

The Research Role of the CSIR

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INTRODUCTION

This poster is not intended to be a policy document, or even a guideline; it is a discussion poster that seeks only to present a partly historical and partly futuristic interpretation of the CSIR's research role. Such discussions are important both in the organisation and within the national research community in order to build a common understanding and enable the most productive allocation of resources.

The CSIR is a significant component of South Africa's public sector research infrastructure. It accounts for about 15% of total government expenditure on research and development (R&D), or about 4% of the total South African R&D expenditure. The organisation contains several unique research facilities and occupies in most respects a unique position within South Africa's National System of Innovation.

However the future of public research institutions is by no means a certainty. In some countries such as the United Kingdom, government funded research organisations have been closed; these countries have opted for a system whereby research performance is split between universities and private companies (also called business enterprise). The future of the CSIR as a mixed-income institution, with income derived from both a direct government grant and contract research, is therefore also not guaranteed. Other models may emerge and gain support. As a result it is important that we can define the CSIR's research role, and show clearly its contribution within the South African context.

WHY DO GOVERNMENTS FUND RESEARCH?

Governments fund research for two main reasons; firstly to support its activities, or more accurately, the activities of the public sector, including defence, poverty alleviation, health, transport infrastructure and environmental management. Secondly, on account of the failure of markets to fund the research that society needs, especially the more fundamental research which is too long term and too high risk for the private sector to support.

Market failure is often more acute in developing countries due to the weak national innovation systems that exist in such countries, in particular business enterprise research and development. For instance, an examination of the R&D survey data from a number of countries indicates that in many developing countries, the proportion of gross expenditure on R&D (GERD) exceeds 60% (see **Figure 1**¹).

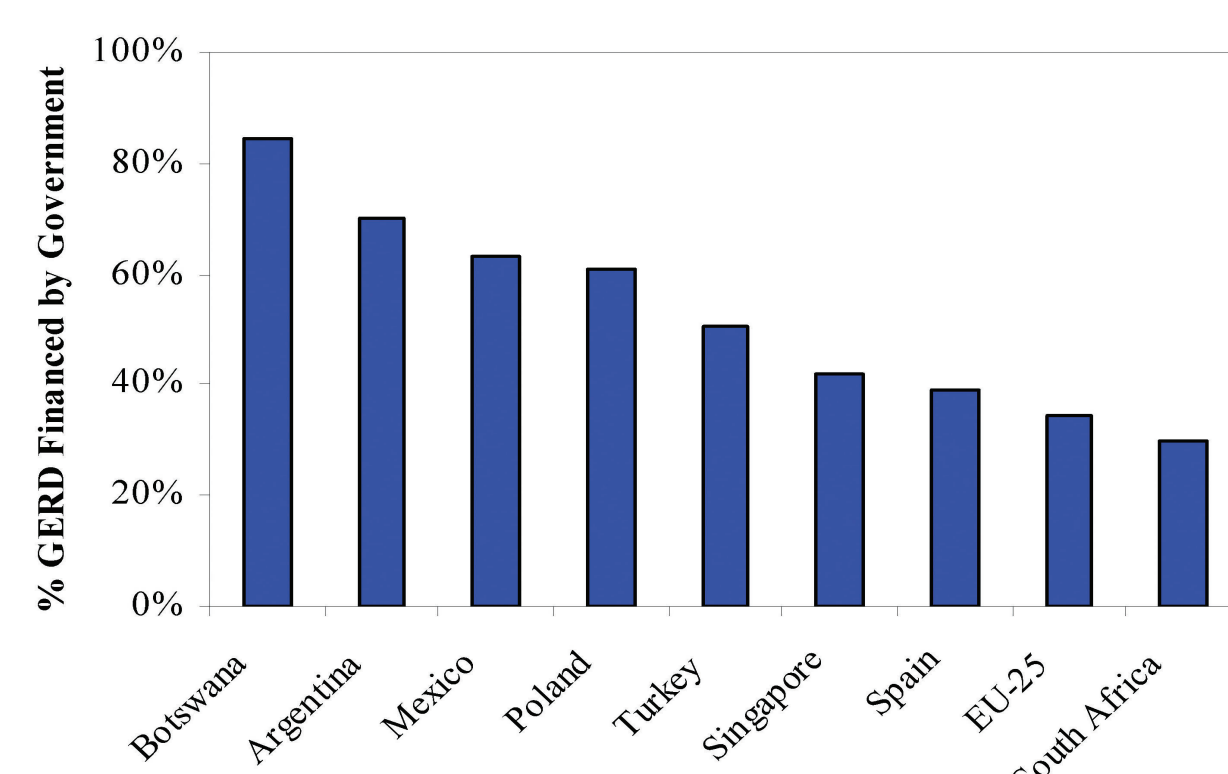


Figure 1: Governments in developing countries typically fund a higher proportion of GERD

¹South Africa is a notable exception to this correlation

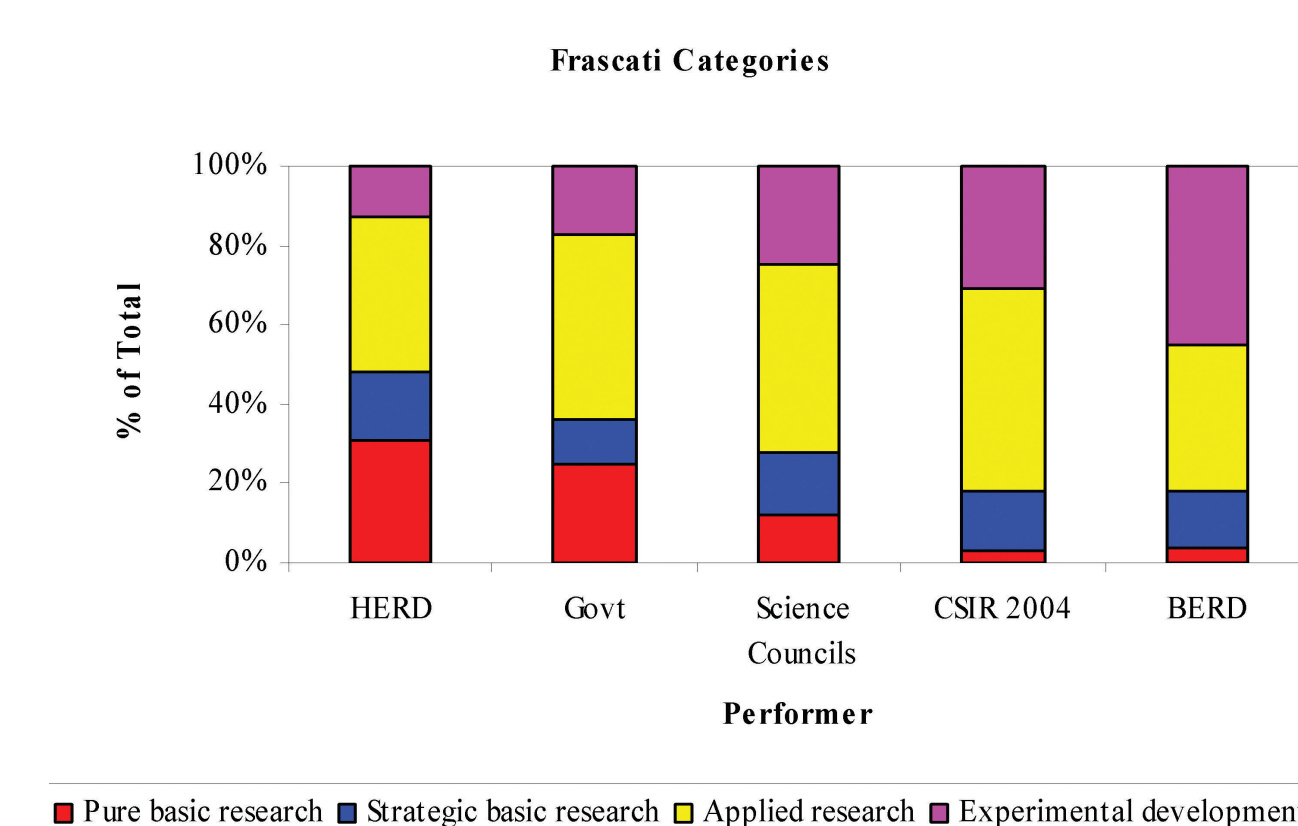


Figure 2: Science councils perform high levels of applied research².

²Definitions of these terms are given in the CSIR S&T Strategy
³Data obtained from the 2001/2 R&D Survey

But even in developed countries, public sector research is an essential component of a national innovation system due to its longer term and more fundamental nature. Whereas in the private sector economic returns are the major driving force for innovation, social return is equally important in the public sector and a large proportion of university research, for instance, is undertaken for the sake of the 'advancement of knowledge'. This role for government funding is most obvious from an examination of the Frascati categories (see **Figure 2**), which shows that business enterprise R&D (BERD) is mostly concentrated on experimental development (research closely linked to the development of new products and services), whereas the research by the higher educational sector (HERD) is dominated by basic research.

Presently the CSIR and the science councils have a central role between the two sets of institutions (business and universities). Many governments continue to fund national research laboratories in addition to universities on account of their more applied focus, which is essential in the overall conversion of new products and services into innovation and hence economic benefit.

WHO PERFORMS PUBLIC-FUNDED RESEARCH?

In the previous section, we have argued that governments have an important funding role in a national innovation system. However this is not equivalent to a performance role and indeed countries differ widely in terms of the public sector research institutions. In the UK, as we have mentioned, many of these institutions have been closed; government simply contracts its R&D needs to private sector organisations. In the USA, many of the large defence and energy laboratories are federal-funded but are managed by universities.

In other words, public-funded research can be performed by non-governmental organisations. Although this has its advantages (in some cases increased efficiency, both in terms of outputs and cost), it has many disadvantages including the inflexibility of a contractual relationship, conflicting objectives and short term planning. Such contractual relationships rarely lead to long term investment in key infrastructure and the building of new technology capabilities through intensive human capital development programmes. These twin objectives were very central to the original rationale for the establishment of the CSIR, to which we now turn our attention.

THE HISTORICAL ROLE OF THE CSIR AND ITS MANDATE

Any discussion on the future research role of the CSIR has to include a brief historical review and an introduction to the Scientific Research Council Act (No 46 of 1988). The CSIR was formally established on 5th October 1945; at its

first formal meeting (of the CSIR Council) on that day, Prime Minister Smuts said, "The time has come when we must tackle our own job and the problems which lie before South Africa. We must develop our own scientific handling of those problems."

These words are still echoed in the Scientific Research Council Act (No 46 of 1988), which governs the CSIR and further defines the objects of the CSIR as being "through directed and particularly multi-disciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic ...". In seeking to meet this mandate, the CSIR has followed a number of models and pursued a number of initiatives, the latter reflecting the priorities of the day and the prevailing theory as to how one can best translate research investment into improvement in quality of life.

An important development, which began 40 years ago, was the diversification of the CSIR's income stream (see **Figure 3**). Apart from a simple economic imperative for the organisation to look outside the Parliamentary Grant in order to grow, the trend was driven by the sentiment that contract income was an excellent indicator of CSIR's relevance to the needs of its partners. This sentiment is still widely reflected in the strategic planning of almost all research and technology organisations.

Apart from the period 1982 to 1990, during which the apartheid state overspent in a desperate attempt to build military strength and stave off economic collapse, the CSIR's income streams have remained reasonably constant in real terms. However the funding crisis of the early nineties (see **Figure 3**) had far reaching consequences for the organisation; it precipitated the closure of many research activities in favour of contract income opportunities of various descriptions, including consulting and knowledge-base services. It was the resultant depletion of the organisation's science and technology base that the Beyond 60 restructuring has sought to redress.

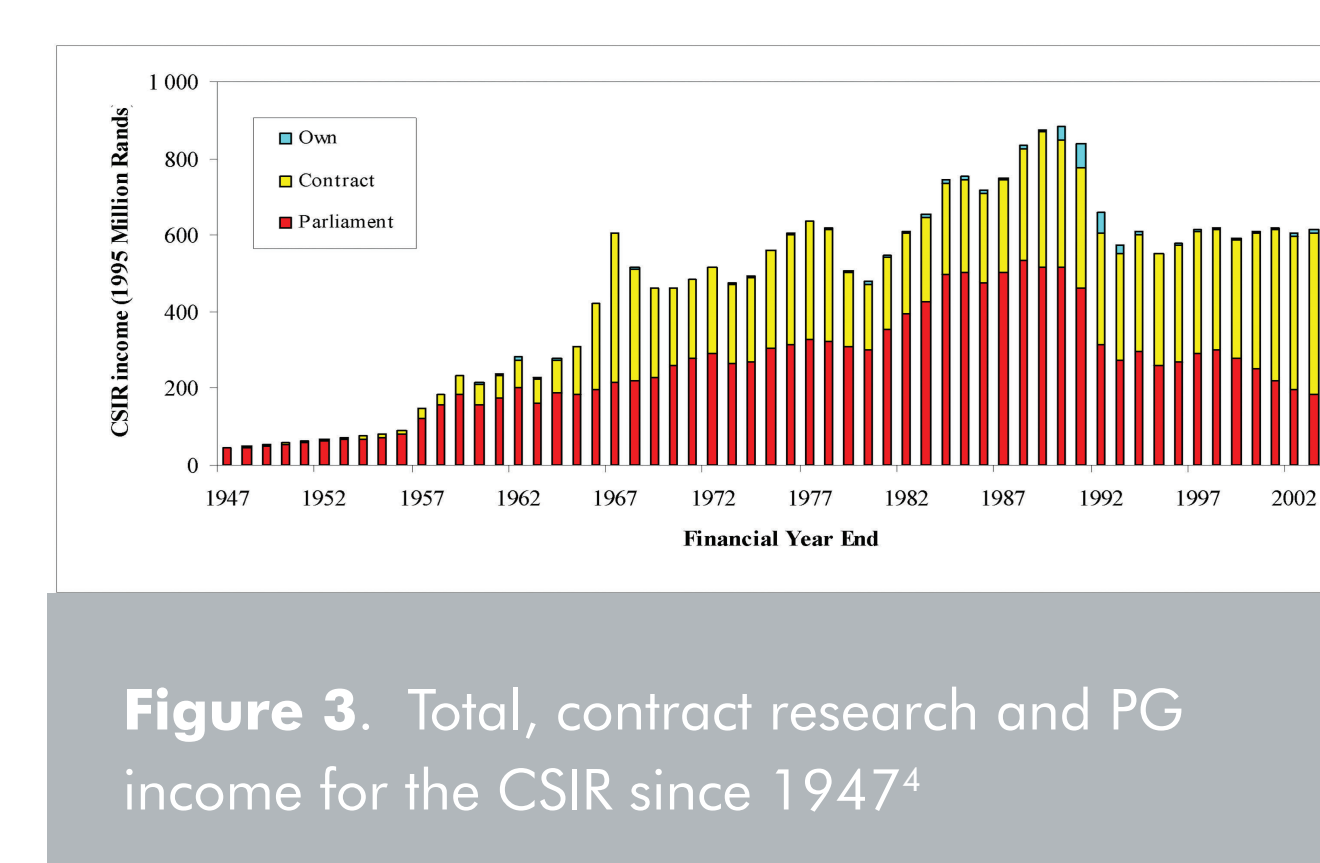


Figure 3. Total, contract research and PG income for the CSIR since 1947⁴

⁴The collection of this data by Dr Bob Scholes is gratefully acknowledged

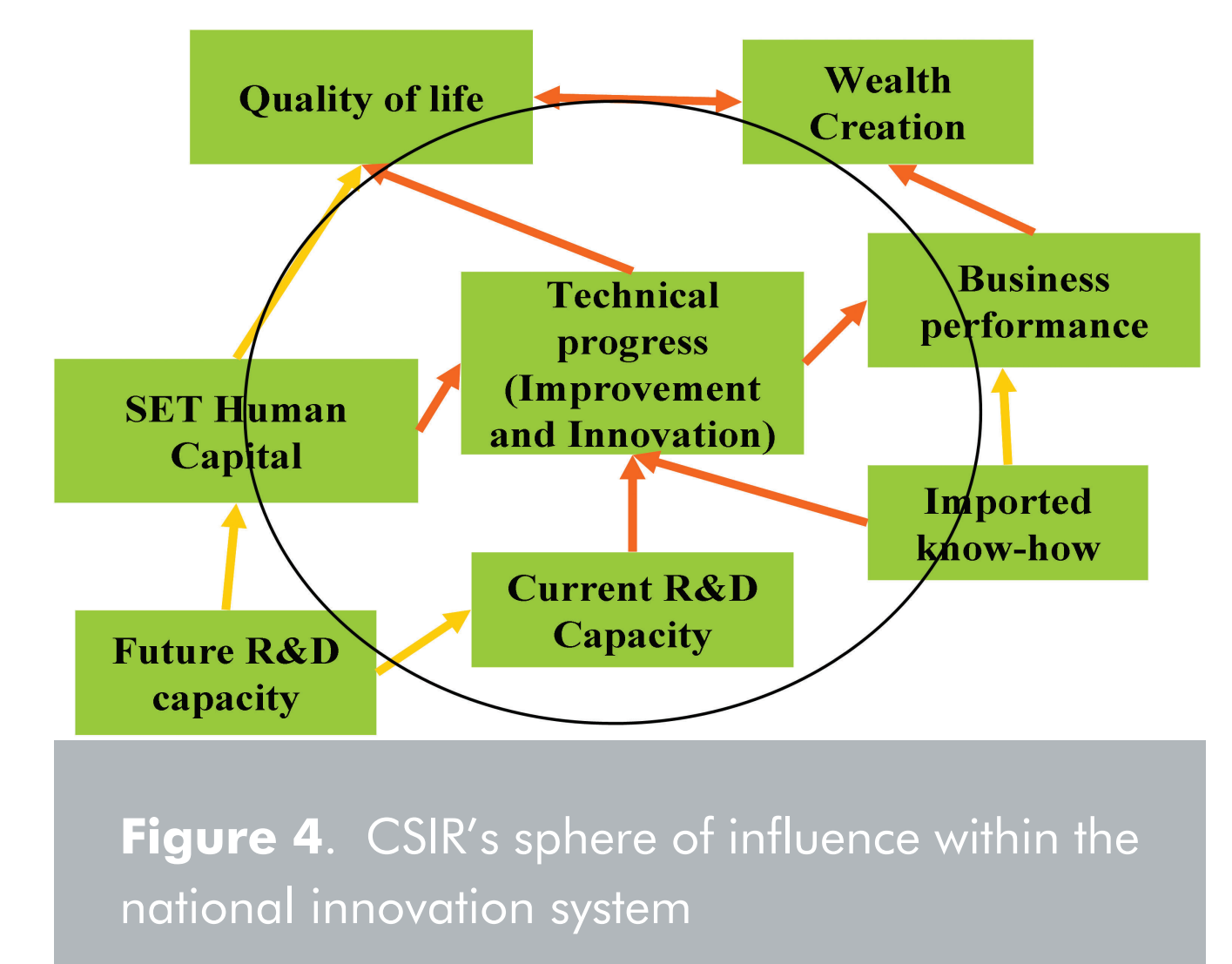


Figure 4. CSIR's sphere of influence within the national innovation system

THE RESEARCH ROLE OF THE CSIR

Many of the initial conditions and challenges that led in 1945 to the formation of the CSIR remain; the country faces an urgent need to develop its human capital, transfer technology from other countries, establish new and strengthen existing industries, thereby creating employment, increasing per capita income and attaining higher levels of economic growth. We must also address the human health challenges, in particular to reduce the prevalence of infectious diseases, such as TB, malaria and HIV/AIDS.

As a result, the research role of the CSIR remains essential within the national innovation system. Although it undertakes a mixture of research types with a highly integrated research and innovation value chain, stretching from strategic basic research to technology transfer and commercialisation, the focus on applied research (leading to innovative products and services) should be dominant. Since this portfolio is mostly far from market and subject to high risk, ongoing support from parliamentary grant is essential, with the attached responsibilities of human capital development, diffusion of technologies from other countries, maintenance of essential research and scientific infrastructure, undertaking of longer term research of high social importance (and not necessarily of high economic return), and the establishment within South Africa of research programmes in emerging areas of S&T. This sphere of influence is shown in **Figure 4** (background figure obtained from the Department of Science and Technology).

The above brief is broad and introduces an inevitable tension between various research programmes with widely different underlying competencies. In mediating this tension and improving the overall impact of its research portfolio, the following recommendations are made:

- Any duplication of, or significant overlap with, the capabilities of the universities or other science councils must be avoided;
- Scanning of the patent literature and in-licensing of intellectual property should be strengthened in order to avoid repetition of work already completed elsewhere and improve technology transfer/integration;
- Funding in support of longer term strategic partnerships with other research organisations, both public and private sector, should be given priority;
- The overall portfolio should be continuously assessed against the priorities of the Department of Science and Technology and recalibrated where necessary;
- The CSIR should be continuously alert to opportunities for applying science and technology to the development needs of poor communities, and should undertake the necessary research to realise these opportunities;
- The organisation should ensure that the research base receives the bulk of its grant income and that it is not again drawn into a role as a knowledge-based service provider; and
- A research portfolio balanced across the Type A, B and C² activities is essential.

In conclusion, the poster has traced the role of public funding in South Africa's research landscape and hence clarified the role that the CSIR has, and should play in the future. Finally a number of recommendations are made in order to maximise the impact it can make through a strong research portfolio.