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COFISA Provincial Biotechnology Foresight Summary Report

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1 Introduction

Between October 2008 and April 2009 provincial Biotechnology Foresight exercises were undertaken in the Eastern Cape, Western Cape, and Gauteng provinces under the auspices of the Cooperation Framework on Innovation Systems between Finland and South Africa (COFISA). The exercises drew participants from a broad range of sectors (including, public, private, research and tertiary education sectors) and focused on the role that biotechnology could play in the future of each province.

This report presents a summary of the whole exercise and a synthesis of the resultant outputs. It also serves as an introduction to the substantial number of reports that were generated during the process, and which may be accessed at www.cofisa.org.za. It is intended to act as a “user-friendly interface” to the processes followed, tools used, and outputs generated.

The report is set out as follows. First, some background to the Foresight exercises is provided, followed by a summary outline of the processes used. Next, the highlights of the process outputs are presented, including a record of the lessons learned.

2 The Biotechnology Foresight project background

COFISA is a programme that has been developed jointly by the governments of South Africa, through the Department of Science and Technology, and Finland, through the Embassy of Finland in Pretoria. Its objective is to contribute to the enhanced effectiveness of the South African National System of Innovation (SANSI) contributing to economic growth and poverty alleviation.

It is widely accepted in many countries that complementing a national innovation policy with a strong regional (i.e. sub-national) development focus has been successful in the development of regional capacities that benefit from national or supra-national flows of resources. However, the 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. Hence, regional innovation policy and mechanisms are needed to provide platforms for cooperation between a large number of actors such as companies, R&D organisations and the public sector.

In 2001 and 2002 the European Union (EU) was confronted with similar situations in the ten Newly Associated Countries (NACs - Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Poland, Romania, Slovakia and Slovenia). The EU launched a range of projects aimed at developing and implementing regional (i.e. sub-national) innovation strategies in each NAC. 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 regional innovations systems. Hence, 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, creating and amplifying regional "triple helix" collaboration, and supporting planning.

Biotechnology is one of the "grand challenge" areas that have been identified in the ten-year innovation plan published by the Department of Science and Technology (DST), and supported by Cabinet. Its crosscutting nature means that in the next twenty years there will be significant scope for new opportunities to emerge in the intersections between biotechnology and a wide range of other disciplines and sectors.

From November 2007 to March 2008, COFISA held a successful Foresight exercise that focused on the future of each of the three chosen provinces, with a particular emphasis on the role of innovation in that future. Following on from this, and in support of DST's biotechnology "grand challenge", COFISA decided to hold a biotechnology Foresight exercise for each of the three provinces during late 2008 and early 2009.

For each province, the objectives of this exercise were:

- To anticipate emerging areas of opportunity related to biotechnology, with a particular focus on the province in question;
- To support existing and encourage new biotechnology SMEs in that province.

3 Overview of the Foresight process

Foresight consists of a variety of techniques and methods used collaboratively to capture the dynamics of change by placing today's reality within the context of tomorrow's possibilities. It is inherently proactive, reflecting the belief that the future is influenced by today's decisions and actions. It is not prediction. Instead it recognises that addressing the future necessitates the management of uncertainty. It develops a well-informed context for current decisions via dialogue involving all stakeholders. And it emphasises the human abilities of forethought, creativity, and systems thinking, in addition to our capacities for analysis and judgement which have tended to dominate strategic planning throughout the industrial era.

In this context, the purpose of the Foresight exercise for each target province was:

- To introduce participants to the importance of regional innovation systems and the role futures thinking has in helping to establish and maintain them.
- To introduce participants to the value and practice of some commonly used Foresight tools and processes in general, and technology road mapping (TRM) in particular.

- To use these methods to encourage the participants to collaborate in creating a range of possible future biotechnology scenarios for their province and to identify the highest priority challenges and opportunities that emerged from these scenarios.
- To ask the participants to examine the highest biotechnology priorities in more depth (again, from a future viewpoint), and to create TRMs that would enable them to be addressed.
- To encourage the multi-sectoral, multi-disciplinary networks of people established throughout the Foresight exercise to continue to communicate and collaborate with each other.
- To build Foresight facilitation capacity by involving in the process four coordinators (with no previous TRM experience), who would receive initial training in all Foresight techniques, but particularly TRM, through learning-by-doing.

A total of six residential, two-day workshops were held between October 2008 and March 2009, made up of two workshops in each of the three target provinces, i.e. the Eastern Cape, Western Cape, and Gauteng.

3.1 First set of two-day residential workshops

3.1.1 *Preparation for the workshop*

The quality of the outputs of any Foresight process depends to a large extent on the mix and appropriateness of the expertise and experience of the delegates and reference groups that participate. This is particularly the case for such a widely cross-cutting area as biotechnology. Significant effort, therefore, was put into identifying within each province a broad range of people with either generalist or specialist expertise in biotechnology, as well as practitioners in biotechnology related private sector activities, and public sector stakeholders.

To optimise the productivity of the carefully selected delegates during the two-day workshop, they were asked to study two documents which were circulated to them prior to the workshop:

- **Biotechnology Trends Analysis:** This draft report provided an overview of Biotechnology Trends at several levels: Developed economies and multinationals; Emerging economies; and South Africa.
- **Three Proto-Scenarios for the province in question - 2030:** These proto-scenarios were synthesised from the contents of the first set of Futures Wheels created during the previous year's COFISA Eastern Cape Innovation Foresight process. Because these innovation Futures Wheels were very rich,

it was decided to take this base material from one of the provinces (Eastern Cape was chosen), and attempt to work them into full blown provincial innovation scenarios. 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 1). 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 first set of provincial Biotechnology Foresight workshops, a similar method was used to create sets of three innovation proto-scenarios for the other two provinces, namely Gauteng and the Western Cape (for details of this process see www.cofisa.org.za).

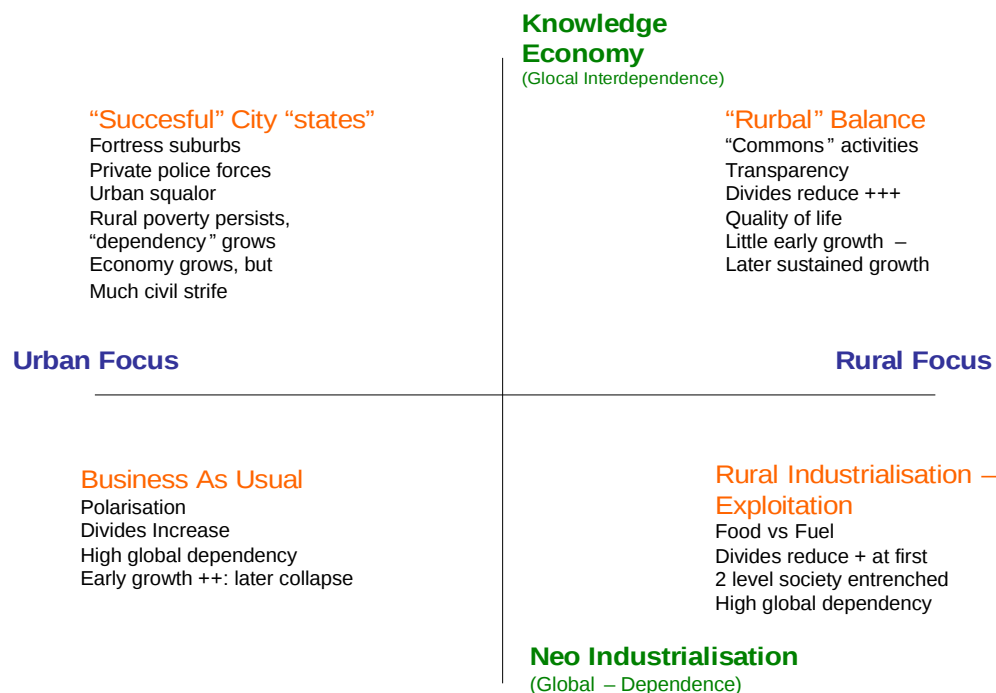


Figure 1: Eastern Cape 2050 Innovation Scenario Quadrants

3.1.2 Workshop Processes

The first workshop in each province began with a fairly substantial introductory session. Following brief self-introductions of all the delegates, the aims and the background of the COFISA programme were presented. Then, the basic concepts of Foresight were presented, and the rationale for the Foresight techniques chosen for this exercise was explained.

Following this introduction, two main items were pursued:

- **Provincial Biotechnology Trends:** Following a slide presentation based on the previously circulated “Biotechnology Trends Analysis” document, the delegates were asked for the rest of the first morning to add any relevant knowledge they had, particularly related to current or emerging biotechnology activities anywhere in their province. To achieve this, three groups of delegates were established based on particular biotechnology focus areas.
- **Provincial Biotechnology Scenarios:** Following a slide presentation based on the previously circulated “Three Scenarios for the province in question - 2030” document, the delegates were asked for the remaining 1.5 days of the workshop to participate in activities designed to convert these proto-scenarios into full provincial Biotechnology Scenarios. To achieve this, they were asked to choose one of three groups of between four and seven delegates, each based on one of the proto-scenarios.

Each group was then employed to produce two levels of biotechnology futures wheels for their particular proto-scenario. Finally, based on the most important issues that they had highlighted in their futures wheels, the groups then wrote fairly detailed biotechnology proto-scenario fragments.

3.2 Between-Workshop Activities

Following the first workshop two sets of activities were undertaken by the COFISA Foresight Team, supported by the workshop delegates:

- A summary of the modifications to the biotechnology trends review were distributed electronically amongst the workshop participants. Their feedback was included in a final COFISA Biotechnology Trends Analysis document for general distribution (available at www.cofisa.org.za).
- The set of biotechnology proto-scenario fragments was crafted into the related original proto-scenario to produce preliminary drafts of each of three provincial Biotechnology Scenarios. These draft scenarios were distributed electronically amongst the workshop participants. Their feedback was incorporated into Version 1 of the set of three provincial Biotechnology Scenarios, which were the primary input to the second workshop, when Biotechnology Road Maps, and Action Plans to Stimulate Biotechnology SMEs were developed.

3.3 Second set of two-day residential workshops

Based on the specific themes that were identified during the first workshop in each province, subject matter specialists were identified for each theme. Together with the

majority of the delegates of the first workshop, these specialists were invited to the second workshop to provide expert inputs to the proceedings.

The second workshop began with a session which reviewed the process so far to ensure that all delegates (newcomers and experienced alike) were primed for the activities. At this stage, as in the previous workshops, three groups (of up to seven delegates) were established, each tasked with creating a technology road map (TRM) based on one of the three provincial biotechnology scenarios. Finally, they were asked to use their TRMs to identify related opportunities for existing and potential SMEs.

3.3.1 Technology Road Mapping

By contrast with the Futures Wheel, a Technology Roadmap (TRM) is a much more time consuming and sophisticated Foresight tool. A TRM provides a high-level view of the technology-related building blocks that are required to deliver a product or service to a market or beneficiaries. It includes high-level dependencies and timing information for the building block identified. 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.

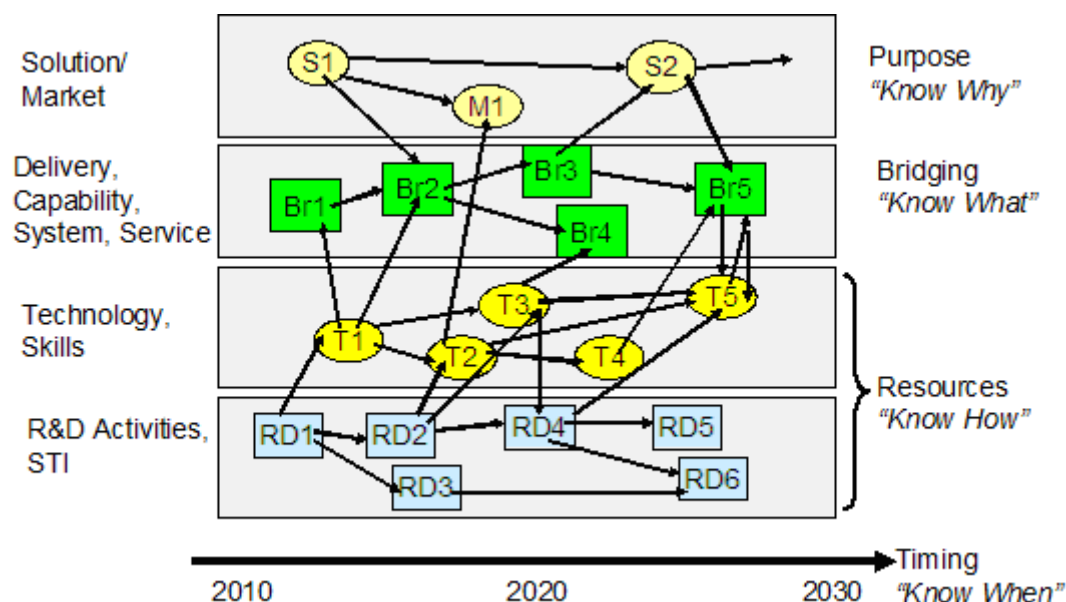


Figure 2: A generic TRM

The most commonly used TRMs have a multi-layer format as shown in Figure 2 above):

- 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 (i.e. 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.

The TRM process that was followed is set out in some detail in the reports for each provincial Foresight exercise (see www.cofisa.org.za).

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 in 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.

4 Highlighted outputs

Being a focused, technology-Foresight exercise, the two sets of workshops in each province resulted in a fairly comprehensive set of products which are available at www.cofisa.co.za:

- 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.
- TRMs, and consequent action plans 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

- Opportunities for SMEs in each province based on the TRMs. The facilitators were particularly impressed with not only the large numbers of opportunities for SMEs that were identified, but also the wide variety of niches (often inter-sectoral and interdisciplinary) that emerged and required SMEs to fill.

5 Learning from the Foresight process

In this section we review the effectiveness of the tools and processes used in the provincial Biotechnology Foresight exercise, particularly with the interests of practitioners (both experienced and potential) in mind.

5.1 Insights concerning tools

5.1.1 *The Futures Wheel*

The Futures Wheel provided a non-judgmental 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 is a non-adversarial mechanism, even when contentious issues arise. It encouraged participation by all, rather than domination by single individuals, which resulted in a sense of joint ownership of the futures envisaged.

The Futures Wheels proved easy to use for both delegates and facilitators alike, quickly resulting in surprisingly rich and innovative material, and fostering energy and enthusiasm amongst the participants.

5.1.2 *Technology Roadmaps*

The TRM process has many strengths. It is both 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.

5.1.3 Full Scenarios

The use of small groups and futures wheels enabled the rapid and efficient production of enough material of sufficient quality and innovativeness to develop very substantial quadrant-based scenarios for all three provinces.

5.2 Insights concerning the process

5.2.1 Participant selection

In the first set of workshops, it proved valuable to draw workshop delegates with biotechnology expertise or market interest from different sectors of society and the economy (public, private, tertiary education sectors, international community, and civil society) to ensure that as broad a vision as possible of the future was captured. Bringing only “experts” together at this stage (which is often done in first world technology Foresight processes) usually creates a very narrow vision of the future, which is less helpful in the context of emerging and developing economies.

However, the identification and subsequent participation of appropriate experts in the second round of workshops added to the plausibility, legitimacy and practicality of the TRMs produced.

5.2.2 Working group size

The value of using small-group sizes of between three and seven persons 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 seems 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 (up to four) can easily be managed simultaneously. For example, the logistics of trying to manage six groups in Gauteng proved problematic. It would have taken an impractical number of facilitators (or a great deal more time) to provide all six groups with the attention they needed to ensure the success of their work, especially when their progress was arrested by difficulties.

5.2.3 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 fully commit. They also significantly 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.

5.2.4 Workshop structure

In the past, one day workshops had been used for provincial Foresight exercises. However, they seemed rushed and difficult to manage. Significant time was required for the introductory session: to introduce new delegates; to overview the process so far; and to explain the workshop agenda and the input materials. Hence the working group sessions, which produced the important outputs of the workshops, were condensed into only half a day.

By comparison, the workshop format used in this exercise, being two-day and residential, introduced a new dynamic which significantly 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.

The above learning suggests that in future, similar exercises should use two-day, residential workshops.

6 Conclusions

Rather than being a fully fledged academic discipline, Foresight should be viewed as an evolving (and growing) set of processes and tools that have been devised to help us imagine, capture, analyse and act upon a range of possible longer-term futures. This provincial Biotechnology Foresight exercise provides a particularly good example of how several Foresight tools can be adapted to local contexts and blended not only to produce results of high quality, innovation and value, but also to provide intense but enjoyable learning experiences for delegates and facilitators alike.

To the best of our knowledge, this is the first time that TRMs have been developed at the regional (sub-national) level in South Africa, and this innovation appears to be succeeding. South Africa's earlier implementations of public-funded Foresight initiatives have tended to be at the national level, have addressed macro-issues, and have seldom been perceived to have delivered the anticipated impact. By contrast, this regional Foresight approach, employing many small groups in short but intense creative sessions, has consumed less time of the participants, been significantly less costly, and taken less than four months to complete.

Another important issue is the contribution of and impact on the significant number of SMEs that took part in this exercise. They appreciated the focus on subjects they

could readily identify with (innovation and biotechnology), the brevity of the process, and the professionalism of COFISA's approach. It was encouraging to the organisers that few SME participants dropped out during the process. Indeed several have remarked subsequently that they have benefited from the new visions and from the networking. They also voiced enthusiasm about using some of the Foresight techniques regularly as part of their ongoing strategic processes.

While much of the specific value of the exercise for biotechnology-related efforts in the three provinces will be determined only in years to come, there have already been success stories reported by some participants. Thus the indications are that the exercise has provided a basis for exploring further, both in the three target provinces and in other provinces, how Foresight in general, and TRMs in particular may be used more widely to add value to innovation-related activities.