energy, infrastructure, HIV/AIDS, biotechnology–areas with long lead times).
- Outputs are usually documents that are shared; but there has also been a focus on the process of the scenario conversation and its intrinsic value. The case study offered in this booklet illustrates this point (see Section 4).
- The timing of the exercises seems to be event-focused–for example in periods of societal change, or around organisational strategic planning time.

3.3 International involvement

South Africa has been recognised and is actively involved internationally in many aspects of Foresight.

In the public arena, the role of the High Road/Low Road and Mont Fleur scenarios in relation to South Africa's political transition is often cited. Key personalities who are associated with these landmark initiatives continue to be recognised and consulted globally as part of the futures intelligence community.

In the private sector, there are numerous South Africans working internationally–primarily in Europe and the US–in the area of futures thinking, publishing, and consultancy. South African practitioners have also been active in working with public and private sector organisations in various parts of Africa on using Foresight.

In 2007 the SA Node of the Millennium Project (SAMP) hosted the country's first International Futures Conference. The event attracted speakers and delegates from about 20 countries, about half of which were other African countries. The participants came from a range of sectors–public, private, NGO, philanthropic, academic–and the importance of Foresight and South Africa's active role in the field was emphasised.

3.4 Summing up South Africa's experience in Foresight

Relative to the rest of Africa, South Africa is advanced in its use of Foresight. South Africa has international visibility concerning some of its more prominent Foresight exercises. Many South African Foresight practitioners are well-respected internationally.

However, by global standards, there is a considerable way to go before the benefits of a widespread culture of Foresight will be available in this country. While many Foresight exercises have been undertaken, particularly involving the public sector, their impact has largely not been assessed. At times, outputs have not been shared or followed up, resulting in the practical benefits of the Foresight initiatives not making an impact on strategies and plans. In this context, the next section describes a set of recent Foresight exercises which provide particularly valuable learning.

Case Study: COFISA Foresight initiatives

COFISA is a programme that has been developed jointly by the governments of South Africa, through the Department of Science & Technology, and Finland, through the Ministry of Foreign Affairs. Its objective is to contribute to the enhanced effectiveness of South Africa's systems of innovation (at both national and provincial levels) in contributing to economic growth and poverty alleviation.

Regional (provincial) Foresight was one of the major mechanisms chosen by COFISA to stimulate the development of South Africa's regional systems of innovation. It aimed to build shared strategic visions of regional innovation, creating and amplifying regional "triple helix"[3] collaboration (between the public sector, private sector and academics/researchers), and supporting planning. Given Finland's globally recognised expertise in futures research and the application of Foresight techniques, particularly to its world-class innovation systems, Finnish expertise was called on throughout the exercises by the South African Foresight experts and practitioners.

Between October 2007 and April 2009 two main regional Foresight exercises were undertaken by COFISA in the Eastern Cape, Western Cape, and Gauteng provinces: Provincial Innovation Foresight (2007-2008), followed by Provincial Biotechnology Foresight (2008-2009). To the best of our knowledge, this is the first time that public sector Foresight initiatives have been practised at the sub-national level in South Africa.

Compared with South Africa's earlier implementations of publicly funded Foresight initiatives at the national level, this regional Foresight approach, employing many small groups in short but intense creative sessions, consumed less of the participants' time, was significantly less costly, and took less than four months to complete. Feedback from many delegates indicates that both provincial Foresight exercises have succeeded beyond the expectations of the sponsors and practitioners, and have had some immediate successes.

This brief overview of these Foresight exercises is based on the 15 detailed reports and two overviews (intended for both practitioners and researchers) that were generated during the process, and which may be accessed at www.cofisa.org.za.

4.1 The Foresight processes

For both Foresight exercises in each of the target provinces the general objectives were:

- To introduce participants to the role of futures thinking, particularly in helping to establish and maintain regional innovation systems;
- To introduce participants to the value and practice of appropriate Foresight tools and processes;
- To encourage participants to use these methods collaboratively to create a range of possible futures for their province, to consider and prioritise the challenges and opportunities that emerged, and to devise action plans to address them;
- To encourage the multi-sectoral, multi-disciplinary networks of people established via the Foresight exercises to continue to communicate and collaborate with each other; and
- To build Foresight facilitation capacity by involving in the process several coordinators (with little Foresight experience), who would receive training in a learning-by-doing mode.

[3]Used to describe multi-level, interdisciplinary communication and collaboration between the three sectors or domains: public sector, private sector and the academic/research community.

Prior to each main Foresight exercise, a full-day Foresight capacity-building workshop was held with the Foresight experts, COFISA team members and the provincial coordinators. Further capacity-building and process learning sessions were held in the evenings before and after each of the workshops.

Throughout the process, workshop participants were drawn from the public, private and tertiary education sectors, as well as civil society. The objective was to have inputs of ideas, issues and opportunities from as many viewpoints as possible, thereby encouraging lateral thinking and creativity.

All workshops in each province for both exercises began with an introductory session which provided: an update on the COFISA programme; a summary of the background and status of the Foresight initiative; and an explanation of the rationale behind the Foresight techniques chosen for the exercise.

In all these workshops, a small number of groups (usually three) of between three and seven delegates were established to work together in learning and applying the Foresight techniques.

Provincial Innovation Foresight

Nine workshops were held between October 2007 and March 2008, made up of three workshops in each of the three target provinces.

In the first set of workshops, each group created a Futures Wheel capturing their main ideas about innovation in their province in 2050, and prioritised the most important themes identified (see Figure 3 in section 2.4.1). They then drew up tables capturing the most important characteristics of their theme.

Based on each of these specific themes, subject matter specialists were identified and added to the delegate lists for the subsequent workshops.

In the second set of workshops, each group worked on one of the main themes. They developed Futures Wheels for 2050 for their theme, which allowed them to identify a range of more focused issues which they again prioritised.

In the third set of workshops, each group worked on one of the focused issues for which they produced fairly detailed action plans.

Provincial Biotechnology Foresight

Six workshops were held between October 2008 and March 2009, made up of two two-day residential workshops in each of the three target provinces.

Two sets of documents were prepared as inputs to the first set of workshops:

- Biotechnology trends analysis (at global, multinational and South African levels); and
- Sets of three provincial innovation proto-scenarios (2030) for each target province.

In the first set of workshops, each group examined the biotechnology trends analysis document, and added emerging trends at the provincial and local levels for their province. Next, each group chose one of the provincial innovation scenarios, and used Futures Wheels sessions to create material to transform them into biotechnology scenarios.

In the second set of workshops, the delegates were first coached on the value, basics and creation of Technology Roadmaps. Back in the small group format, each group then selected a main theme from their biotechnology scenario, and produced a biotechnology roadmap to 2030 for their theme (for further details, see the three provincial biotechnology Foresight reports at www.cofisa.org.za/docs.html). Finally, they identified specific opportunities for existing and potential small and medium enterprises (SMEs) within their biotechnology roadmap.

4.2 Highlighted outputs

Provincial Innovation Foresight

The focus of the first two workshops in each province was at a high level. The outputs constituted a multi-faceted, often complementary (but sometimes contradictory) picture or vision of what life in the province would look like in 2050. Although independently developed, these visions did share common aspects as well as having features that were specific to each province. The aspects of the visions that were shared across the three provinces were:

- Free societies, with full participation in the economy and governance through free and transparent access to user-centric knowledge;
- "Green futures", where there is no contradiction between meeting human energy, housing, and food needs and maintaining a high-quality environment where people live in a self-sustaining, pollution-free ecosystem;
- Knowledge societies, with knowledge-driven economies; and
- Innovative societies with a particular focus on innovative green technologies.

The third workshop focused at a more detailed level. Each working group developed action plans for one focused theme that they selected as being central to the future that they wanted to see emerge by 2050. One example from each province is presented in Table 4 of these high-priority, focused themes and their corresponding high-level actions:

Province	Theme	High-level action(s)
Eastern Cape	Platform for agrarian innovation and transformation	Establish rural integration framework
Western Cape	Service innovation via knowledge-intensive business services (KIBS)	Kick-start KIBS for "clusters" via mapping
Gauteng	Free info-infrastructure: breaking the monopolies	Use market drivers and awareness creation to kick-start process

Table 4: Themes and high-level actions

Provincial Biotechnology Foresight

Being a much more focused, technology Foresight exercise, the two sets of workshops in each province resulted in a fairly comprehensive set of products:

- A Biotechnology Trends Report, including information on emerging trends within each province.
- Three sets of three full biotechnology scenarios for each province, incorporating a wide set of scenario fragments produced by every working group.
- Technology Roadmaps, consequent action plans, and opportunities for SMEs in each province for the following biotechnology focus areas:

Province	Biotechnology focus area
Eastern Cape	Bio-agriculture and algae farming
	Industrial and environmental biotechnology
	Health innovation
Western Cape	Waste, environmental and marine management
	Alternative energy from plants
Gauteng	Biotechnology adoption/adaptation cluster
	Wellness and prevention
	Diagnostics and therapeutics

4.3 Insights concerning tools and processes

These insights have been gained from both the provincial innovation and the provincial biotechnology Foresight processes.

Tools

The Futures Wheels: These provided a non-judgemental brain-storming mechanism to tap into participants' diverse views on issues and possible opportunities concerning the future, in a synergistic way that is not normally experienced in the working environment. It proved to be a non-adversarial mechanism, even when contentious issues arose. It encouraged participation by all, rather than domination by single individuals, which resulted in a sense of joint ownership of the futures envisaged. It proved easy to use for delegates and facilitators alike, quickly resulting in surprisingly rich material, and fostering energy and enthusiasm amongst the participants.

Full scenarios generated from Futures Wheels: Because the general provincial innovation Futures Wheels for 2050 produced in the first set of workshops were very rich, it was decided to take this base material from one of the provinces (the Eastern Cape was chosen), and attempt to work it into full provincial innovation scenarios. None of the experts involved had built scenarios in this way before. Once the material had been collated and clustered, two major axes emerged, and so quadrant-based scenarios were developed for three of the four quadrants (the fourth was seen as "business as usual", and not developed further–see Figure 7). In this way, three substantive scenarios (approximately 15 pages each) were written by the South African Foresight experts over a period of 10 working days. The process was deemed so successful that as input to the subsequent provincial biotechnology Foresight exercise, a similar method was used to create sets of three innovation scenarios for the other two provinces, namely Gauteng and the Western Cape.

Technology Roadmaps: A TRM is a powerful tool for longer-term planning, and was used both to minimise risk and to amplify innovation. It proved especially useful where there was a lack of knowledge regarding the readiness or even existence of various technology components. In these circumstances, a range of parallel, interlinked paths were mapped out with associated decision trees, so that immediate progress could be made along several of these paths towards the chosen long-term goal.

But building a TRM did not prove to be an easy exercise. Its complexity required a commitment from all participants in the group to be prepared to learn throughout the process (especially from inevitable mistakes), whilst maintaining good group dynamics. Focusing on a technology theme of the appropriate size proved particularly difficult. The tendency to choose too broad an area always led to too much complexity, which, in turn, forced the group to retrace its steps and reduce the theme's scope.

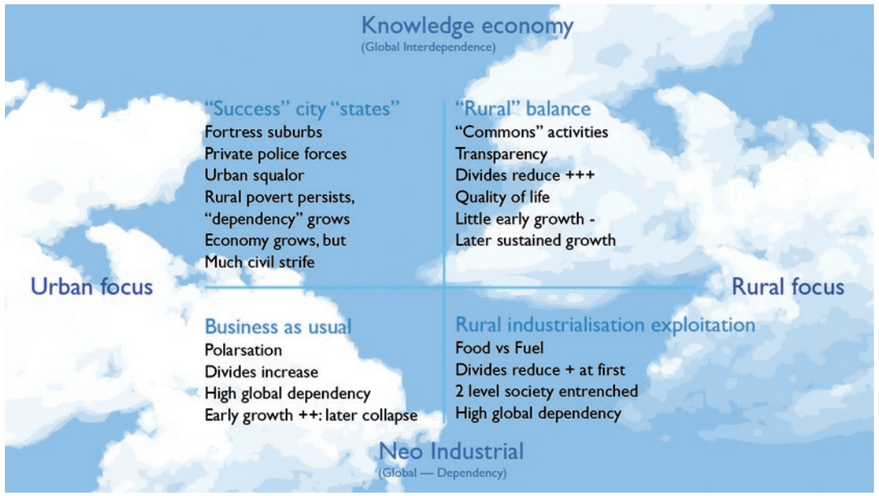


Figure 7: Eastern Cape 2050 Scenario Quadrants

Processes

Participant selection: For the first workshops, it proved valuable to draw delegates from different sectors of society and the economy (public, private, tertiary education, international community, civil society) to ensure that as broad a vision as possible of the future was captured. Bringing only "experts" together at this stage can produce a narrow vision of the future, which may be less useful in the context of emerging and developing economies.

However, the identification and subsequent participation of appropriate experts in the following workshops added to the plausibility, legitimacy and practicality of the outputs. Some even became champions of the ongoing actions.

Working group size: The value of using small groups of between three and seven people cannot be over-emphasised. The volume and creativity of their outputs went significantly beyond the expectations of the organisers. In addition, their predominantly constructive (often humorous!) dynamics seem to have amplified the network-building qualities that are an important, but difficult-to-quantify product of most Foresight exercises. Once the groups had worked together in person, it seemed that they also continued to work well together via digital mechanisms. Indeed, the impact of these groups was so impressive that collaborative research into their dynamics is planned by the Finnish and South African Foresight experts.

However, it should be recognised that only a limited number of such groups can easily be managed simultaneously in a workshop. We recommend not more than four.

Input materials: The production of quality materials as inputs to each workshop pays dividends. Many delegates said that these documents gave the process stature and credibility, and encouraged them to commit fully. They also saved on the amount of time required for each workshop, thereby reducing the inconvenience to the delegates, reducing the workshop costs, and improving the efficiency and quality of the overall exercise.

Workshop structure: The one-day workshops were rushed and difficult to manage. Significant time was required for the introductory session, leaving insufficient time for the working group sessions, which produced the important outputs of the workshops. By contrast, the two-day workshops, being residential, introduced a new dynamic which increased the commitment of and enjoyment by the delegates. The quality of the outputs appeared to benefit as well, as did the level of networking.

4.4 Capacity building

The exercise was intended not only to create useful visions for each of the provinces, but also to create broader awareness of the value of futures thinking, and to build capacity. Capacity building in a "learning-by-doing" mode was achieved at three levels:

- Involving all delegates in the use of some of the most popular and easy-to-use Foresight tools so that they feel empowered to use them (unaided) in future as they see fit;
- Developing Foresight coordinators (one for each province), chosen from the local black SME pool; and
- Bringing together Finnish and South African futures experts and researchers in an action learning environment to stimulate future collaboration, particularly in the adaptation of Foresight techniques to the needs and realities of emerging and developing economies.

Foresight and the emerging knowledge society

As the knowledge society emerges, we are experiencing a world where uncertainty abounds, change occurs ever more often and more rapidly, and complexity appears to be growing exponentially. In the developed world, it is hoped that the knowledge economy will bring sustained growth and prosperity, whilst in developing countries the knowledge society is expected to bring economic growth and eradicate poverty.

It is recognised that a major pillar of the knowledge society is a well-functioning system of science, technology and innovation (STI), with a broad concept of innovation being both understood and practised throughout all sectors and levels of society. More recently, it has become clear (particularly from European experience over the past decade) that a well-functioning STI system in general, and widespread innovation in particular, require Foresight to be understood and practised across all levels and sectors of society. In other words, a culture of Foresight is seen as an essential, ubiquitous component of an emerging knowledge society. The implications of this at the national, regional (sub-national), organisational and individual levels are discussed in the following sections.

5.1 Foresight and national transformation

> ***"As a factor in governance, the purpose of Foresight is to enhance the ability of decision-makers to engage and shape events at a longer range and, therefore, to the best advantage of the citizens they serve."***
>
> ***Leon Fuerth***

Today, most industrialised countries conduct national Foresight exercises in some form, driven by the escalation in industrial and economic competition and increasing pressures on government spending. For example, the European Commission has been influential in promoting technology Foresight by supporting candidate countries to develop a full Foresight capability.

Most public Foresight programmes in the 1990s had a technology focus, with participation limited to experts in nominated fields. However, there is now a trend towards increased participation and the inclusion of broader socio-economic challenges, eg in the UK, Germany and Japan. One of the merits of broader models of Foresight is their ability to take account of scientific, economic, social and environmental factors in any field, even the most technologically complex (such as nanotechnology).

Although South Africa seems to be unusual in the widespread use of Foresight (and particularly scenarios) for public policy purposes, with many exercises having been undertaken at the national level over the past two decades, their results or impact in most cases have been limited or perceived to be limited by:

- Processes taking much too long;
- Inadequate awareness campaigns and dissemination;
- A narrow base of participation; and
- Inadequate monitoring and evaluation.

It is a concern that the historical "top-down"[4], national approach to Foresight initiatives across Africa has created unfortunate misconceptions among many African leaders who have been exposed to them. These misconceptions may be summarised as follows:

- Foresight is (and can only be) done by "experts"; and
- Foresight is a major exercise or "event" to be run once every 10 years.

52 Foresight and regional transformation

In many countries there is movement towards complementing their national innovation policy with a strong regional (sub-national) development focus. For example, in the UK, greater user-centred and demand-based approaches to STI, alongside increasing devolution of political authority to the regions, has led to the successful use of futures techniques in the development and delivery of regional policies by engaging with local communities. The participative approach to Foresight is particularly well adapted to the local and regional levels, where a wide array of participants can actively be involved to build a vision of possible regional futures. Local Foresight exercises allow solutions which fit the specifics of local circumstances, such as demographics and economic factors.

In 2001 and 2002 the EU launched a range of projects aimed at developing and implementing regional (sub-national) innovation strategies (RIS) in the 10 newly associated countries (NACs: Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Poland, Romania, Slovakia and Slovenia). Major activities aimed at achieving this objective have included:

- Applying Foresight in a context of RIS projects in many European regions (over 150 to date);
- Developing regional Foresight into a more permanent, often embedded, activity; and
- Creating synergy by combining Foresight and RIS into a broader perspective, as a basis for development towards knowledge-based regions.

Foresight techniques have been widely used in each NAC and are continuing to prove of high value at every stage of the process of establishing their RIS. The most distinct differentiation of Foresight from most other RIS activities is the longer time horizon, which also underpins the main benefits of RIS-related Foresight:

- Foresight uses both quantitative and qualitative methods which allow consideration of several alternative development possibilities;
- The long time horizon "neutralises" current burning issues, facilitating cooperation between diverse regional actors, reducing conflict, and building consensus;
- Foresight enables continuation, expansion and establishment of dialogue and collaboration between the RI system's main stakeholders; and
- The regional innovation policy is linked to other regional policies (industrial, labour etc) and related development measures are often amplified by Foresight activities.

[4]Top-down: an approach which emphasises the strategies and decisions of those at the top of the management or power hierarchy, with these being accepted and carried out by the lower layers of the hierarchical structure.

In South Africa, the national system of innovation (SANSI) has been criticised for the weak integration between policy at the national level and innovation-related policy and support measures as well as organisations at the provincial and local levels. The concept of a regional innovation system is relatively new in South Africa. Hence, successful innovation processes need to be developed between a large number of actors such as companies, R&D organisations and the public sector. Regional innovation policy and mechanisms are needed to provide platforms for cooperation between these different actors.

As described in section 4, regional Foresight was one of the major mechanisms chosen by COFISA to stimulate the development of South Africa's regional systems of innovation by building shared strategic visions on regional innovation.

5.3 Foresight and private-sector transformation

Historically in the private sector, Foresight has been a tool mostly employed by large companies and multi-nationals. Some successes are well known, but there are probably many more that are kept commercially confidential because of their ongoing proprietary value.

It is widely recognised that SMEs are essential mechanisms for sustainable, organic growth in developing and emerging economies. But most of these countries are slow to adapt their regulations and policies to the needs and realities of these entities, many of which, as a result, stay outside the formal economy in "grey" systems. Foresight is almost certainly beyond the capabilities (and current thinking) of the vast majority of these SMEs. However, its value to them is probably the greatest–especially at a combined (cluster) level.

Governments throughout Africa (including in South Africa) have yet to recognise and address this gap and opportunity. Ideally, they should develop mechanisms to facilitate SME Foresight, but without too much bureaucracy, which would likely drive away the very people who need to be encouraged.

5.4 Foresight and individual transformation: changing mindsets

As seen above, Foresight has had some impact in improving strategic activities of companies and governments (at national, regional and local levels). Yet a higher level of benefit is promised when Foresight is used as a mechanism to help individuals and groups to change not only their visions and plans, but the way they use their minds.

As Einstein argued, successful new futures need new thinking–minds willing and able to adjust their thinking as circumstances (current and anticipated) dictate. This may require whole paradigm shifts. In Africa, where top-down Foresight initiatives have dominated to date, balance needs to be restored via much more emphasis on bottom-up Foresight initiatives, contextualised to the circumstances of regions, communities and individuals in even the poorest and most remote areas.

For example, Foresight might play a significant role in improving the plight of African youth, so many of whom do not benefit from the formal education system. How might Foresight techniques be used to change the mindset and future prospects of these excluded youth (both male and female)? Could it move them on from their current, understandable but counter-productive "dependency mindset", to one where they begin to regain control of their futures as individuals and a generation?

Conclusion, and now what?

6.1 Summing up: Foresight and South Africa

In a knowledge era, role-players in South Africa at all levels–national, regional, organisational, and even individual –have multiple and overlapping areas where Foresight is required as a key survival strategy. Foresight is alive and well in South Africa, and there are numerous examples of successful and less successful exercises from which new practice can benefit.

An enthusiastic, small (but growing) group of practitioners and participants have experienced first-hand the value of thinking about the future in organised and creative ways. To summarise this experience, South Africans are doing the following:

- **South Africa produces Foresight**
  A lot of Foresight work is undertaken, most often as part of organisational strategy and tactical planning. Many organisations in South Africa–public and private–have an internal Foresight or strategy function which will typically include expertise in specific Foresight tools and processes. Many of the products may however be proprietary and not publicly available.

  Ad hoc, public-interest Foresight processes are undertaken too.

- **South Africa consumes Foresight**
  Foresight work in and about South Africa appears to be of significant interest locally and also internationally. As an example, 110 South African private and public institutions currently subscribe as paying associates to the Foresight product services of the Institute of Futures Research at the University of Stellenbosch. A Google search on "South African foresight" produces over 400 000 hits, and this figure jumps to many more (nearly 4-million) using the wider term, "scenarios". International citation of and reference to South Africa's Foresight exercises would appear to be extensive.

- **South Africans are taking steps towards a culture of Foresight**
  Initiatives such as COFISA and the SAMP Node (see section 3) have, in recent years, contributed towards expanding and systematising the use of Foresight in South Africa. Their efforts have been to widen participation in and the use of Foresight beyond the domain of experts and "haves", to a more broadly based set of stakeholders in South Africa's future.

For any organisation or individual wishing to experiment with a Foresight exercise, or to explore further aspects of their future using Foresight techniques and tools, there are several lessons emerging from the South African experience of Foresight that can, with profit, be borne in mind:

- The majority of the Foresight exercises, even if in the public interest, have not been initiated by government. There is therefore evidence of multiple champions for Foresight in South Africa, which is to be encouraged. Foresight does not lend itself to introspection in isolation.
- There has been a tendency to make use of domain experts for input, and consultants for facilitation in Foresight exercises. Both of these approaches are reasonable, although the option of facilitating one's own Foresight exercise, once sufficient experience is gained, should be kept in view.
- Foresight methods and tools are constantly expanding and evolving, and there is much that can be done to operationally use futures thinking–even by the lay person.
- Although Scenarios methods dominate, the temptation to remain with the majority and so be restricted to this tool should be resisted. There are other valuable tools that may be better suited to the purpose of

a particular Foresight exercise. The COFISA case study (see section 4) gives a good example of the use of multiple tools at various stages of a process. This nuanced and rich use of the spectrum of tools is to be encouraged.

- There are only a few examples of recurrent Foresight processes, such as the Presidency and the CSIR. This suggests that many do not build Foresight into their organisational culture through a continual "Foresight conversation". This is a mistake. There is value in building on previous Foresight exercises and seeing the requirement for Foresight as an essential ingredient for ongoing anticipatory governance.
- Many of the exercises appear to be client-driven, with relatively narrow attempts at dissemination or popularisation of results. Only a few of the identified South African studies, for example, can be retrieved from the Internet. This is to the detriment of Foresight practice in general as the experience does not then expand the Foresight knowledge-base and perspective. If at all possible (and taking the necessary precautions to preserve commercial confidentiality), the generic process and output materials of one's Foresight exercise should be made available for others to learn from.
- In addition, critiques of Foresight include the need for improved monitoring and evaluation, a broader base of participation, and an inclusive approach to the systematic analysis of alternative futures.

Finally, some pointers for the future of the future:

- At the national level: The full potential of the appropriate use of Foresight has yet to be realised. Many current Foresight activities are seen to be peripheral or experimental, and insufficient stakeholders are active users for cumulative benefits of widely used Foresight to begin to occur. Pointers to the future exist in the form of the Finnish Parliamentary Committee for the Future, and the Scottish Futures Forum–models which need to be examined and learned from rather than copied.
- At the regional level: The impact of the COFISA processes indicates that much more can and should be done at this level. Opportunities identified in COFISA's target provinces (Eastern Cape, Western Cape and Gauteng) need to be pursued, whilst all the other provinces need similar facilitation to step up their Foresight activities and capabilities.
- At the organisational level: The potential impact of the use of Foresight by and for SMEs (individual SMEs and in groups) needs to be explored with some urgency. Two areas of potential development are particularly exciting. Firstly, the use of Foresight to direct investment in SME-intensive cluster development, particularly in remote and rural regions. Secondly, the use of Foresight to strategise the growth of SMEs in the provision of knowledge-intensive business services.
- At the individual level: Awareness needs to be created that Foresight can be used by any individual at any stage in their lives to help with the quality and the understanding of their thinking about their roles and futures. A few tools lend themselves to non-expert application in this way, and can quickly spread "Foresight literacy" across much of the population. The potential benefits of such activities amongst those who are marginalised (for example, with women and youth, at individual and group level, especially in the poorest communities), is particularly exciting.

6.2 The way forward

This booklet has advanced the argument that Foresight is for everyone and needs to be engaged at multiple levels.

COFISA is ending its project term with a study and process to design a National Foresight Programme that aims to institutionalise the learning and progress in Foresight that has developed over the years in South Africa. This will make great strides towards embedding Foresight formally, and would provide a powerful national resource.

For those who are interested in Foresight and now want to take things forward on their own or in their institutions after reading this booklet, the following advice is offered:

1. Look at the suggested resources below for further reading and examples. There are plenty of other references available in libraries, bookstores and the Internet, and these can provide a more detailed introduction to Foresight concepts, methods and practices.
2. Decide exactly what your need for Foresight application is, and whether you want to apply Foresight towards a specific strategic goal, of if you want to experiment for the purpose of learning.
3. Determine the appropriate approach and methodologies for your application. As discussed in this booklet, there are levels at which Foresight can be done quite effectively with a do-it-yourself approach. However, there are also many human and literary resources that can help you determine a suitable approach at little or no cost. Many Foresight enthusiasts are only too glad to promote the use of Foresight and can offer advice or direction.
4. Share as you learn because this is essential to growing our budding culture of Foresight!

Suggested resources

http://www.cofisa.org.za/docs.html
COFISA Document Library
- This Document Library of the Cooperation Framework on Innovation Systems between Finland and South Africa (COFISA) includes reports and other material on various Foresight exercises conducted in South Africa in the period 2007-2009.

http://www.sun-e-shop.co.za/?Task=moreinfo&SKU=ISBN+978-1-920109-92-9
Breaking the Mould: The Role of Scenarios in Shaping South Africa's Future.
Nick Segal for South Africa Node of the Millennium Project (2007)
- This product of the SA Node's "South African Scenarios Study: Two Decades of Learning" project is a contextual and methodological analysis of the major public-interest Scenario exercises that were conducted in South Africa around the 1994 transition to democracy.

http://www.foresightfordevelopment.org
Foresight for Development Africa
- The Foresight for Development online initiative is a project initiated in 2009 to develop and pilot the use of a collaborative Internet platform for developing, updating and accessing Foresight knowledge, tools, and products by and for Foresight practitioner communities in Africa. It aims to be a centralised resource for Foresight practitioners and enthusiasts on the continent.

http://www.stateofthefuture.org
State of the Future Report (Annual)
The Millennium Project
- This "report card on the future" which has been produced annually since 1997 distils the collective intelligence of over 2 700 leading scientists, futurists, scholars, and policy advisors who work for governments, corporations, non-governmental organisations, universities, and international organisations. It is a paper publication of some 100 pages, and includes a detailed CD which contains thousands of pages of the cumulative, underlying research.

http://www.millennium-project.org/millennium/FRM-V3.html
Futures Research Methodology CD Version 3.0
Jerome C Glenn and Theodore J Gordon (Eds)
- This internationally peer-reviewed compilation is the largest, most comprehensive collection of methods and tools to explore future possibilities ever assembled in one resource. The CD-ROM covers 37 futures research methods or categories of methods.

Acronyms

AFI	African Futures Institute
AIDS	Acquired Immune Deficiency Syndrome
ANC	African National Congress
AU	African Union
COFISA	Cooperation Framework on Innovation Systems between Finland and South Africa
COSATU	Congress of South African Trade Unions
CSIR	Council for Scientific and Industrial Research
DACST	Department of Arts, Culture, Science & Technology
DFID	Department for International Development (UK)
DST	Department of Science & Technology
DT	Disruptive Technology
dti	Department of Trade & Industry
ET	Emerging Technology
EU	European Union
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
KIBS	Knowledge Intensive Business Services
NAC	Newly Associated Country
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
R&D	Research and Development
RI	Regional Innovation
RIS	Regional Innovation Strategy
S&T	Science and Technology
SADC	Southern African Development Community
SAMP	South African Node of the Millennium Project (SA Node)
SANSI	South African National System of Innovation
SME	Small and Medium Enterprises
STI	Science, Technology and Innovation
TRM	Technology Roadmap
UK	United Kingdom
UN	United Nations
UNAIDS	Joint United Nations Programme on HIV/AIDS
UNIDO	United Nations Industrial Development Organisation
UNDP	United Nations Development Programme
US	United States
WFS	World Futures Society
WFSF	World Futures Studies Federation

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COFISA

Cooperation Framework on Innovation Systems betwe

Finland & South Africa

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