Main Results of the South African Innovation Survey 2005

(Covering the period 2002 – 2004)

A survey undertaken on behalf of the Department of Science and Technology (DST) by the Centre for Science, Technology and Innovation Indicators (CeSTII) of the Human Sciences Research Council (HSRC)

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EXECUTIVE SUMMARY

Background

The Centre for Science, Technology and Innovation Indicators (CeSTII) was commissioned by the Department of Science and Technology to undertake a national innovation survey based on international best practice. This report presents the main findings of the South African Innovation Survey 2005, covering the period 2002–2004. Where available, comparisons are made with the results of the Fourth Round of the Community Innovation Survey (CIS4) for European Union (EU) countries, as provided by Eurostat.

Methodology

The design of the Innovation Survey 2005 was informed by Eurostat guidelines and the structure of the Statistics South Africa business register. The survey design thus comprises:

- a random stratified sample (by sector and size of enterprise) drawn from the business registry database of Statistics South Africa in conformity with the Small Business Amendment Act (No. 26 of 2003);
- a postal survey with at least two telephonic and two written correspondences;
- provision for a non-response survey if the response rate is below 70%;
- extrapolation of results to the target population based on the weighted sample.

After cleaning the final returned questionnaires and data, an overall response rate of 37.3% from a sample size of 2 627 enterprises was obtained. This was a relatively high response rate in comparison with two previous unofficial innovation surveys undertaken in South Africa in which the response rates were less than 10%. The results of the survey were extrapolated to the target business population of 31 456 enterprises based on the weights of 120 strata.

Results

The results of the Innovation Survey 2005 indicate that 51.7% of South African enterprises were engaged in innovation activities between 2002 and 2004. This compares favourably with the European Union (EU) average of 40%. The proportion of EU enterprises engaged in innovation activities ranged from 16% in Bulgaria to 65% in Germany.

Total turnover of the enterprises was recorded as R1 144.4 billion. About 75.5% of this turnover is accounted for by enterprises with innovation activities. Innovative enterprises also employed more staff than non-innovative enterprises and accounted for 78% of total employees. Another feature of innovative enterprises is that they are more export-oriented than non-innovative enterprises.

Enterprises that had product innovations (comprising innovation in either goods or services) accounted for the majority of innovators in the survey. Approximately 10% of the turnover of product innovators in 2004 was generated by innovations that were new to the market, representing turnover of about R67.8 billion. A further 11.8% was generated by the sale of products that were new to the enterprise concerned but not new to the market. About 80% of innovative South African enterprises introduced new or improved products to the market, which is higher than recorded for any European countries. In comparison, about 78% of innovative enterprises in Iceland introduced new or improved products to the market.

South Africa performs relatively well in terms of the percentage share of turnover generated by the sale of new or significantly improved products (new to the market and not just new to the enterprise) compared with other countries. In South Africa, this share is 10.1%, compared to the 8.6% average for EU countries.

Product innovations by innovative enterprises in South Africa were developed mainly by the enterprises themselves (51.3%). About 23% of enterprises collaborated with other enterprises or institutions to develop product innovations, while a further 6.4% relied on other enterprises or institutions to develop their innovations.

About a quarter of all enterprises (24.8%) introduced process innovations involving new or significantly improved methods of manufacturing or producing new goods and services. Some 21.3% developed new delivery or distribution methods, and 22% produced new or significantly improved supporting processes for their operations.

Of the 16 264 innovative enterprises, 54.9% reported that their innovations originated in South Africa, and 25.4% reported that their innovations were developed mainly abroad.

Innovative enterprises spent approximately R27.8 billion on innovation activities, which represents about 3.2% of the turnover of these enterprises. In both the industrial and services sector, the bulk of innovation expenditure was devoted to the acquisition of new machinery, equipment and software and was equivalent to about 2.1% of the turnover of innovative enterprises. Intramural and outsourced R&D accounted for 0.69% of the turnover of all enterprises and 1% of the turnover of innovative enterprises. South Africa's profile of expenditure on innovation activities is very similar to the EU average.

Altogether, about 11.8% of innovative industrial enterprises and 6.5% of all innovative enterprises received public funding for their innovation activities between 2002 and 2004. This does not compare particularly well with European countries, where only Bulgaria reported less public funding for innovation than South Africa. In 10 out of 24 European countries, more than 25% of innovative enterprises receive public funding for innovation.

Almost half of all innovative enterprises rated sources of information within the enterprise as highly important for innovation activities. Clients and customers, as external market sources, were rated as highly important by 35% of innovative enterprises, followed by suppliers (24%) and competitors (13%). Universities and technikons were rated as highly important by only 5% of enterprises, and government and public research institutes by only 3% of enterprises. In terms of highly important sources of information for innovation, South Africa's profile appears to be much the same as that of the average profile for the expanded European Union (EU-27).

Private sector enterprises in South Africa are sometimes criticised for lacking cooperative civilities and partnerships with other organisations. However, in terms of cooperative partnerships related to innovation activities, South African enterprises appear to have a relatively high intensity of cooperative linkages, with 39.9% of innovating enterprises having innovation activities with other enterprises and institutions. By comparison, an average 26% of innovative enterprises in the EU have collaborative partnerships. As in Europe, the percentage of cooperation partnerships among innovative South African enterprises for innovation with consultants, universities and public research institutes is higher than the corresponding scores for these potential partners as sources of information for innovation.

Improved quality of goods and services was cited as a highly important effect of innovation by about 46% of innovative enterprises. Increasing the range of goods and services was an important outcome for 34.3% of enterprises. Increased capacity of production or service provision was cited as the most important effect of process innovation by 19.1% of innovative enterprises, followed by improved flexibility of production or service provision (15.1%). Other highly important effects of innovation were meeting government regulatory requirements (21.4% of innovators) and reducing environmental impacts or improving health and safety (12.8%).

Innovative industrial enterprises appear to be most hampered in their innovation activities by the lack of funds within their enterprise or group, while non-innovative industrial enterprises cited the domination of the market by established enterprises as the major factor. Both innovative and non-innovative enterprises in the services sector also tended to cite the domination of established enterprises in their market as hampering their innovation activities.

Compared with EU countries, relatively few innovative South African enterprises applied for patents or registered industrial designs, but they were about average in terms of registering trademarks and claiming copyright.

Conclusions and recommendations

The Innovation Survey 2005 is South Africa's first official innovation survey based on a proper random stratified sample from the official business register. It is thus difficult to make precise comparisons with previous innovation surveys undertaken in the country. Care must be exercised in reaching policy conclusions based on a single official innovation survey.

With this proviso in mind, there are still some obvious conclusions that may be drawn. Despite a relatively low response rate compared with European countries, the survey should be regarded as a success for a developing country. Subsequent South African innovation surveys will benefit from the learning experience and the database resource that was built in the course of the survey, so that it becomes a more robust source of data for analysis. Much richness in the analysis comes from having undertaken an internationally comparable survey, which can be readily compared with results from many other countries. The next stage of analysis will be an examination of the micro data.

Despite the best intentions of governments to stimulate innovation with funding, public funds do not appear to have much penetration into the activities of innovative enterprises in most countries. The reason could be that successful, competitive enterprises are not keen to seek public funds, as this would disclose strategic information to others about their business activities. Enterprises appear to be more open about engaging in publicly funded R&D where the application of activities is possibly less obvious to those outside the business. Current public funding programmes for innovation in South Africa could perhaps be intensified, better publicised and aimed at establishing more trusting relationships between funders and performers of innovation activities.

Expenditure on innovation activities results in sales of new and improved products by enterprises. Enterprises invested some R27.8 billion in innovation activities in 2004. Previous investment in innovation activities resulted in R67.8 billion sales of products that were new to the market and R147 billion if products new to the enterprise are included. These returns on innovation activities do not include the benefits to the

enterprise of innovative processes or organisational innovations. Business and government need to be made aware of these tangible benefits of innovation in order to further encourage innovation. The closeness of the estimate of expenditure on intramural R&D obtained in the Innovation Survey 2005 (R5.7 billion) compared to the R5.9 billion recorded for the equivalent business sectors in the 2004/05 R&D Survey is encouraging.

The results of the Innovation Survey 2005 clearly show that South African enterprises have much in common with enterprises in many EU countries. For example, the results of the South African survey closely resemble those of the EU-27 profile on questions such as the factors hampering innovation and the most important outcomes of innovation for enterprises. These similarities indicate that South Africa can potentially learn much from the experiences related to policies and instruments for supporting innovation in the EU. In a follow-up exercise, the results will also be compared to those available from other developing countries.

The results of the Innovation Survey 2005 clearly show that South Africa is not a 'technology colony', depending exclusively on foreign technology. Most innovations are developed by enterprises in South Africa, and the influence of foreign partners is comparable to the experience of other countries. South African enterprises are clearly very active in both R&D and innovation, and this bodes well for their future competitiveness.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immune deficiency syndrome
BEE	Black economic empowerment
CEO	Chief executive officer
CeSTII	Centre for Science, Technology and Innovation Indicators
CIS	Community Innovation Survey
CIS4	Fourth Round of the Community Innovation Survey (also CIS1, CIS2 and CIS3 – first three rounds of CIS),
DST	Department of Science and Technology
EU	European Union
EU-27	Expanded European Union (27 countries)
FRD	Foundation for Research Development
HIV	Human immunodeficiency virus
HSRC	Human Sciences Research Council
IPR	Intellectual property rights
ISP	Industrial Strategy Project
NACI	National Advisory Council on Innovation
NESTI	National Experts on Science and Technology Indicators
NRF	National Research Foundation
NSI	National System of Innovation
OECD	Organisation for Economic Cooperation and Development
R&D	Research and experimental development
S&T	Science and technology
SACOB	South African Chamber of Business
SIC	Standard Industrial Classification
SPII	Support Programme for Industrial Innovation
THRIP	Technology and Human Resources for Industry Programme

Country codes

AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
EU-27	European Union average (27 countries)
FI	Finland
FR	France
HU	Hungary
IE	Ireland
IS	Iceland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SA	**South Africa**
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom

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MAIN RESULTS OF THE SOUTH AFRICAN INNOVATION SURVEY 2005

BACKGROUND

The Centre for Science, Technology and Innovation Indicators (CeSTII) was commissioned by the Department of Science and Technology (DST) to conduct the first of an official series of South African Innovation Surveys as part of DST's effort to establish a baseline set of science and technology (S&T) indicators for monitoring, reporting on and fine-tuning the national system of innovation (NSI) in support of South Africa's National Research and Development Strategy. The broader objectives of the South African Innovation Survey are to:

- collect information on the sources and resources for innovation in enterprises;
- provide an indication of the extent to which public funding for innovation activities is taken up by enterprises;
- uncover the main obstacles preventing enterprises from engaging in innovation activities;
- draw national and international comparisons of innovation intensity;
- obtain an understanding of the importance of research and experimental development (R&D) and non-R&D based innovation in different sectors;
- keep abreast of the European Union (EU) Community Innovation Survey (CIS) developments;
- produce a set of internationally comparable data and indicators for providing insights into the patterns of innovation in the mining, manufacturing and services sectors in South Africa;
- provide special insights into innovation processes in South Africa and inform the development of innovation policy.

In March 2001, Eurostat (the central statistical office of the European Communities) circulated an open invitation to non-EU member states to use the core CIS questionnaire and survey methodology for national innovation surveys in order to improve the comparability of innovation indicators between regions and economies worldwide. The letter and the CIS3 questionnaire and methodology were circulated to the Organisation for Economic Cooperation and Development's (OECD) National Experts on Science Technology and Innovation Indicators (NESTI) group through its website in March 2001 (see Appendix 3). The current survey was thus aligned with

the Fourth Round of the European Community Innovation Survey (CIS4), and CeSTII has worked closely with DST, the OECD, Eurostat and Statistics South Africa in this regard.

INTRODUCTION

This report presents the main findings of the South African Innovation Survey 2005, covering the period 2002–2004. Where available, comparisons are made with the results of CIS4 for EU countries, as provided by Eurostat.

Innovation in the private sector is a critical factor in boosting growth in the economy and contributing to the quality of life. While some innovation is based directly on the results of research and experimental development (R&D), much innovation by enterprises is based on non-R&D activities, such as the acquisition of external knowledge or new equipment and machinery. Unlike earlier innovation surveys (CIS1 and CIS2), which tended to be confined to technological innovations, the CIS4-based surveys consider product innovations (both goods and services), process innovations, organisational innovations and marketing innovations.

As in other countries, there are several public programmes and support programmes for R&D and innovation in place in South Africa with the aim of stimulating the development of high-level human resources, research outputs and innovations, which will in turn grow and diversify the economy. Among other issues, the Innovation Survey not only looks at how many firms benefit from these public programmes of support for R&D and innovation, but also measures innovation activities in small firms and industry sectors that do not usually access such funds.

This report focuses on benchmarking the results of the South African Innovation Survey with the results of CIS4 undertaken in the various EU countries (as well as Norway and Iceland). The results of innovation surveys are also available for several non-EU and non-OECD countries such as Brazil, Malaysia and Argentina. Some of the methodologies employed and the basic results for these other countries are discussed by Mani (2007). It is not the intention of this report to analyse these developing and other country results in any detail, because the methodologies and timeframes employed in these surveys differ from CIS4. Some of the main results of these surveys are provided for comparative purposes only, mostly with respect to the percentage of innovating enterprises. However, we intend to provide comparisons of the results from these countries and from South Africa in a subsequent report or paper.

BOX 1: DEFINITIONS OF INNOVATION, BASED ON THE CORE CIS4 QUESTIONNAIRE

A *product innovation* is the introduction to the market of a new good or service or a significantly improved good or service with respect to its capabilities, such as improved user-friendliness, components or sub-systems.

A *process innovation* is the use of new or significantly improved methods for the production or supply of goods and services.

The innovation (new or improved) must be new to the enterprise, but it does not need to be new to the industry sector or market.

A distinction is made between product innovations that are new only to the firm and those that are new to the market of the enterprise.

BOX 2: PREVIOUS INNOVATION SURVEYS IN SOUTH AFRICA

There have been two previous innovation surveys in South Africa. The first was carried out by the Foundation for Research Development (FRD) and the Industrial Strategy Project (ISP) for the years 1992–1994 and was published in October 1997 (Blankley & Kaplan 1997). This survey covered only the manufacturing sector and was based on the first Community Innovation Survey (now referred to as CIS1). A total of 2 732 questionnaires were distributed, and 244 completed questionnaires were received, giving a response rate of 8.9%. This survey was aimed at covering innovating enterprises (to link up with the R&D survey) and was a pilot project on a very limited budget.

The second survey was undertaken by the University of Pretoria and the Eindhoven University of Technology (in the Netherlands) for the period 1998–2000 and covered the manufacturing and services sectors (Oerlemans et al. 2004). Questionnaires were distributed to 7 039 enterprises, and of these 617, or 8.4%, were returned.

Both these surveys relied on commercially available databases of addresses for their samples.

METHODOLOGY

The South African Innovation Survey 2005 was based on the guidelines of OECD's *Oslo manual* (OECD 2005), and more specifically, on the methodological recommendations and core questionnaire for CIS4 provided by Eurostat, the Statistical Office of the European Communities (see Appendix 4). The CIS4 core questionnaire was modified slightly for South Africa through piloting exercises with businesses and a national stakeholder workshop organised by the National Advisory Council on Innovation (NACI) and the DST. The main differences between the CIS4 core questionnaire and the South African Innovation Survey 2005 questionnaire were the replacement of EU sources of funds with local ones, the change of EU-specific regions to ones that were relevant to South Africa and the replacement of typical EU terminology with South African terms. The final South African Innovation Survey 2005 questionnaire was directly comparable with the CIS4 instrument except for these specific differences (see Appendix 5 and Appendix 6).

One of Eurostat's strongest recommendations is that, where possible, countries should make use of the most up-to-date version of their national business register for the innovation survey in order to promote international comparability. Through the Memorandum of Agreement between Statistics South Africa and the DST on official science and technology (S&T) statistics (which includes CeSTII by virtue of its survey agency role for DST), Statistics South Africa agreed to provide a suitable random sample as well as advice on conducting the survey, as requested in the Innovation Survey Sampling Specifications document prepared by CeSTII.

The survey design was informed by Eurostat guidelines and the structure of the Statistics South Africa business register and comprises:

- a random stratified sample (by sector and size of enterprise) drawn from the business registry database of Statistics South Africa;
- a postal survey with at least two telephonic and two written correspondences;
- a non-response survey if the response rate is below 70%;
- the extrapolation of results to the target population based on the weighted sample.

Innovation surveys require a very high response rate (usually 70% or more) in order to ensure accurate results. Drawing a very large sample from the business register could therefore be counterproductive in that regard. Based on the CeSTII resources available for the survey and on the advice of Statistics South Africa, a random stratified sample of 3 087 enterprises with appropriate strata weights for the mining, manufacturing and services sectors was obtained from the September 2004 business register of Statistics South Africa. Statistics South Africa provided comprehensive documentation to accompany the sample (Statistics South Africa, 2004).

The first part of 2005 was dedicated to confirming the accuracy of details in the address list and identifying a contact person in the 3 087 enterprises (ideally the CEO). Through this checking and cleaning process, all non-valid enterprises (in other words, those that were not identifiable or traceable through several methods, as well as duplicates and inactive entities) were removed from the database. The remaining entries in the database totalled 2 627 valid enterprises. The CIS methodological guidelines do not recommend replacing these enterprises.

The postal survey was dispatched in August 2005, and the survey remained in the field until April 2006. During this time, enterprises that did not respond promptly received at least two written correspondences (postal and e-mail) and two telephonic reminders to participate in the survey. The work was carried out by a survey manager and six research assistants operating in a dedicated survey call centre. Completed returned questionnaires were checked, and any incomplete information was supplemented, where possible, by telephoning respondents and asking for the required information. By April 2006, the research assistants were encountering defensiveness from enterprises that had not yet responded, and it was decided to close the fieldwork.

After cleaning the final data, a realised sample total of 979 completed questionnaires was obtained, yielding an overall return rate of 37.3% from a sample size of 2 627. This is a better return rate than in previous surveys (see Box 2) but quite far short of the Eurostat recommended return rate of at least 70%. Accordingly, a non-response survey became necessary in order to check whether there were any significant differences between respondents and non-respondents regarding their propensity to innovate.

In order to follow up on enterprises that had not responded to the survey, a non-response telephonic survey of a simple random sample of 15% of non-respondents was undertaken (following Eurostat best practice recommendations). Non-respondents were assured that by just answering the three simple questions asked about their innovation activities, they would not be contacted again regarding their obligation to complete the survey questionnaire. An acceptable response rate of 89% was obtained from the non-response survey. An electronic logging system was used throughout the main survey and the non-response survey, and completed questionnaires were recorded and verified on a custom-designed database.

The purpose of the non-response survey was to determine the extent to which non-respondents are less or more innovative than respondents (in other words, a check for bias). Non-respondents were found, overall, to be slightly less innovative than respondents, and the weights for the proportion of non-respondent innovators were accordingly adjusted at strata level to reflect this difference.

A combination of factors presented challenges to conducting the South African Innovation Survey. Through the efforts of a dedicated survey team and support from the DST and the Human Sciences Research Council (HSRC), these challenges were successfully managed. The South African business sector generally resists participating in surveys, and potential respondents complain of being overburdened by numerous official and unofficial surveys. Large enterprises tend to be fairly cooperative, but small and medium-sized firms are more reluctant to complete questionnaires. Many of the smallest firms did not see the relevance of the Innovation Survey to their businesses. Because of the relatively low response rate to the survey, some of the smaller sub-strata did not obtain any responses, and the sub-sector total had to be compiled on the basis of the available strata data for the sub-sector. This was less of a problem with the larger firms, where the survey tended to be undertaken on a census basis, with corresponding low weights for the strata.

An important aspect of the South African Innovation Survey is that enterprise size classes are officially determined by turnover. Turnover is currently used as an official proxy for the number of personnel in the four size classes of enterprise of the Statistics South Africa business register. Statistics South Africa plans to update the business register with the numbers of personnel per enterprise in the future. The relationship between turnover and the number of full-time

employees is prescribed by a schedule contained in the Small Business Amendment Act (Act No. 26 of 2003). The returned questionnaires indicated that a number of the firms in the smaller size classes (2–4) actually had far higher numbers of staff and greater turnovers than prescribed for the size class to which they had been assigned in the register according to their recorded turnovers for 2002. To overcome this problem, the most obvious outliers were moved upwards to size classes 1 or 2, and the weights were adjusted accordingly.

While Eurostat recommends that the CIS4 should target enterprises with 10 or more employees only, this cut-off point also has to be treated differently in the South African case. The level of turnover of enterprises in the Statistics South Africa business register is used to determine a cut-off point for enterprises with fewer than 10 personnel. Enterprises in size class 4 (firms with a turnover of less than R3–6 million per year, depending on the SIC sector), scheduled by the Small Business Amendment Act as enterprises that employ fewer than 20 personnel, were cut off at the 30.5 percentile. Only enterprises above this percentile were included in the sample frame.

Two senior statisticians at the University of Cape Town were consulted on these statistical and analytical issues. Through a cautious and consultative process, we arrived at a final set of weightings. The final results were thus calculated for a smaller number of enterprises than the population listed in the Statistics South Africa business register, but the results of the mostly qualitative questions are representative of the relevant business sectors. For the quantitative questions on turnover, expenditure and number of personnel, the relatively low response rate and the cut-off percentiles in the sampling of size class 1 and 4 enterprises in the database means that the totals calculated will be less than national totals measured in other specific labour force or industry surveys. However, the relative proportions of these quantitative measures, such as the percentage of employees working for innovative enterprises, are more important than the actual numbers. It should be noted that innovation surveys are generally regarded as a good source of qualitative data on innovation activities rather than a reliable source of quantitative data (such as national R&D surveys).

Although an analysis of the preliminary survey data had shown that there was a significant correlation between turnover and the number of employees of enterprises, this relationship proved to be rather weak for the survey as a whole. The size classes are thus far more representative of the turnovers of enterprises than of the number of employees. Officially, the

Small Business Amendment Act prescribes the use of turnover for delineating size classes of enterprises, and the size classes used in this report therefore reflect official South African policy. The results will thus differ from those collected in the EU, where only the number of personnel is used to establish the size classes of enterprises. Furthermore, the size classes prescribed in the Small Business Amendment Act differ from those used in the EU. Comparisons with countries that base their size classes on employee numbers, as recommended by CIS4 methodology, will have to be viewed in the light of these differences.

RESULTS

RATE OF INNOVATION

Innovation activities include the acquisition of machinery, equipment, software, licences, engineering and development work, training, marketing and R&D. Only when these activities are specifically undertaken to develop and/or implement a product or process innovation can they be counted as innovation activities. The innovation survey results represent the activities of a total of 31 456 enterprises, 51.7% of which reported undertaking innovation activities. The innovation rate was defined as the proportion of enterprises that undertook any innovation activities during the last three financial years (2002–2004). Table 1 shows that 54.8% of industrial enterprises were innovative, compared with 49.3% of service enterprises. Almost 30% of enterprises had both product and process innovations, while 12% had only product innovations. A total of 4.4% of innovative enterprises reported only ongoing or abandoned innovation activities during 2002–2004 (in other words, the innovation end product was not produced during the period that was surveyed).

Table 1: Innovation rate: percentages of innovative and non-innovative enterprises in South Africa, 2002–2004

	Total	Industry[a]	Services[b]
Enterprises with innovation activity	**51.7**	**54.8**	**49.3**
Product only innovators	11.9	10.9	12.7
Process only innovators	5.7	3.8	7.3
Product and process innovators	29.7	38.1	22.9
Enterprises with only ongoing or abandoned activities	4.4	2.0	6.3
Enterprises without innovation activity	**48.3**	**45.2**	**50.7**

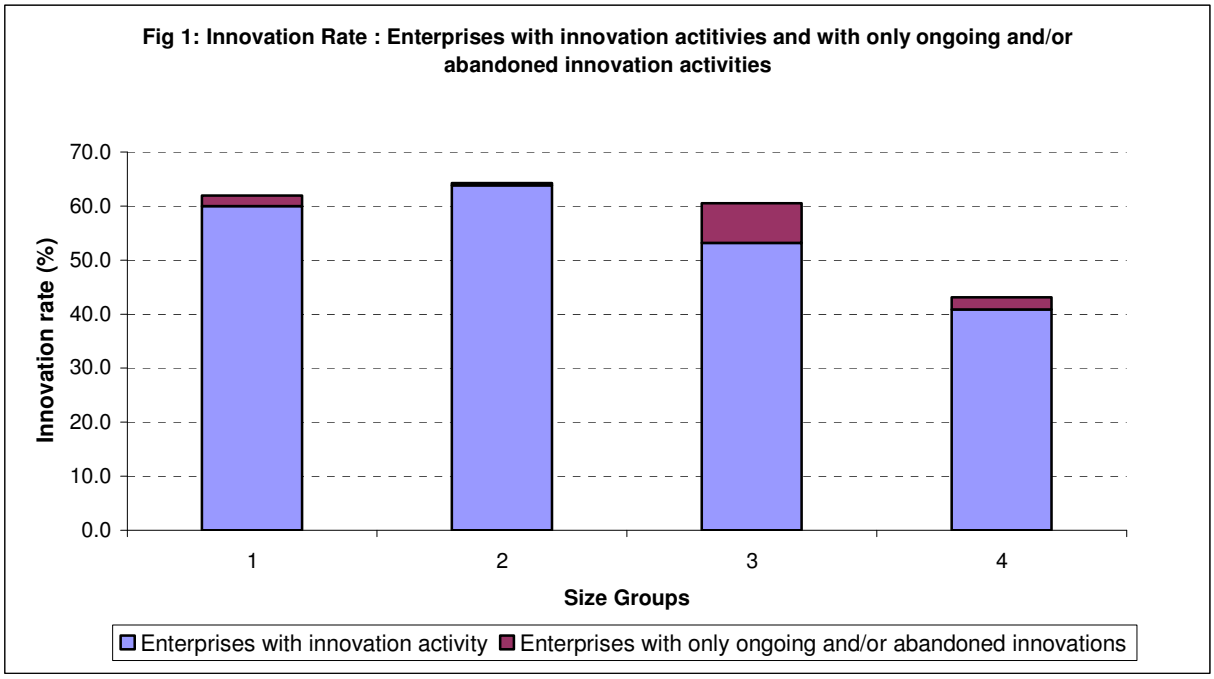
Note:

a. Industry comprises mining and quarrying, manufacturing, electricity, gas and water supply.
b. Services comprise wholesale and retail, transport, storage and communication, financial intermediation, computer and related, R&D services, architectural and engineering, and technical testing.

The EU average for enterprises with innovation activity is 42.0% in total, 41.5% for industry and 37.0% for the services sector.

Source: Appendix Table 1A

In the case of South Africa, where the size class of enterprises in the national business register is by turnover rather than number of employees, there does not appear to be a strong relationship between the size of enterprises and the rate of innovation. In other countries and in previous innovation surveys undertaken in South Africa, where the size class of enterprises was determined by the number of personnel, there is a clear trend of increasing innovation activity with increasing size classes of enterprise. Figure 1 shows that size class 2 has the highest innovation rate at almost 64%, which is slightly higher than the 60% rate of innovation in size class 1. As expected, however, innovation rates are lowest (41%) in size class 4, comprising the smallest enterprises.

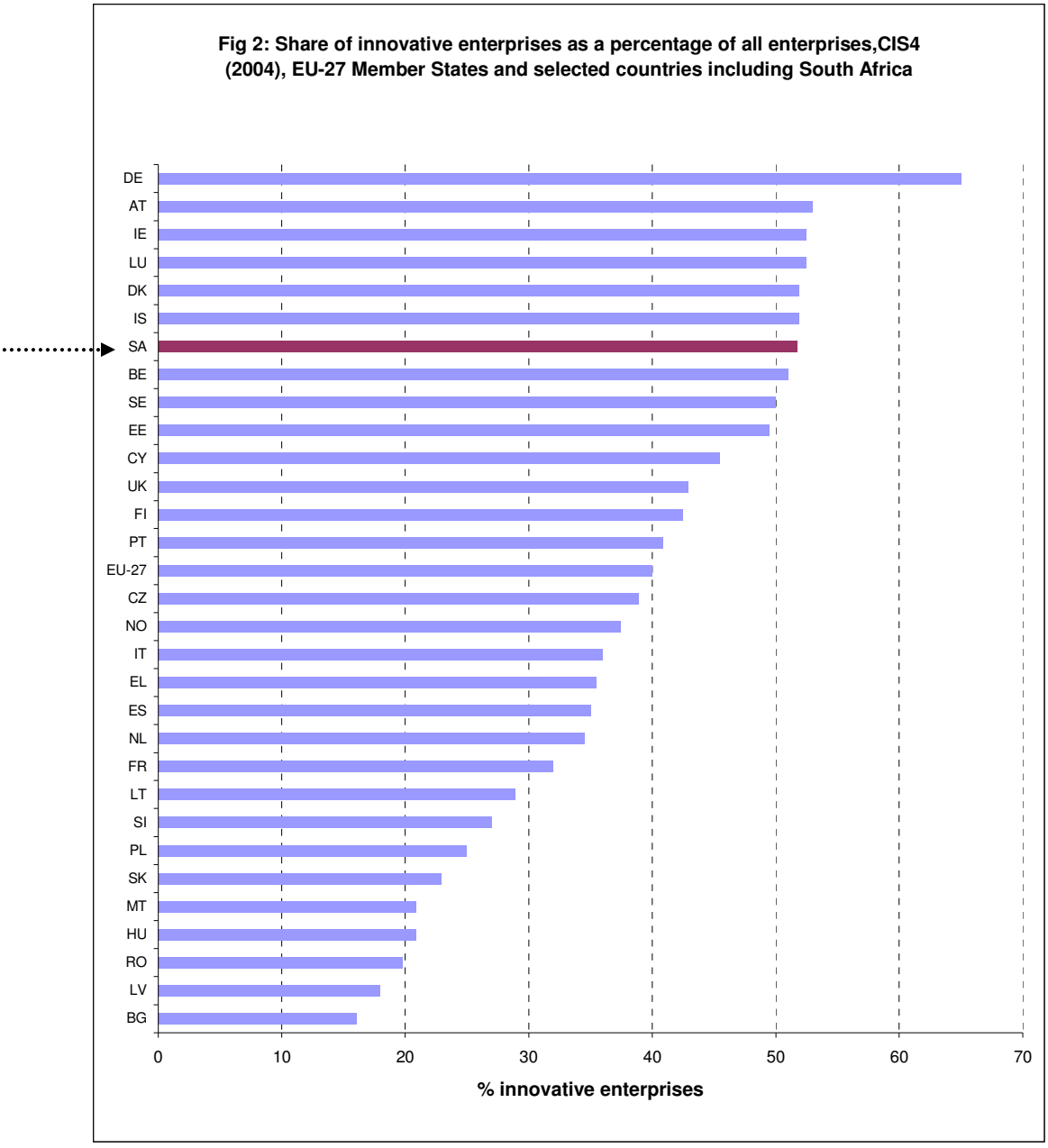


Source: Appendix Table 1B

The overall innovation rate of 51.7% shown in Figure 2 compares favourably with the rates recorded for Iceland and Denmark (52%), Belgium (51%), Sweden (50%), Estonia (49%), Cyprus (46%) and the UK (43%). The figure for South Africa seems fairly high, but in the 1998–2000 survey by Oerlemans et al. (2004), a total of 57% of firms reported innovations in products and services, which is about 5% more than reported in the current survey.

Mani (2007) reports from the Industrial Survey of 2000 in Brazil that about 31.5% of enterprises introduced innovations between 1998 and 2000. He also reports that about 35% of Malaysian enterprises reported innovation activities for the period 2000–2001. In Argentina, 59% of

manufacturing firms reported innovation activities between 1998 and 2001 (Chudnovsky et al. (2006). However, to discuss the results of these surveys in non-EU and non-OECD countries, the methodologies employed, the sectors surveyed and the years in which the surveys were conducted, as well as prevailing economic conditions, need to be carefully compared, and this should be the topic of a more detailed subsequent report or paper.



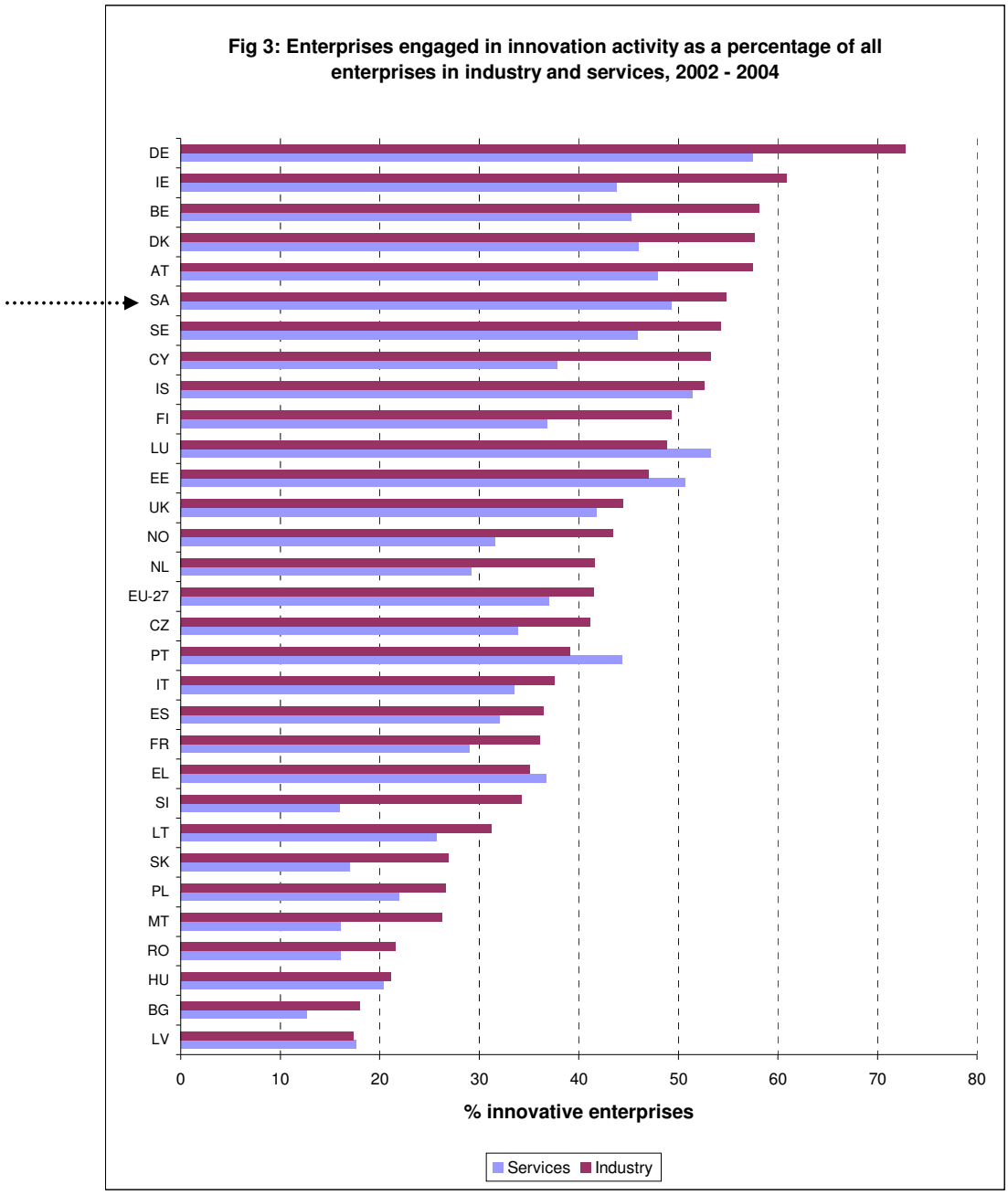
Note:

a. In this Figure and elsewhere, the following country acronyms are used: AT Austria; BE Belgium; BG Bulgaria; CY Cyprus; CZ Czech Republic; DE Germany; DK Denmark; EE Estonia; EL Greece; ES Spain; EU-27 European Union average (27 countries); FI Finland; FR France; HU Hungary; IE Ireland; IS Iceland; IT Italy; LT Lithuania; LU Luxembourg; LV Latvia; MT Malta; NL Netherlands; NO Norway; PL Poland; PT Portugal; RO Romania; SA South Africa; SE Sweden; SI Slovenia; SK Slovakia; UK United Kingdom

b. In this Figure and elsewhere, the EU-27 average does not include Norway and Iceland, which are not European Union member states.

Source: All data except for South Africa are estimates from European Communities (2007b); South African data are from Appendix Table 1A.

In most European countries, industrial enterprises are more innovative than service enterprises, but in a few countries such as Luxembourg, Estonia, Portugal, Greece and Latvia, the services sector rates of innovation are higher than those in industry (see Figure 3). The proportion of enterprises engaged in innovation activities ranged from 72.8% in German industry to 12.7% in Bulgarian services. In South Africa, 54.8% of industrial enterprises were innovative, compared with 49.3% of enterprises in the services sector. This compares favourably with the EU-27 averages of 41.5% for industry and 37.0% for services.



Source: All data except for South Africa are estimates from European Communities (2007a); South African data are from Appendix Table 1A.

THE CHARACTERISTICS OF ENTERPRISES COVERED BY THE SURVEY

The 31 456 enterprises of the survey population employ about 1.77 million employees, of whom some 78% work in enterprises with innovation activities (Table 2A).

Table 2A: Number of enterprises, number of employees and total turnovers: comparisons of enterprises with innovation activities, 2002–2004

	Total	Industry percentage	Services percentage	Total percentage
Total number of enterprises	31 456	44.3	55.7	100.0
Enterprises with innovation activities	16 264	47.0	53.0	51.7
Number of employees	1 770 745	57.1	42.9	100.0
Number of employees in enterprises with innovation activities	1 381 976	78.3	77.6	78.0
Turnover (R million)	1 144 445	45.1	54.9	100.0
Turnover of enterprises with innovation activities	863 632	84.7	67.9	75.5

Source: Appendix Tables 1A, 2A and 3A

The total turnover of the enterprises was recorded as R1 144.4 billion. About 75.5% of this turnover is accounted for by enterprises with innovation activities (Table 2A). The industrial sector is more innovation intensive, with 84.7% of turnover accounted for by industrial enterprises with innovation activities, compared with the 67.9% of turnover generated by innovative service enterprises.

The majority of enterprises in the population were independent enterprises and not part of a larger group (Table 2B). Only 13.6% of enterprises were part of a larger group, and most of these were medium-sized enterprises in size classes 2 and 3.

Table 2B: Number of enterprises stating that they were part of a larger group

Number of enterprises	**Total**				
Size class	1	2	3	4	Total
Part of a larger group	790	1 512	1 465	523	4 289
Not part of a larger group	836	3 848	13 055	8 789	26 527
No response	6	0	634	0	640
Percentage of enterprises					
Part of a larger group	2.5	4.8	4.7	1.7	13.6
Not part of a larger group	2.7	12.2	41.5	27.9	84.3
No response	0.0	0.0	2.0	0.0	2.0

Source: Appendix Table 28B

Table 3: Number[a] and percentage of enterprises with innovation activity by size class and turnover, 2004

Size class		1	2	3	4	Total
All enterprises: turnover (R million)		899 169	120 860	104 764	19 651	1 144 444
Enterprises with innovation activity	Turnover (R million)	708 875	72 982	72 422	9 353	863 632
	%	**78.8%**	**60.4%**	**69.1%**	**47.6%**	**75.5%**
Enterprises without innovation activity	Turnover (R million)	190 294	47 878	32 342	10 298	280 812
	%	**21.2%**	**39.6%**	**30.9%**	**52.4%**	**24.5%**

Note:
a. Numbers do not always total exactly because of rounding
Source: Appendix Table 3B

Table 3 shows that the innovative enterprises of size class 1 were responsible for the greatest turnover contribution through innovation activities (78.8%) and accounted for 82% of all turnover produced by innovative enterprises. Although non-innovative firms comprised 48.3% of all enterprises covered in the survey (Appendix Table 1A), they accounted for only 24.5% of the total turnover recorded.

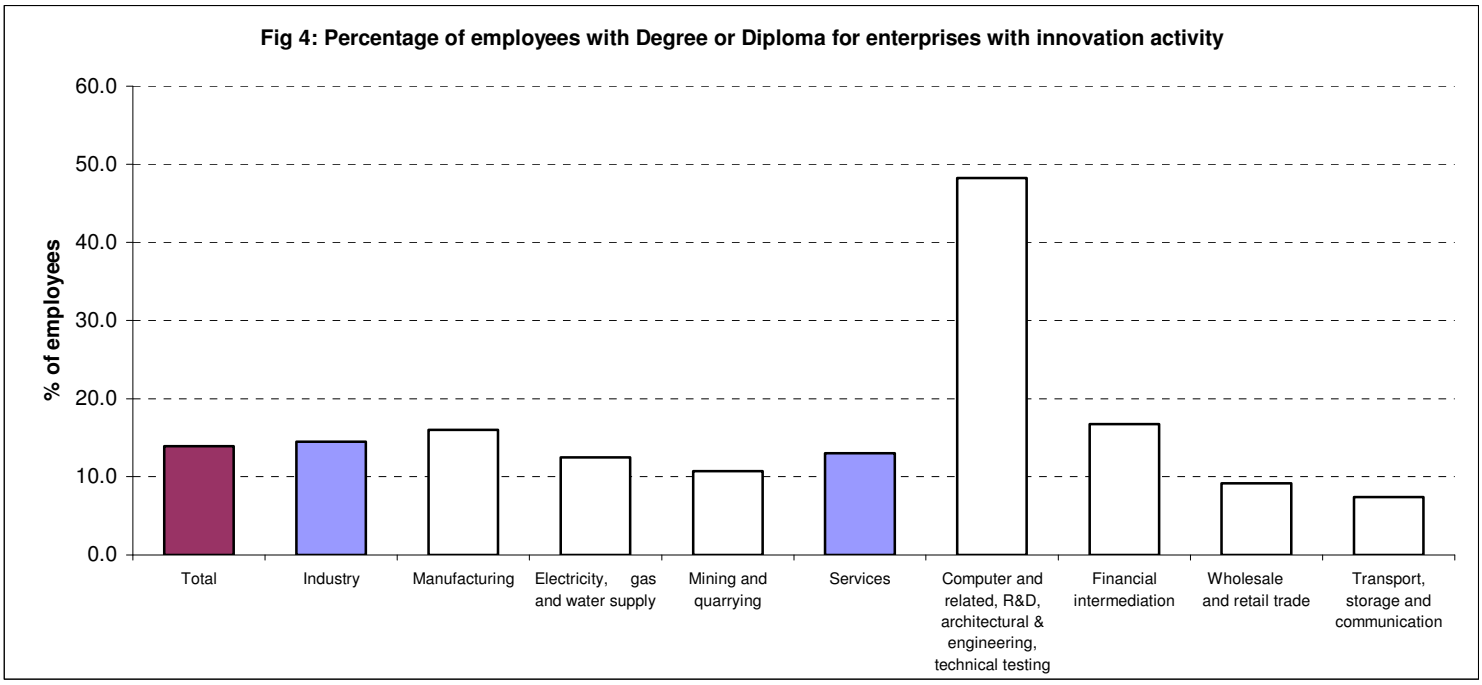
Innovative enterprises employed more staff than non-innovative enterprises and accounted for 78% of total employees. Innovative enterprises in size class 1 employed 87.2% of staff in the size class (Table 4).

Table 4: Enterprises with innovation activity by size class and number of employees[a]

Size class	1	2	3	4	Total
All enterprises: number of employees (thousands)	1 060	312	298	100	1 771
Enterprises with innovation activity (% employees)	87.2%	68.4	68.1%	70.7%	78.0%
Enterprises without innovation activity (% employees)	12.8%	41.4	31.9%	29.3%	22.0%

Note:
a. Numbers do not always total exactly because of rounding
Source: Appendix Table 2B

Innovative enterprises employed 1 381 976 staff, of whom 179 072 employees, or 13% of the total, had a tertiary education qualification (diploma or degree). In the industrial sector, the manufacturing sector had the highest percentage of employees with a tertiary qualification (16%). The services sector with the highest percentage of employees with a tertiary qualification (48.2%) was R&D, architectural and engineering, and technical testing (Figure 4).



Source: Appendix Table 20A

Innovative enterprises appear to be more export-oriented than non-innovative enterprises (Table 5). About 67% of non-innovative enterprises sold goods and services in only some provinces of South Africa, compared with 54% of innovative enterprises. Other countries in Africa are an important destination for goods and services produced by innovative South African enterprises (19.3%), followed by Europe (5.1%) and Asia (5.4%).

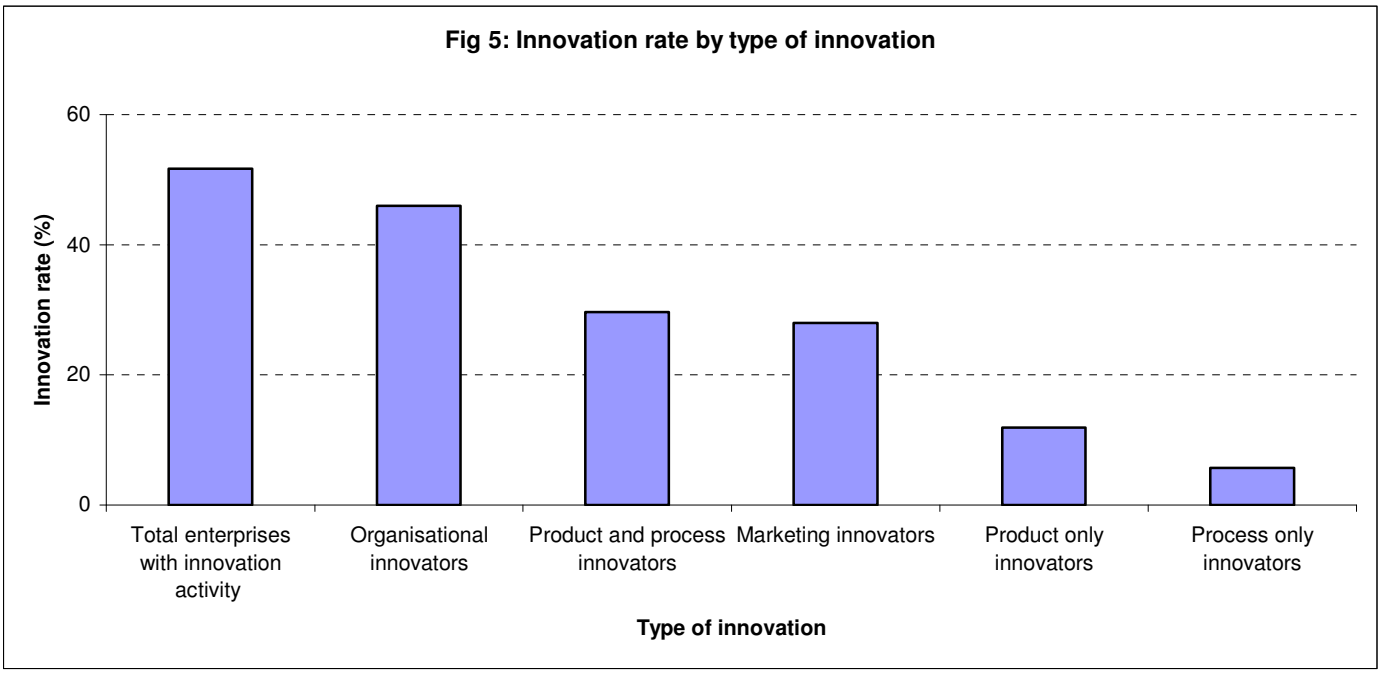
Table 5: Geographic distribution of goods and services sold by innovative and non-innovative enterprises, 2002–2004

Proportion of enterprises (%)	Total	Industry	Services
All enterprises			
South Africa (Only some provinces)	60.2	60.9	59.7
South Africa (National)	31.3	34.5	28.7
Rest of Africa	14.0	16.2	12.3
Europe	4.2	5.2	3.4
USA	3.0	4.0	2.1
Asia	4.1	2.6	5.4
Other countries	5.4	8.4	3.0
Enterprises with innovation activity			
South Africa (Only some provinces)	54.4	50.8	57.5
South Africa (National)	37.5	41.0	34.4
Rest of Africa	19.3	20.1	18.5
Europe	5.1	7.5	3.0
USA	3.9	6.2	1.9
Asia	5.4	3.6	7.0
Other countries	5.4	7.9	3.3
Enterprises without innovation activity			
South Africa (Only some provinces)	66.5	73.2	61.8
South Africa (National)	24.5	26.6	23.1
Rest of Africa	8.4	11.5	6.2
Europe	3.2	2.5	3.7
USA	2.0	1.4	2.4
Asia	2.7	1.2	3.8
Other countries	5.4	9.1	2.8

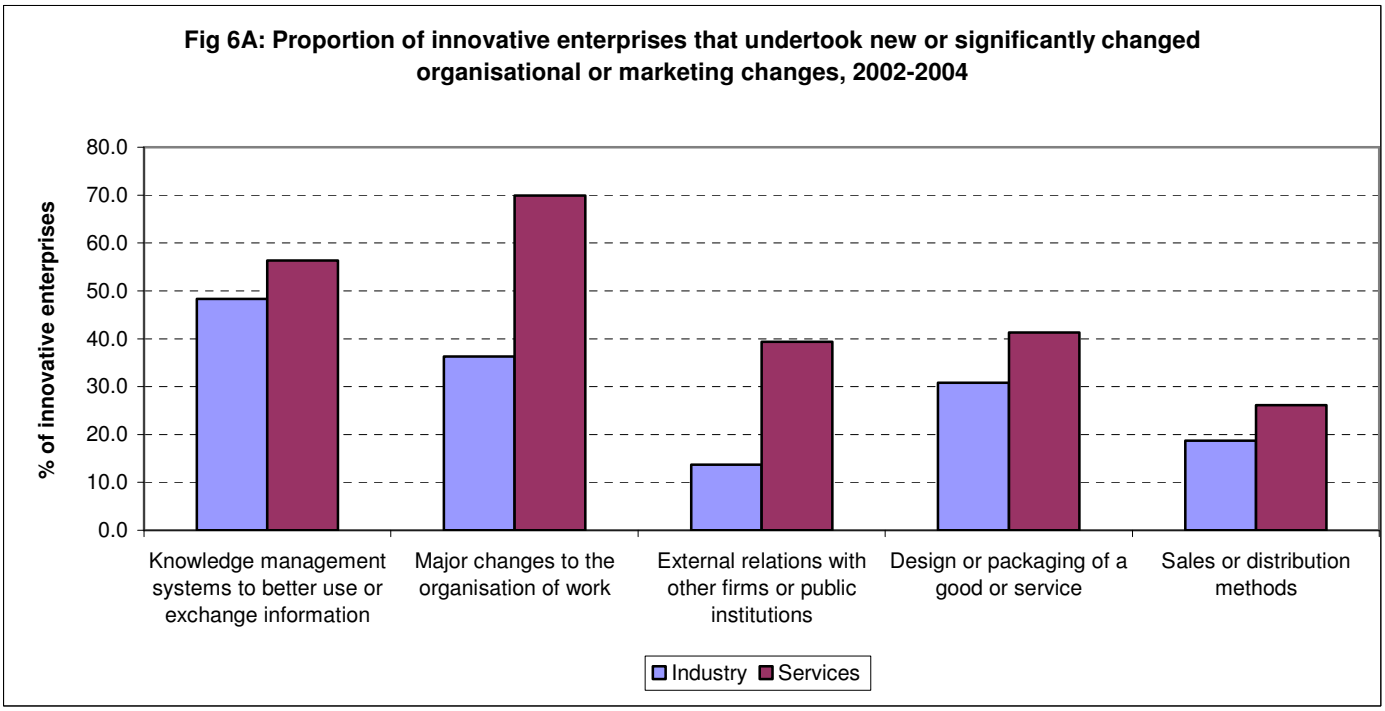
Source: Appendix Table 17A

TYPES OF INNOVATIONS

The survey was based on enterprises answering questions concerning their innovation activities in each of the four types of innovation: product, process, organisational and marketing. The rates of innovation for each type of innovation are illustrated in Figure 5. Relatively few enterprises had only process innovations (5.7%) or only product innovations (11.9%). About 46% of enterprises had organisational innovations, and almost 28% had marketing innovations.



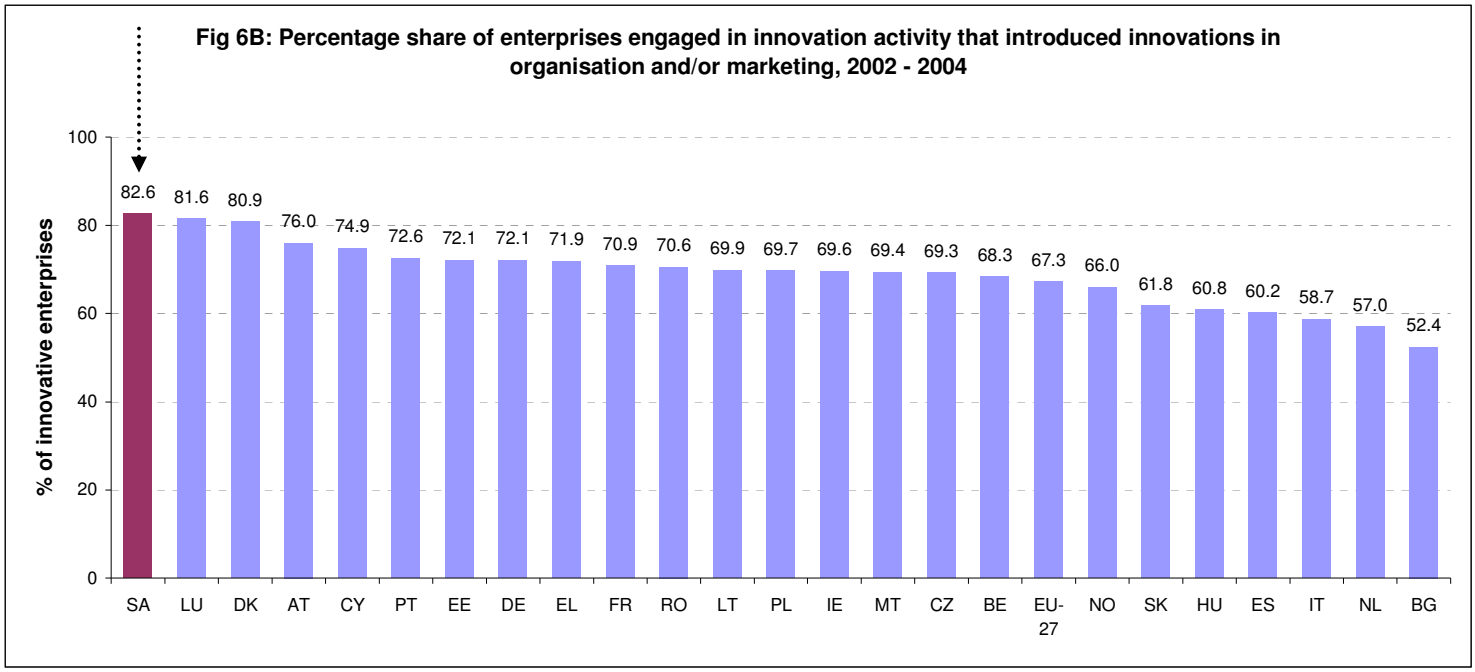
Source: Appendix Tables 1A and 21A



Source: Appendix Table 14A

Figure 6A provides more detail on the organisational and marketing innovations undertaken by enterprises. Enterprises in the services sector have a greater proportion of organisational and marketing innovations than industrial enterprises (Figure 6A). In terms of organisational innovations, the majority of enterprises (54.1%) introduced major changes to the organisation of

work (see Appendix Table 14A), while 52.6% implemented knowledge management systems to better use or exchange information.



Source: All data except for South Africa are from European Communities 2007a; South African data are from Appendix Table 21A.

Figure 6B shows the international comparisons of the percentage of innovative enterprises that introduced innovations in organisation and/or marketing. Innovative South African enterprises were more active in this regard than their European counterparts, with 82.6% of South African enterprises with innovation activity recording some form of organisational or marketing innovations, compared with 67.3% for the EU-27. Luxembourg (81.6%) and Denmark (80.9%) were the only two European countries in which more than 80% of all innovating enterprises introduced this kind of innovation. However, levels of organisational and/or marketing innovations are generally high in all countries, and over 50% of innovative enterprises in all countries surveyed reported innovation activities of this nature. The high score in South Africa could partly reflect the changes many enterprises have had to make in response to national policies such as employment equity and black economic empowerment (BEE) as well as other business regulations. The high rates of organisational innovation in the services sector in South Africa, particularly regarding major changes in the organisation of work, reflect the recent strong growth and consequent competition in this sector.

PRODUCT (GOODS OR SERVICES) INNOVATION

Enterprises that had product innovations (comprising innovation in either goods or services produced) accounted for the majority of innovators in the survey. Approximately 10% of the turnover of product innovators in 2004 was generated by innovations that were new to the market, representing turnover of about R67.8 billion (Table 6). Enterprises in size class 4 generated the highest proportion of turnover based on product innovations that were new to the market (13.2%), while size class 3 enterprises generated the highest proportion of turnover from product innovations that were new to the firm (23.6%). Enterprises in size class 1 generated the highest proportion of total turnover for all innovative enterprises from product innovations (82%).

Table 6: Product innovators: proportion of turnover in 2004 attributed to the different types of products

All product innovators	Turnover generated (R million)	Percentage turnover generated
Product innovations new to the market	67 848	10.1
Product innovations new to the firm	79 194	11.8
Products unchanged or only marginally modified	526 705	78.2
Total	**673 747**	**100**

Product innovators: proportion of turnover in 2004 attributed to the types of products by size of enterprise (%)

Size class	1	2	3	4	Total
Product innovations new to the market	10.1	12.0	7.1	13.2	10.1
Product innovations new to the firm	9.8	17.8	23.6	19.2	11.8
Products unchanged or only marginally modified	80.1	70.2	69.2	67.6	78.2
Total (% of turnover produced by product innovators per size class)	82.0	8.6	8.2	1.4	100

Source: Appendix Tables 5A and 5B

Table 7 provides an international comparison of the percentage of enterprises that introduced new or improved products to the market as a percentage of innovative enterprises. South Africa appears to have the highest rate of innovation in this regard, but the reasons for South Africa's high performance are not clear. A possible explanation is that there is a fairly low threshold to this question in that the goods or service introduced need only to be new to the enterprise, and not new to the market, and this could have been achieved between 2002 and 2004. Given the relatively positive developments and changes in the economy over these years, this could be a result of businesses expanding and exploring new markets with new or improved goods or services. In Europe, particularly in larger countries, business thresholds related to what constitutes a new or improved product could also be higher than in South Africa, resulting in a lower record of innovation in EU countries. In general, it is easier to be innovative in less mature

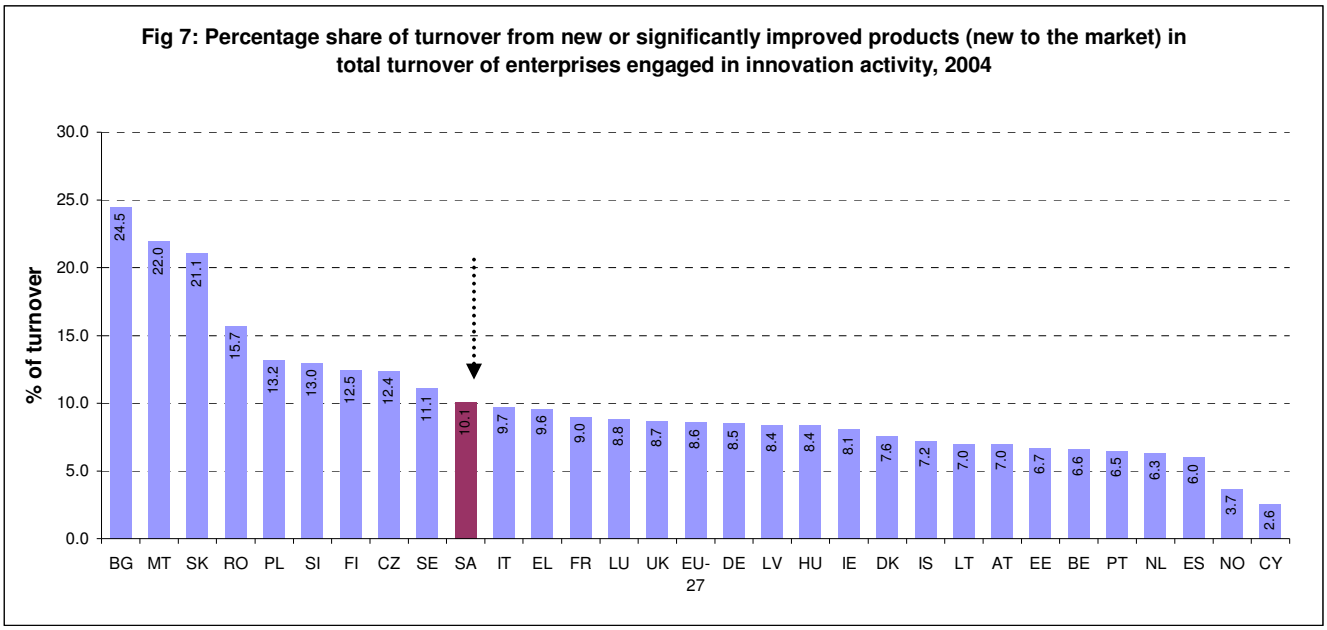
economies where there are more opportunities or gaps than in more advanced economies to introduce new or improved products.

In the EU, it was only in three countries (Bulgaria, Sweden and Luxembourg) that more than 50% of innovative enterprises introduced new or significantly improved products. On average in the EU-27, about one third of innovative enterprises introduced new or improved products to the market. In South Africa, the share of innovative industrial enterprises that introduced new or significantly improved products to the market (89.4%) was substantially higher than the equivalent share of innovative service enterprises (72.5%). Table 7 shows that in the top four innovative countries in Europe, the percentage of service enterprises that introduced new or improved products to the market was higher than for innovative industrial enterprises, namely for Iceland (85.9% compared with 69.5%), Bulgaria (71.1% compared with 50.6%), Sweden (57.8% compared with 47.5%) and Luxembourg (54.2% compared with 42.2%). However, for the EU-27 as a whole, innovative industrial enterprises introduced more new or improved products to the market than innovative service enterprises did (37.4% compared with 33.7%).

Table 7: Enterprises that introduced new or improved products to the market as a percentage of enterprises engaged in innovation activity by sector, 2002 - 2004

	Total	Industry	Services
South Africa	**80.4**	**89.4**	**72.5**
Iceland	77.6	69.5	85.9
Bulgaria	56.4	50.6	71.1
Sweden	52.4	47.5	57.8
Luxembourg	51.6	42.2	54.2
Finland	49.6	49.8	49.3
Austria	48.4	49.3	47.4
Netherlands	48.3	49.5	47.2
United Kingdom	47.8	47.1	48.4
Denmark	47.7	46.9	48.6
Slovenia	46.6	44.3	53.7
Poland	46.4	44.1	50.5
Ireland	44.5	55.5	29.8
Greece	44.4	44.3	44.5
Estonia	41.9	37.2	47.2
Slovakia	41.6	39.4	47.0
Czech Republic	41.5	42.1	40.3
Belgium	40.7	41.0	40.3
France	38.6	42.6	33.6
Norway	36.5	33.4	40.1
Hungary	36.3	37.1	35.0
EU-27	35.9	37.4	33.7
Latvia	34.5	38.0	30.8
Lithuania	34.5	39.9	27.6
Italy	31.1	32.0	28.6
Portugal	30.1	32.1	26.8
Romania	27.9	29.2	25.1
Germany	26.9	33.8	18.3
Malta	25.0	25.3	24.6
Spain	20.9	23.4	16.8
Cyprus	14.6	16.0	12.3

Source: All data except for South Africa are estimates from European Communities (2007a); South African data are from Appendix Table 27A.



Source: All data except for South Africa are estimates from European Communities (2007a); South African data are from Appendix Table 5A.

Figure 7 shows that South Africa performs relatively well in terms of the percentage share of turnover generated by the sale of new or significantly improved products (new to the market and not just new to the enterprise) compared with other countries. It should be noted that the leading countries on this indicator were four new members of the European Union, namely Bulgaria (24.5%), Malta (22.0%), Slovakia (21.1%) and Romania (15.7%). South Africa's 10.1% is higher than the percentages for Italy (9.7%), Greece (9.6%) and France (9.0%). For the EU-27, the average share of turnover produced by products new to the market was 8.6%. These findings could result from increased opportunities for introducing new and improved products in less mature economies.

Table 8 shows that product innovations developed by innovative enterprises were mainly developed by the enterprise itself (51.3%). About 23% of enterprises collaborated with other enterprises or institutions to develop product innovations, while a further 6.4% relied on other enterprises or institutions to develop their innovations.

Table 8: Responsibility for the development of product innovations in innovative enterprises, 2002–2004

Product innovations developed mainly by:	Number of enterprises	Percentage of enterprises (%)
Mainly own enterprise	8 341	51.3
Own enterprise in collaboration with other enterprises or institutions	3 699	22.7
Other enterprises or institutions	1 041	6.4
Non-responsive enterprises*	3 183	19.6
Total	**16 264**	**100.0**

Source: Appendix Table 6A

* Enterprises that returned the questionnaire, but did not respond to this question.

In size class 4, just over 85% of innovative enterprises reported that product innovations were developed mainly by their own enterprise (Table 9). A total of 30.7% of enterprises in size class 3 reported collaborating with other enterprises or institutions in developing product innovations, while only 5.1% of innovative enterprises in size class 4 had any such collaboration. About 11% of innovative size class 1 enterprises relied on other enterprises or institutions to develop their innovations, but this was rare (0.5%) in the smallest enterprises (size class 4). It makes sense, on the one hand, that larger enterprises have the resources to engage in such collaborative arrangements with other enterprises and institutions. On the other hand, smaller enterprises probably tend to use their own inhouse personnel and resources, as they have less capacity for collaboration with others and could possibly be more vulnerable to loss of intellectual property through such collaborations.

Table 9: Responsibility for the development of innovations innovative enterprises by size class, 2002–2004

Size class	1	2	3	4	Total
Product innovations developed mainly by:					
Mainly own enterprise	48.5	57.0	33.3	85.1	51.3
Own enterprise in collaboration with other enterprises or institutions	22.4	23.8	30.7	5.1	22.7
Other enterprises or institutions	11.0	2.4	10.3	0.5	6.4
Non-responsive enterprises*	18.1	16.9	25.7	9.3	19.6
Total	**979**	**3 420**	**8 061**	**3 804**	**16 264**

Source: Appendix Table 6B

* Enterprises that returned the questionnaire, but did not respond to this question

PROCESS INNOVATION

Process innovation is the use of new or significantly improved methods for the production or supply of goods and services. Process innovations are very important in that they often lead to better quality control, greater efficiency, compliance with new regulations and less waste. They are less tangible than the development and sale of new innovative products and services, but they also affect the bottom line of enterprises by improving quality or saving costs in the production of goods and services.

Table 10: Number of enterprises involved in specific process innovations, 2002–2004

Number of process innovators	Total	Industry	Services
Methods of manufacturing or production	**7 804**	3 672	4 132
Delivery or distribution methods, logistics	**6 689**	3 548	3 142
Supporting activities	**6 981**	3 096	3 885
Percentage process innovators (%)			
Methods of manufacturing or production	**24.8**	26.3	23.6
Delivery or distribution methods, logistics	**21.3**	25.5	17.9
Supporting activities	**22.2**	22.2	22.2

Source: Appendix Table 24A

About a quarter of all enterprises (24.8%) introduced process innovations involving new or significantly improved methods of manufacturing or producing new goods and services (Table 10). Some 21% of all enterprises developed new or significantly improved logistics, delivery or distribution methods for inputs, goods and services. In the third category of process innovation, 22.2% of enterprises produced new or significantly improved supporting activities for processes, such as maintenance and operating systems for purchasing, accounting or computing. In total, 35.4% of all enterprises produced process innovations. Industrial enterprises were more active in process innovations (41.9%) than enterprises in the services sector (30.2%). See Appendix Table 23A.

Table 11: Responsibility for process innovations, 2002–2004

Number of process innovators	Total	Industry	Services
Mainly own	**6 149**	4 552	1 597
Own together with others	**3 726**	556	3 170
Mainly others	**1 188**	667	521
Percentage process innovators			
Mainly own	**19.5**	32.7	9.1
Own together with others	**11.8**	4.0	18.1
Mainly others	**3.8**	4.8	3.0

Source: Appendix Table 25A

Process innovations were mostly developed inhouse, and fewer than 20% of enterprises reported that innovations were developed mainly by their enterprises. Some 11.8% of enterprises developed process innovations in collaboration with other enterprises or institutions (Table 11). Only 3.8% of enterprises relied mainly on other enterprises or institutions to develop process innovations for them.

Table 12: Origin of process innovations, 2002–2004

Size Class	1	2	3	4	Total
Number of process innovators					
South Africa	575	2 675	3 512	1 848	8 610
Abroad	183	240	1 609	346	2 378
Non-process innovators	874	2 445	10 033	7 118	20 470
Percentage of process innovators					
South Africa	35.2	49.9	23.2	19.8	27.4
Abroad	11.2	4.5	10.6	3.7	7.6
Non-process innovators	53.6	45.6	66.2	76.4	65.1

Source: Appendix Table 26B

The majority of process innovations (27.4%) were developed within South Africa (Table 12), while 7.6% of process innovations originated mainly from abroad. This suggests that South African enterprises are quite capable of developing their own new processes and are not as dependent on foreign technology as is sometimes believed.

Of the 16 264 innovative enterprises with product and/or process innovations, 54.9% reported that their innovations originated in South Africa, and 25.4% reported that their innovations were developed mainly abroad (Table 13). A higher proportion of innovative industrial enterprises reported that their innovations were developed in South Africa (67.4%), with only 22.0% reporting that the innovations were developed mainly abroad. Fewer innovative service enterprises reported that their innovations had been developed in South Africa (43.9%), while 28.4% reported that their innovations had been developed abroad.

Table 13: Origin of innovations, 2002–2004

Origin (%)	Total	Industry	Services
All innovative enterprises (number of enterprises)	**16 264**	**7 637**	**8 627**
South Africa	54.9	67.4	43.9
Abroad	25.4	22.0	28.4
Non-responsive enterprises*	19.7	10.6	27.7

Source: Appendix Table 7A

***** Enterprises that returned the questionnaire, but did not respond to this question

INNOVATION ACTIVITIES AND EXPENDITURES

Innovative enterprises spent approximately R28 billion on innovation activities, which represents about 2.4% of the total turnover of all enterprises in both the industrial and services sectors (Table 14). Expenditure on innovation activities as a percentage of the turnover of innovative enterprises was 3.2% overall. The services sector had a higher share of innovation expenditure, equivalent to 3.6% of the turnover of innovative service enterprises, compared with 2.9% for industrial enterprises.

Table 14: Enterprises that declared innovation expenditure by sector, 2004

R million	**Total**	**Industry**	**Services**	**% of turnover of *all* enterprises**
Intramural (inhouse) R&D	5 691	3 155	2 537	0.50
Extramural or outsourced R&D	2 190	725	1 465	0.19
Acquisition of machinery, equipment and software	18 084	8 525	9 559	1.58
Acquisition of other external knowledge	1 841	225	1 616	0.16
Total	**27 806**	**12 630**	**15 177**	**2.43**

% of turnover of *innovative* enterprises	**Total**	**Industry**	**Services**
Intramural (inhouse) R&D	0.7	0.7	0.6
Extramural or outsourced R&D	0.3	0.2	0.3
Acquisition of machinery, equipment and software	2.1	2.0	2.2
Acquisition of other external knowledge	0.2	0.1	0.4
Total	**3.2**	**2.9**	**3.6**

Source: Appendix Tables 4A and 3A

Table 14 indicates that in both the industrial and services sectors, the bulk of innovation expenditure was devoted to the acquisition of new machinery, equipment and software and was equivalent to about 1.58% of the turnover of all enterprises and 2.1% of the turnover of innovative enterprises. Intramural and outsourced R&D accounted for 0.69% of the turnover of all enterprises and 1% of the turnover of innovative enterprises.

International comparisons of innovation activities in innovative enterprises provide some interesting comparisons. The proportion of innovative South African enterprises undertaking

intramural R&D is similar to the average for the EU (about 52%), and South Africa ranks 10th out of 24 countries on this scale (Table 15). The country is listed 17th in terms of the percentage of innovative enterprises that outsourced or engaged extramural R&D (19.3%). Despite relatively high expenditure on the acquisition of machinery, equipment and software, South African enterprises are not as active as enterprises in other countries in such acquisitions. Based on the 54.1% of enterprises reporting such expenditure, the country ranks only 22nd. South Africa ranks 5th in terms of the percentage of innovative enterprises engaged in the acquisition of other external knowledge (28.3%).

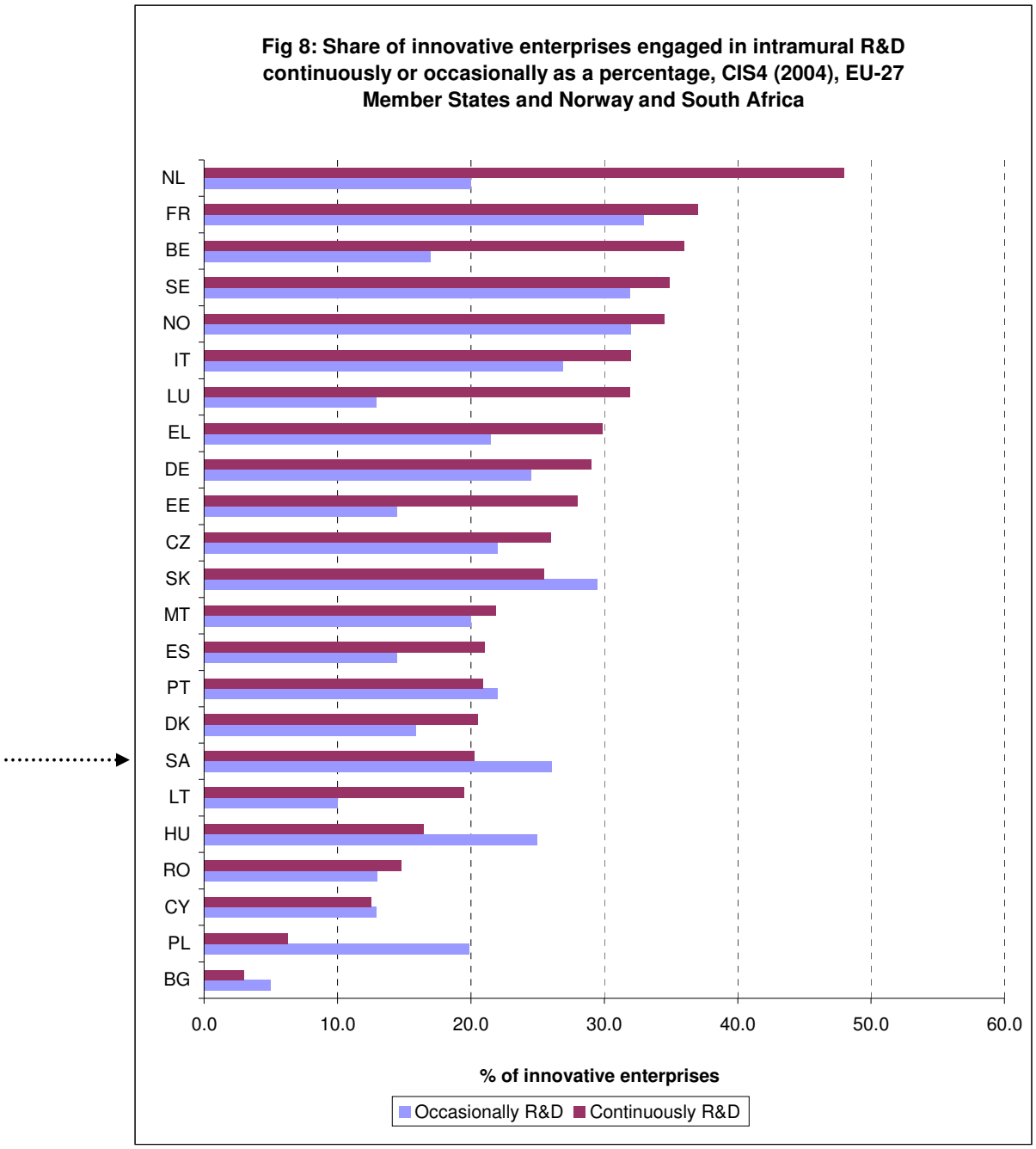
In Europe, Ireland and France had the highest proportion of innovative enterprises engaged in inhouse R&D, with 86% and 70% respectively. Bulgaria and Poland recorded the least amount of intramural R&D activity, with 9% and 14% respectively of innovative enterprises having inhouse R&D activities.

Table 15: Share of innovative enterprises by type of innovative activity, 2004 (EU member states, Norway and South Africa)

	Enterprises engaged in intramural R&D	Enterprises engaged in extramural R&D	Enterprises engaged in acquisition of machinery, equipment and software	Enterprises engaged in acquisition of other external knowledge
Ireland	85.5	22.2	71.4	23.7
France	70.2	24.9	60.0	23.9
Netherlands	67.4	35.0	63.8	24.8
Sweden	66.1	28.4	65.5	41.1
Norway	65.9	40.3	30.4	21.9
Italy	59.1	21.1	90.6	20.2
Slovakia	54.8	26.1	77.3	23.7
Germany	53.8	20.9	72.9	23.5
Belgium	53.3	26.4	73.4	19.6
EU-27	52.2	22.0	75.1	21.5
South Africa	**51.7**	**19.3**	**54.1**	**28.3**
Greece	50.6	32.0	91.6	14.7
Czech Republic	48.7	24.3	75.6	24.3
Luxembourg	45.0	25.0	75.7	24.3
Portugal	43.8	29.0	86.0	24.8
Estonia	43.2	23.0	82.6	35.9
Hungary	42.4	16.1	75.5	17.3
Malta	42.4	9.0	49.3	13.2
Denmark	40.1	23.2	63.2	35.6
Spain	34.9	20.3	66.6	12.6
Lithuania	29.6	16.8	86.5	27.2
Romania	27.7	9.1	78.9	12.8
Poland	26.2	9.2	90.7	7.8
Cyprus	24.5	15.5	97.7	33.4
Bulgaria	8.6	12.6	65.9	24.5
SA Rank (1-24)	**10**	**17**	**22**	**5**

Source: All data except for South Africa are estimates from European Communities (2007b). Data for Latvia, Austria, Finland and the United Kingdom are missing, and the EU-27 average is based only on available data; South African data are from Appendix Table 4A.

The survey contained a question on whether intramural R&D was carried out occasionally or continuously (see Figure 8). The Netherlands had the highest proportion (48%) of innovative enterprises undertaking continuous R&D, followed by France (37%) and Belgium (36%). In South Africa, almost 21% of innovative enterprises undertook R&D on a continuous basis, while 26% of enterprises undertook R&D occasionally.



Source: All data except for South Africa are from European Communities (2007a); South African data are from Appendix Table 29A.

FINANCIAL SUPPORT FOR INNOVATION ACTIVITIES

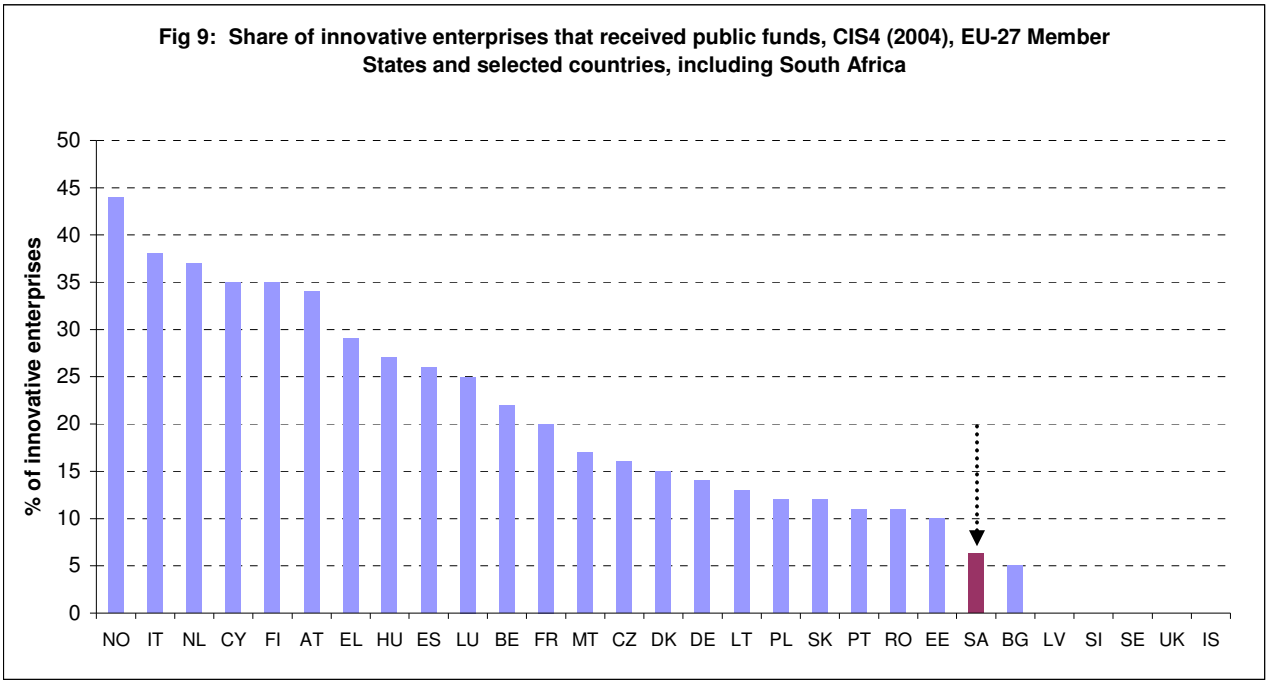
National funding agencies, such as the National Research Foundation, which currently houses the Innovation Fund and the Technology and Human Resources for Industry Programme (THRIP), appear have a stimulatory effect on innovation activities. About 6.4% of innovators in industry received funding for innovation activities from national funding agencies (Table 16), while 1.1% of innovative enterprises in the services sector received funding from such sources.

A further 5% innovative enterprises in the industrial sector and 0.4% in the services sector received funding from national government. Altogether, about 6.5% of all innovative enterprises and 11.8% of innovative industrial enterprises received public funding for their innovation activities between 2002 and 2004.

Table 16: Percentage of innovative enterprises that received financial support for innovation activities from government sources, 2002–2004

Percentage of innovative enterprises (%)	Total	Industry	Services
Metros and municipalities	0.0	0.0	0.1
Provincial government	0.2	0.3	0.1
National government	2.6	5.0	0.4
National funding agencies	3.6	6.4	1.1
Foreign government/public sources	0.1	0.1	0.0
Total	**6.5**	**11.8**	**1.7**

Source: Appendix Table 19A



Source: All data except for South Africa are estimates from European Communities (2007b); South African data are from Appendix Table 19A.

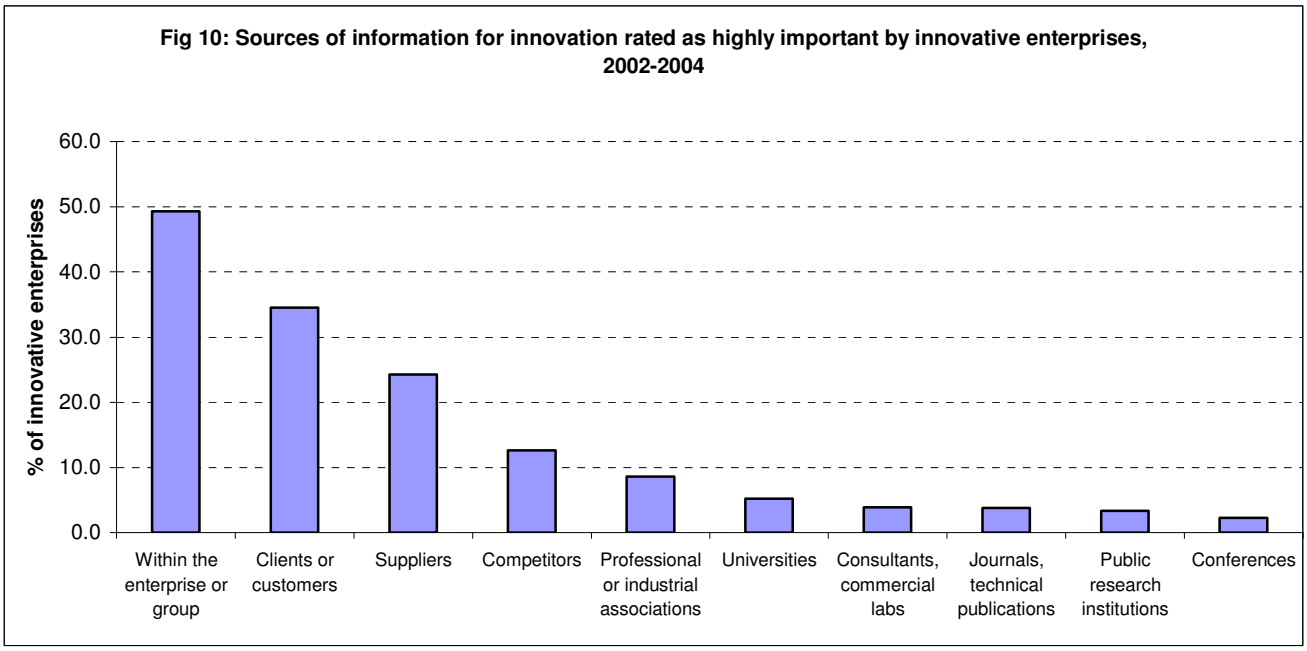
However, when considered in an international context, South Africa appears to support innovation activities in relatively few enterprises. Figure 9 shows that, of the countries that produce such data, Bulgaria was the only country to have provided less public funds to innovative enterprises than South Africa. In 10 out of 24 countries, more than 25% of innovative enterprises receive public funding for innovation. This could possibly result from countries having favourable tax incentives for R&D and innovation or from a strong history of direct funding of R&D and innovation through grants and subsidies at both the national and EU levels.

For example, it would be expected that the EU's Framework Programme for Research and Technological Development, regarded as a major tool for supporting the creation of the European Research Area (with the Seventh Framework Programme now in place for the period 2007–2013), would be a valuable source of funding for innovation. In CIS4, however, the countries with the highest percentages of innovative enterprises indicating that they received European Union funding for their innovation activities were Greece (19.7%), Austria (9.3%), Finland (8.4%) and Denmark (6.5%). Of these countries receiving EU funding, relatively few received funding from the Fifth or Sixth Framework Programmes: 7.8% for Greece, 2.6% for Austria, 4.3% for Finland and 3.4% for Denmark (European Communities 2007b).

Direct measures for innovation support are more likely to lead to the development of relationships between government, industry and third parties such as higher education institutions. In the case of South Africa, the combined funding offered by the Innovation Fund, THRIP and the Support Programme for Industrial Innovation (SPII) totalled R363 million in 2004, and not all this funding went to industry (at most, possibly R250 million). Considering that the enterprises surveyed spent R27.8 billion on innovation activities, the available funding of R250 million represents only about 0.89% of the total. Public funding for R&D activities in the business sector appears to be more favourable, and 32.9% of businesses in the 2005/06 R&D Survey accessed public sources of funding for R&D, although the monetary value of such funding was low. The South African business sector spent a total of R6.7 billion on R&D in 2004 according to the National R&D Survey for that year, of which R0.48 billion (or 7.1%) came from public funding sources (DST 2006).

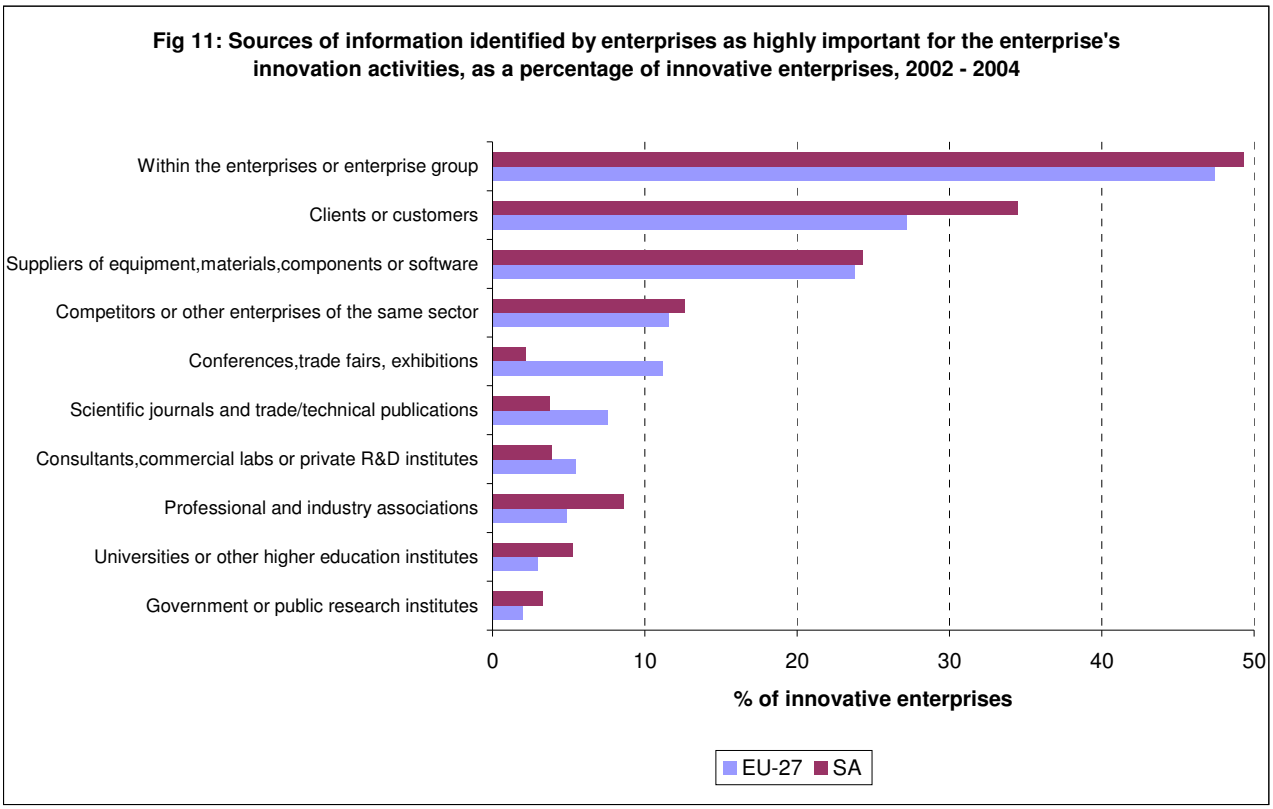
In order to provide public funding to 20% of innovative enterprises (equivalent to the proportion of innovative enterprises in France that received public funding in the period 2002–2004), South Africa would have to fund some 3 252 enterprises, with 196 from size class 1 (largest firms), 684 from size class 2, 1 612 from size class 3 and 760 from size class 4. Without double-counting, about 7% of enterprises in size class 1 are currently being funded from public sources, 2% in size class 2, 4.5% in size class 3 and 5.7% in size class 4 (see Appendix Table 19B). South Africa clearly lags behind other countries in the public funding of R&D and innovation in the private sector.

SOURCES OF INFORMATION AND COOPERATION FOR INNOVATION ACTIVITIES



Source: Appendix Table 11A

Almost 50% of all innovative enterprises rated sources of information within the enterprise as highly important for innovation activities (Figure 10). Clients and customers were rated as highly important external market sources by 35% of innovative enterprises, followed by suppliers (24%) and competitors (13%). Universities and technikons, and government and public research institutes were rated as highly important by only 5% and 3% of enterprises respectively.



Source: Data for EU-27 are from European Communities (2007c); South African data are from Appendix Table 11A.

South Africa's profile in terms of highly important sources of information for innovation appears to be much the same as the average profile for countries in the expanded European Union (EU-27), with almost half of innovative enterprises rating internal sources of information as highly important (see Figure 11). South African enterprises consider clients and customers to be highly important sources of information to a greater extent than their EU counterparts, but indicate that conferences, trade fairs and exhibitions are not as useful (perhaps because there is less diversity in such resources in South Africa than in the EU). South African enterprises also report that professional and industry associations, universities and public research institutes are slightly more useful than the EU-27 average.

Table 17: Highly important sources of information for innovation in innovative enterprises (EU member states, Norway and South Africa), 2002-2004

	Internal sources	External: market resources				External: institutional sources		External: other sources		
	Sources within your enterprise or enterprise group	Suppliers of equipment, materials, components or software	Clients or customers	Competitors or other enterprises in your sector	Consultants, commercial laboratories or private R&D institutes	Universities and technikons	Government and public research institutes	Conferences, trade fairs, exhibitions	Scientific journals and trade/technical publications	Professional and industry associations
Cyprus	85.9	50.6	22.1	27.9	25.3	2.3	2.8	36.4	18.5	7.0
Luxembourg	64.9	36.8	36.6	16.8	8.7	5.4	4.4	26.3	19.1	14.0
Ireland	64.3	36.4	49.9	14.6	5.7	2.7	2.8	16.1	11.2	4.7
Finland	56.9	15.8	38.1	8.3	2.4	4.9	2.4	8.0	5.3	2.0
Denmark	56.2	27.6	32.4	8.1	7.7	3.3	0.5	5.7	5.4	2.7
Belgium	54.7	30.0	38.9	18.3	4.3	3.8	2.3	12.9	8.9	7.6
France	54.5	20.3	25.6	7.9	4.6	2.3	2.0	6.9	6.9	3.5
Germany	53.3	21.6	35.0	13.9	2.6	3.4	1.4	11.0	6.5	4.8
Norway	52.1	20.0	35.0	9.4	6.2	3.1	3.2	8.7	4.7	4.6
South Africa	**49.3**	**24.3**	**34.5**	**12.6**	**3.9**	**5.2**	**3.4**	**2.2**	**3.8**	**8.6**
Malta	48.6	21.5	27.8	16.0	4.9	2.8	–	16.7	10.4	5.6
Poland	48.0	19.7	32.5	20.8	–	3.5	4.2	22.2	19.2	–
Greece	46.2	42.6	25.5	17.5	10.2	4.4	2.3	31.9	21.5	8.1
EU-27	45.7	23.2	26.7	12.2	5.7	3.6	2.7	11.5	8.3	5.5
Spain	45.1	30.2	19.6	10.5	5.5	3.2	4.4	8.6	4.3	4.5
Netherlands	45.0	20.9	27.0	11.0	3.9	2.6	2.0	6.9	3.7	5.4
Hungary	41.7	23.4	28.2	17.7	6.5	4.7	1.2	12.6	9.9	5.5
Czech Republic	39.4	23.3	32.1	14.3	4.5	3.0	1.4	14.2	7.4	3.3
Romania	38.0	37.6	30.9	19.1	4.9	2.7	2.6	23.0	22.8	6.4
Slovakia	37.1	23.7	30.1	12.4	3.0	1.8	1.1	13.3	8.3	3.4
Italy	36.3	21.8	13.8	5.6	10.7	2.0	1.0	8.9	5.6	5.8
Estonia	34.1	22.6	25.6	11.3	4.2	3.3	2.1	14.0	5.5	2.3
Bulgaria	33.1	26.7	33.1	16.7	7.0	5.4	3.3	18.5	16.3	7.9
Lithuania	32.2	15.8	19.1	8.6	7.1	1.1	2.1	13.5	6.4	2.9

Note:

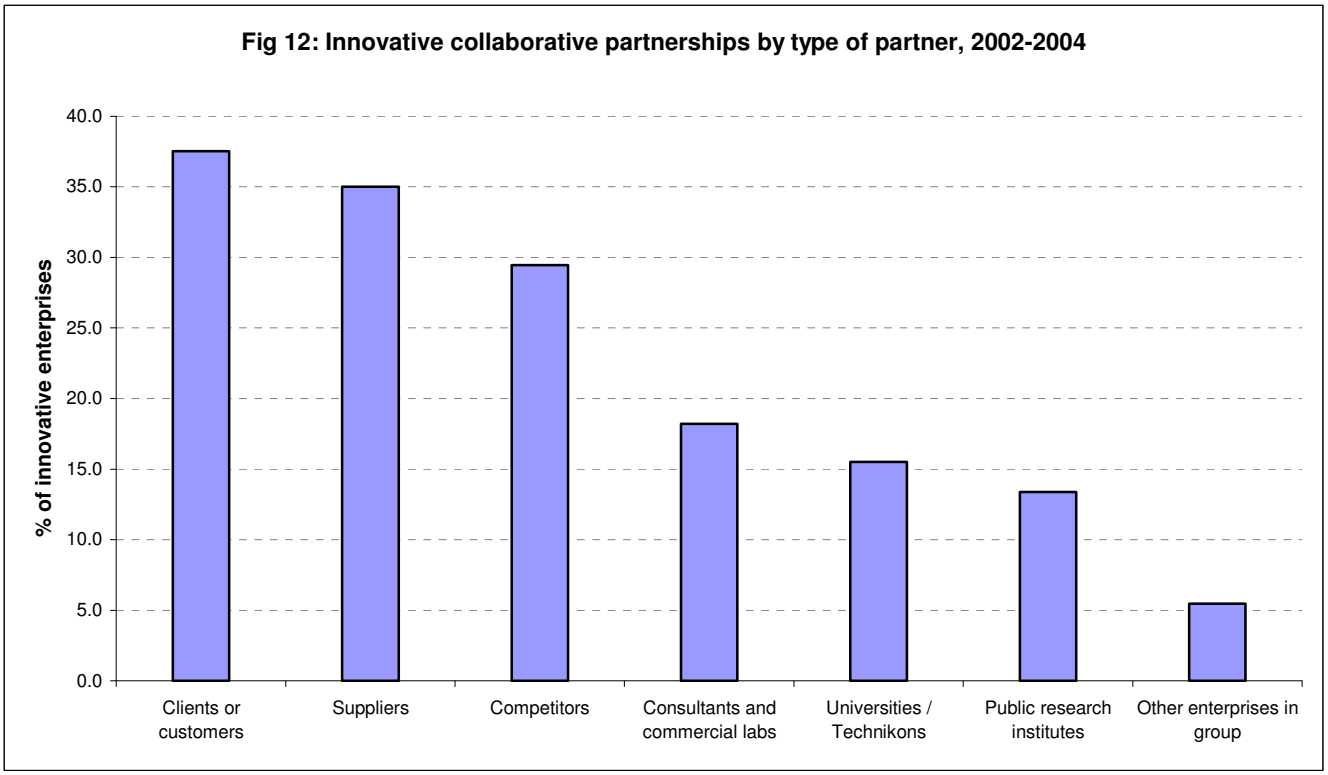
a. The EU-27 data is a Eurostat estimate that excludes missing, confidential or unreliable data for the following countries: Latvia, Austria, Portugal, Slovenia, Sweden and the United Kingdom.

Source: All data except for South Africa are from European Communities (2007c); South African data are from Appendix Table 11A.

Table 17 shows the ways in which the various countries rated the relative importance of various sources of information. There is considerable variation, and the overall picture is not as clear as in Figure 11. Although some of the new members of the EU appear to rate most sources of information for innovation fairly low, Cyprus appears high on the list for using own and market sources, but relatively low on the list regarding the importance of universities and public research institutes. It is difficult to conclude that there is any discernible pattern distinguishing particular groups of countries. However, enterprises tended to rate their own sources of information, as well as suppliers and customers, quite highly. In general, consultants, universities and public research institutions are rated quite low, which calls into question some of the current thinking and exuberance about the importance of industry, university and public sector linkages for innovation activities within national systems of innovation.

Eurostat raises the questions of why innovative enterprises do not make more use of knowledge generated by universities and public research institutes. Eurostat asks whether the research generated by these institutions is "too theoretical to be applied for industrial purposes" or if "public research is too expensive for industry to afford?" (European Communities 2007c). Similar questions could be raised in South Africa.

COOPERATION PARTNERS FOR INNOVATION ACTIVITIES



Source: Appendix Table 22A

Table 18: Collaborative partnerships for innovation activities by type of partner, 2002–2004

Percentage of enterprises (%)	Total	Industry	Services
Clients or customers	37.5	35.8	39.0
Suppliers of equipment, materials, components or software	35.0	34.6	35.4
Competitors or other enterprises in the sector	29.4	27.9	30.8
Consultants, commercial laboratories or private R&D institutes	18.2	24.1	13.0
Universities or technikons	15.5	23.6	8.3
Government or public research institutes	13.4	19.3	8.1
Other enterprises within the enterprise group	5.5	3.9	6.9

Source: Appendix Table 22A

Private sector enterprises in South Africa are sometimes criticised for lacking cooperative linkages and partnerships with other organisations. However, Figures 12 and 13 and Tables 18 and 19 suggest that South African enterprises have relatively high intensities of cooperative linkages in innovation activities with other enterprises and institutions. Figure 12 shows that clients (or customers), suppliers and competitors (or other enterprises in the same sector) were the most important collaborative innovation partners. Collaborative partnerships with these three types of partners are slightly more prevalent in innovative services sector enterprises than

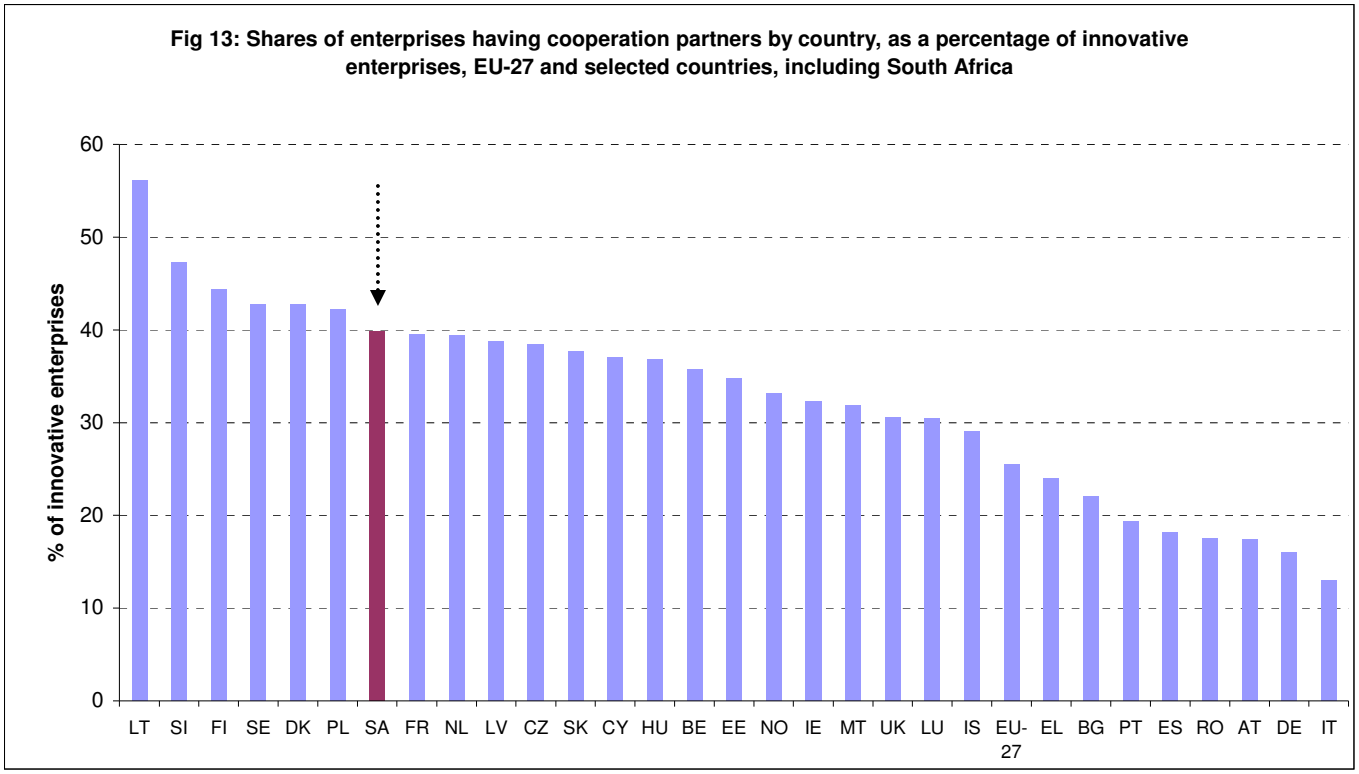
in innovative industrial enterprises (Table 18). The most common cooperation partners in the EU were suppliers (17%) and customers (14%); collaboration rates were higher in South Africa, with 37.5% for customers and 35.0% for suppliers (Table 19).

Figure 13 shows that between 2002 and 2004, about 40% of innovative enterprises in South Africa were engaged in some sort of collaborative partnerships involving innovation activities, in comparison with 26% for the EU-27 average. In the EU, the proportion of innovative enterprises engaged in cooperative partnerships ranged from 13.0% in Italy to 56.1% in Lithuania (Table 19). Lithuania, Slovenia, Finland, Sweden, Denmark and Poland all recorded higher proportions of cooperative linkages than South Africa. Austria, Germany and Italy appear to have the lowest rates of cooperative partnerships in innovative enterprises. Lithuania was the only country where more than half (56.1%) of innovative enterprises reported cooperative partnerships in innovation.

Table 19: Different types of cooperation partners of enterprises by country, as a percentage of innovative enterprises (EU member states and selected countries including South Africa)

	All types of cooperation	Other enterprises within your enterprise group	Suppliers of equipment, materials, components or software	Clients or customers	Competitors or other enterprises in your sector	Consultants, commercial labs or private R&D institutes	Universities and technikons	Government and public research institutes
Lithuania	56.1	16.7	45.5	34.5	25.4	24.9	12	9.6
Slovenia	47.3	15	37.5	33	20.4	19.7	19.5	13.2
Finland	44.4	23.5	40.8	41.4	34.2	32.7	33.2	26.4
Denmark	42.8	17.4	28.4	27.8	14.8	19	13.7	6.9
Sweden	42.8	17.2	32	27.9	10.8	19.8	17.4	6.4
Poland	42.2	12.7	28.2	16.4	8.5	7.9	6.2	8.7
South Africa	**39.9**	**5.5**	**35.0**	**37.5**	**29.4**	**18.2**	**15.5**	**13.4**
France	39.5	16.6	25.7	19.8	14.1	12.7	10.1	7.3
Netherlands	39.4	17.5	29.7	21.8	12.3	15	12.4	9.4
Latvia	38.8	6.1	32.6	28.7	25.1	18.3	13.8	12.2
Czech-Republic	38.4	13.5	30.7	26.1	15.3	15	13.1	7.4
Slovakia	37.7	14	31.7	30.2	21.2	18.6	14.8	11.4
Cyprus	37.0	5.9	24.5	4.2	12.8	16.9	2.2	1.7
Hungary	36.8	10.1	26.2	19.6	13.6	12.6	13.7	5
Belgium	35.7	16.9	25.9	21.2	9.5	15	13.2	9.2
Estonia	34.8	15.6	23.3	22.9	18.5	10	8.6	6.1
Norway	33.2	14	23.1	22.3	11.9	20.3	14.8	16.3
Ireland	32.3	16.7	23.2	25.2	6	10.1	10.1	5.7
Malta	31.9	16	22.2	16.7	5.6	13.9	4.2	4.2
United Kingdom	30.6	14.8	22.6	22.3	11.1	12.6	10	7.6
Luxenbourg	30.5	20.3	24	22.2	14.9	11	10	8.2
Iceland	29.1	5.3	19.8	19.8	13.8	6.7	5	13.1
EU-27	25.5	9.5	16.5	13.9	8.3	8.9	8.8	5.7
Greece	24.0	3.6	11	7.8	11.3	6.5	6.4	2.5
Bulgaria	22.0	4.9	16.2	13.4	7.6	7.5	6	3.9
Portugal	19.4	5.7	13.9	11.5	6.8	8.7	7.5	4.8
Spain	18.2	3.8	9.5	4.2	3	4.1	4.7	5.2
Romania	17.5	8.7	13.8	10	6.6	4.9	3.7	4.3
Austria	17.4	8.2	7.5	7.8	3.9	7.3	10	5.2
Germany	16.0	5.2	7	8.1	4.3	2.9	8.5	4.1
Italy	13.0	3	7.3	5.1	4.8	6.4	4.7	1.5
SA Rank (1-30)	**7**	**24**	**4**	**2**	**2**	**9**	**4**	**3**

Source: All data except for South Africa are from European Communities (2007c); South African data are from Appendix Table 22A.



Source: All data except for South Africa are from European Communities (2007a); South African data are from Appendix Table 22A.

In the more detailed results for this question from individual countries, Table19 shows that South Africa scores relatively highly with respect to the proportion of innovative enterprises that have collaborative partnerships with suppliers, customers and competitors. Consultants, universities and public research institutes all appear to be more involved as cooperative partners for innovation in the various countries compared to their fairly low placing as sources of information in Table 17. In South Africa, cooperation partnerships for innovation with consultants, universities and public research institutes are also much higher (Table 19) than the corresponding scores for sources of information (shown in Table 17).

EFFECTS OF INNOVATION DURING 2002–2004

The Innovation Survey included a question that required innovative enterprises to qualitatively assess and classify the levels of success of their innovation activities (both product and process innovations) in various market and operational outcomes. Improved quality of goods and services was cited as a highly important effect of innovation by about 46% of innovative enterprises (Table 20) and was more important for industrial enterprises (49.2%) than for service enterprises (42.8%). Increasing the range of goods and services was also an important outcome for 34.3% of enterprises (44.9% for industrial enterprises), while entering new markets or increasing market share appeared rather less important and was cited as a highly important effect by only 22.8% of innovative enterprises. Increased capacity of production or service provision was cited as the most important effect of process innovation by 19.1% of innovative enterprises, followed by improved flexibility of production or service provision (15.1%). Other highly important effects of innovation were meeting government regulatory requirements (21.4% of innovators) and reducing environmental impacts or improving health and safety (12.8%). With South Africa tightening up on environmental regulations, health and safety in the workplace and the introduction of various other pieces of legislation (such as black economic empowerment and employment equity), it is expected that enterprises will have to be innovative in responding to such pressures.

Table 20: Highly important effects of innovation on outcomes for innovative enterprises

Percentage of enterprises (%)	Total	Industry	Services
Product outcomes			
Increased range of goods and services	34.0	44.1	25.1
Entered new markets or increased market share	23.4	29.8	17.8
Improved quality of goods or services	45.6	47.9	43.6
Process outcomes			
Improved flexibility of production or service provision	15.4	16.5	14.5
Increased capacity of production or service provision	19.5	16.6	22.0
Reduced labour costs per unit output	8.1	14.7	2.2
Reduced materials and energy per unit output	7.3	13.0	2.2
Other outcomes			
Reduced environmental impacts or improved health and safety	12.7	23.3	3.3
Met governmental regulatory requirements	21.6	24.6	18.9

Source: Appendix Table 8A

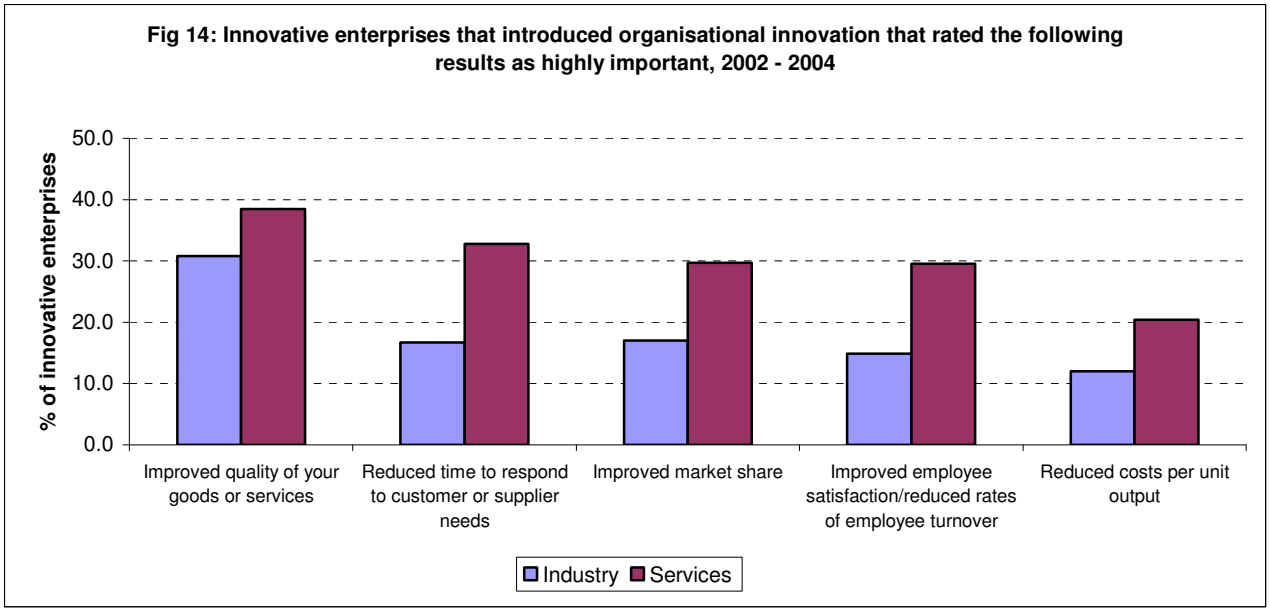
Table 21: Percentage share of enterprises engaged in innovation activity that cited the various effects of innovation as highly important, 2004

	Product orientated effects			Process orientated effects				Other effects	
	Increased range of goods and services	Entered new markets or increased market share	Improved quality of goods and services	Improved flexibility of production or service provision	Increased capacity of production or service provision	Reduced labour costs per unit output	Reduced materials and energy per unit output	Reduced enviromental impacts or improved health and safety	Met regulation requirements
Latvia	76.1	77.3	74.8	72.5	71.9	60.2	56.5	45.5	60.5
France	52.6	58.6	49.5	30.9	32.3	34.9	15.9	19.1	29.1
Luxenbourg	48.2	34.5	53.2	37.6	30.3	16.3	7.6	15.3	37.6
Bulgaria	42.7	32.9	45.6	22.8	23.4	18.9	17.0	20.7	26.7
Ireland	40.7	32.8	32.7	22.1	23.5	19.3	10.1	11.1	13.8
Czech-Republic	40.6	25.7	40.0	26.8	25.3	16.9	13.7	15.5	7.9
Netherlands	38.8	33.1	46.9	33.9	30.5	20.9	12.8	12.3	14.2
Slovenia	38.1	32.2	49.6	30.8	31.0	28.4	17.2	18.6	15.5
Germany	38.0	31.7	37.7	27.5	19.9	15.1	9.5	10.3	10.3
United Kingdom	37.1	36.5	40.9	23.6	23.2			15.5	25.7
Greece	36.6	29.7	58.8	43.0	40.0	13.7	9.3	21.2	18.6
Estonia	35.2	33.2	34.2	22.2	22.8	15.2	12.3	9.2	15.6
Belgium	34.8	33.3	46.6	24.7	25.8	16.6	8.8	13.3	14.4
South Africa	**34.3**	**22.8**	**45.9**	**15.1**	**19.1**	**8.0**	**7.3**	**12.8**	**21.4**
EU-27	34.2	29.4	37.8	24.7	24.4	15.6	8.4	14.1	18.4
Slovakia	34.1	25.3	34.8	27.1	24.5	6.8	8.8	12.2	13.7
Poland	33.4	26.7	35.1	21.1	23.2	15.0	12.0	19.2	25.4
Hungary	31.5	19.6	35.1	20.9	21.9	4.1	6.2	13.2	19.4
Sweden	31.2	19.8	29.3	16.3	21.6	17.9	7.1	9.7	12.9
Iceland	30.5	19.3	23.4	16.0	15.3	13.8	5.7	2.9	7.2
Spain	28.1	19.6	35.2	25.2	32.5	12.7	7.0	16.2	23.0
Cyprus	26.6	17.1	29.8	64.7	56.9	27.0	8.2	29.8	46.8
Italy	25.4	15.1	34.1	18.7	23.2	18.1	4.4	14.7	19.4
Austria	25.4	20.8	35.3	23.1	19.0	7.0	4.9	8.2	13.5
Finland	25.3	21.6	24.2	15.9	17.1	13.0	5.9	7.2	9.8
Denmark	25.1	19.7	26.7	21.9	18.4	14.5	6.7	8.7	12.6
Lithuania	24.1	20.8	27.9	19.6	21.1	9.3	5.9	8.8	20.8
Norway	23.1	16.2	23.6	13.5	13.4	10.0	4.3	8.1	12.4
Malta	21.5	19.4	21.5	17.4	15.3	6.9	4.9	11.8	18.8
Romania	17.1	29.1	37.1	28.6	32.3	15.5		17.7	14.9
Portugal	9.7	15.4	9.5	8.8	6.1	17.9	25.8	12.6	12.5
SA Rank (1-30)	**15**	**17**	**9**	**28**	**23**	**25**	**17**	**16**	**9**

Source: All data except for South Africa are from European Communities (2007a); South African data are from Appendix Table 8A.

International comparisons for individual countries on the highly important effects of product innovations are shown in Table 21. South Africa lies towards the middle of the listing and has roughly the same scores as the average for the EU-27. As in the EU-27, the most frequently cited effect of product innovation in South Africa was improved quality of goods and services. The second most important effect of product innovation in both Europe and South Africa was 'increased range of goods and services', which was a highly important effect for just over a third (34.3%) of all innovative enterprises. It was only in Latvia (77.3%) and France (58.6%) that enterprises ranked 'entered new markets or increased market share' as the top effect of innovation. In the EU-27, only 29.4% of innovative enterprises ranked this outcome as the most important effect of product innovation, compared with 22.8% in South Africa.

With respect to the effects of process-oriented effects of innovation, both South African and European enterprises generally reported a lower frequency of highly important outcomes than for product innovation. On all four process outcomes, South Africa's share of highly important outcomes ranked lower than the EU-27 average ratings. On the three other effects (such as reducing environmental impacts or improved health or safety), South Africa was closer to the EU-27 average. In terms of meeting regulatory requirements, 21.4% of innovative enterprises in South Africa rated this as a highly important outcome, compared with 18.4% of enterprises in the EU-27 countries. Just over 60% of innovative enterprises in Latvia rated meeting regulatory requirements as a highly important outcome of innovation activities.



Source: Appendix Table 18A

Innovative enterprises that introduced organisational innovations were asked to report on the most important outcomes associated with their innovation activities. Figure 14 shows that for 34.9% of innovative enterprises, improving the quality of their goods and services was the most important outcome. This was followed by reducing the time taken to respond to customer or supplier needs, which was reported by 25.2% of innovative enterprises. Only 16.5% of innovative enterprises considered that reducing the cost per unit output was highly important.

FACTORS HAMPERING INNOVATION ACTIVITIES IN 2002-2004

A total of 18.9% of innovative enterprises experienced problems with certain innovation activities and reported that these activities were seriously delayed during 2002–2004 (Table 22A). Some 10% of innovative enterprises abandoned innovation projects in the concept stage, while 12.3% reported abandoning innovation projects once they had already begun.

Table 22A: Number of enterprises with innovation activity that cited problems with their innovation activity, 2002–2004

Number of innovative enterprises	Total	Industry	Services
Abandoned in the concept stage	**1 715**	905	810
Abandoned after the activity or project was begun	**1 999**	855	1 144
Seriously delayed	**3 070**	1 164	1 906
Percentage of innovative enterprises (%)			
Abandoned in the concept stage	**10.5**	11.8	9.4
Abandoned after the activity or project was begun	**12.3**	11.2	13.3
Seriously delayed	**18.9**	15.2	22.1

Source: Appendix Table 12A

Enterprises were asked to rate the degree to which a number of specific factors hampered their innovation activities during the three-year period 2002–2004. Table 22B shows that 26.2% of all enterprises indicated that developing innovative activities within their enterprises was hampered or restrained because the market was already dominated by established enterprises. The second most cited factor was a lack of funds within the enterprise (25.3%), and the third was that the costs of innovation were perceived to be too high (20.4%).

Table 22C gives more detail of the factors hampering innovation activities in innovative and non-innovative enterprises in the industrial and services sector. Innovative industrial enterprises appear to be most hampered in their innovation activities by the lack of funds within their enterprise or group, while non-innovative industrial enterprises cited the domination of the market by established enterprises as the major factor. Both innovative and non-innovative enterprises in the services sector also tended to cite their innovation activities as being hampered by the domination of established enterprises in their market.

Table 22B: Highly important factors that hampered innovation activities of all enterprises, 2002–2004

Percentage of enterprises	Industry (Total)	Services (Total)	**Total** *Total	**Total** Innovative	**Total** Non-innovative
Cost factors					
Lack of funds within the enterprise or group	26.0	24.8	**25.3**	**29.1**	**21.3**
Lack of finance from sources outside the enterprise	16.6	14.4	**15.4**	**18.7**	**11.9**
Innovation costs too high	18.1	22.2	**20.4**	**22.8**	**17.7**
Knowledge factors					
Lack of qualified personnel	16.9	16.9	**17**	**20.4**	**13.2**
Lack of information on technology	8.3	1.0	**4.3**	**3.5**	**5.1**
Lack of information of markets	5.2	2.8	**3.8**	**3.3**	**4.4**
Difficulty in finding cooperation partners	11.2	5.6	**8.1**	**4.0**	**12.5**
Market factors					
Market dominated by established enterprises	20.5	30.7	**26.2**	**23.2**	**29.3**
Uncertain demand for innovative goods or services	6.5	12.6	**9.9**	**9.5**	**10.3**
Reasons not to innovate					
No need due to prior innovations	5.1	3.3	**4.1**	**3.0**	**5.2**
No need because of no demand for innovations	4.3	12.9	**9.0**	**0.7**	**18.0**

Note:
a. *Total includes all enterprises
b. ** Total = percentage of innovative or non-innovative enterprises in both services and industry
Source: Appendix Tables 13A and 13AA

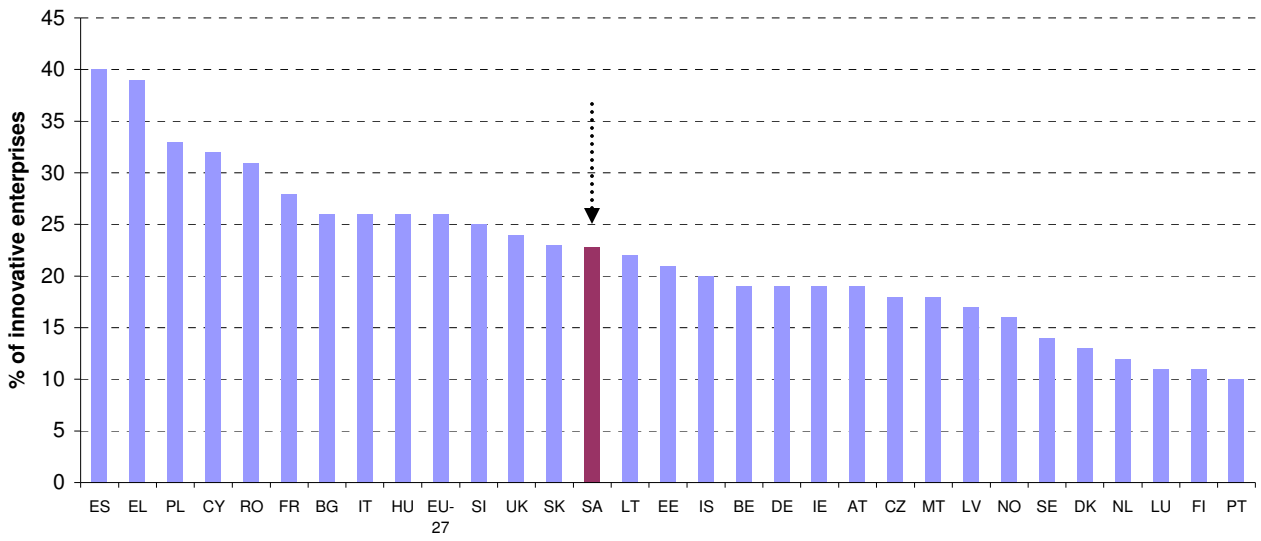
Table 22C: Highly important factors that hampered innovation activities of innovative and non-innovative enterprises, 2002–2004

Number of enterprises	Industry		Services		Total	
	Innovative	Non-innovative	Innovative	Non-innovative	Innovative	Non-innovative
Cost factors						
Lack of funds within the enterprise or group	32.0	18.6	26.6	23.2	29.1	21.3
Lack of finance from sources outside the enterprise	16.3	17.0	20.7	8.3	18.7	11.9
Innovation costs too high	15.4	21.3	29.3	15.2	22.8	17.7
Knowledge factors						
Lack of qualified personnel	15.0	19.2	25.1	9.0	20.4	13.2
Lack of information on technology	5.9	11.3	1.3	0.7	3.5	5.1
Lack of information of markets	1.0	10.2	5.2	0.3	3.3	4.4
Difficulty in finding cooperation partners	5.4	18.4	2.8	8.3	4.0	12.5
Market factors						
Market dominated by established enterprises	14.5	27.7	30.9	30.4	23.2	29.3
Uncertain demand for innovative goods or services	3.3	10.5	14.9	10.2	9.5	10.3
Reasons not to innovate						
No need due to prior innovations	1.2	9.8	4.7	1.9	3.0	5.2
No need because of no demand for innovations	1.0	8.2	0.4	25.0	0.7	18.0

Source: Appendix Tables 13A and 13AA

Figure 15A compares the various EU countries and South Africa with respect to their perception that innovation activities are hampered by overly high costs of innovation. South Africa appears in the middle cluster, with 22.8% of enterprises citing high costs as a factor hampering innovation. The highest proportion of enterprises in Spain and Greece indicated that they that felt that the costs of innovation were too high (40% and 39% of respondents respectively), while respondents from Finland (11%) and Portugal (10%) indicated that their enterprises were not really hampered by this factor.

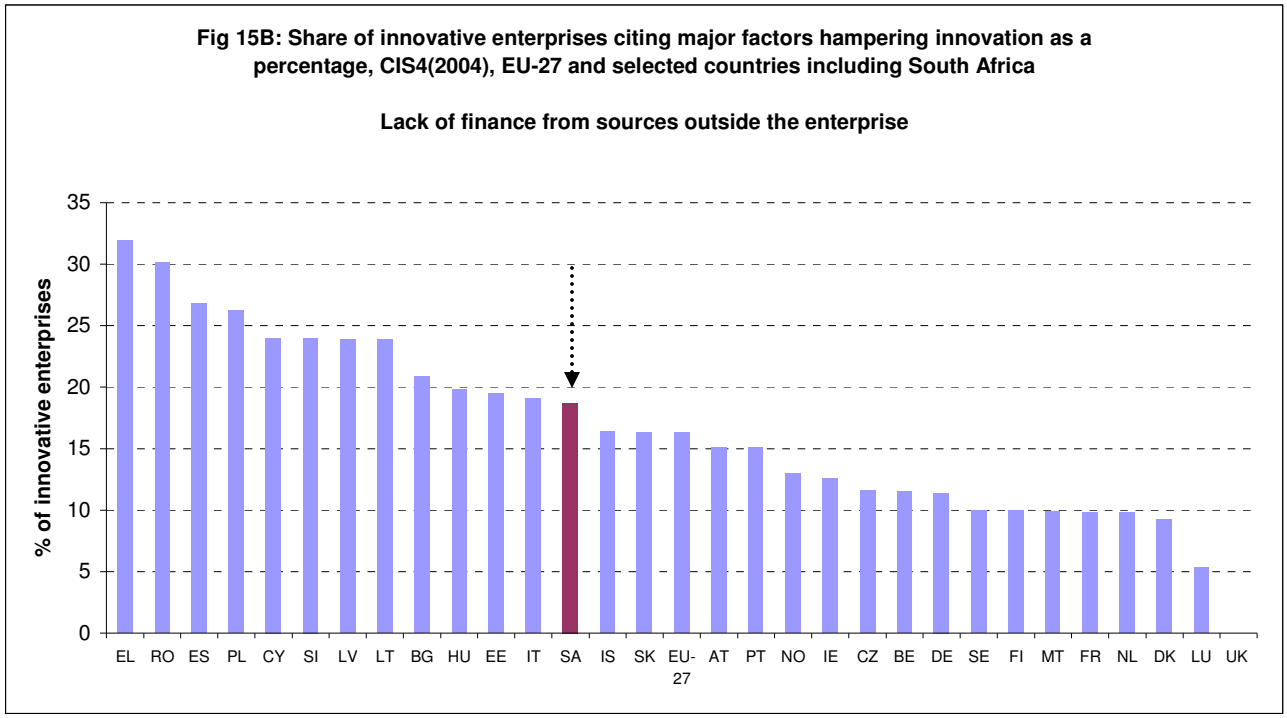
Fig 15A: Share of Innovative enterprises citing major factors hampering innovation as a percentage, CIS4(2004), EU-27 and selected countries including South Africa



Source: All data except for South Africa are estimates from European Communities (2007b); South African data are from Appendix Table 13A.

Figure 15B compares the responses of enterprises in the various countries with respect to their perception that their innovation activities are hampered by a lack of finances from sources outside their enterprises. These sources would also include public funding for R&D/innovation activities. Again, South Africa ranks about mid-way among the countries (with 18.7% of innovative enterprises citing lack of finances as a factor hampering innovation), alongside Italy and Iceland. It appears that innovation activities of respondents from enterprises in Greece (31.9%), Romania (30.1%) and Spain (26.8%) are most hampered by the lack of finances from sources outside the enterprise.

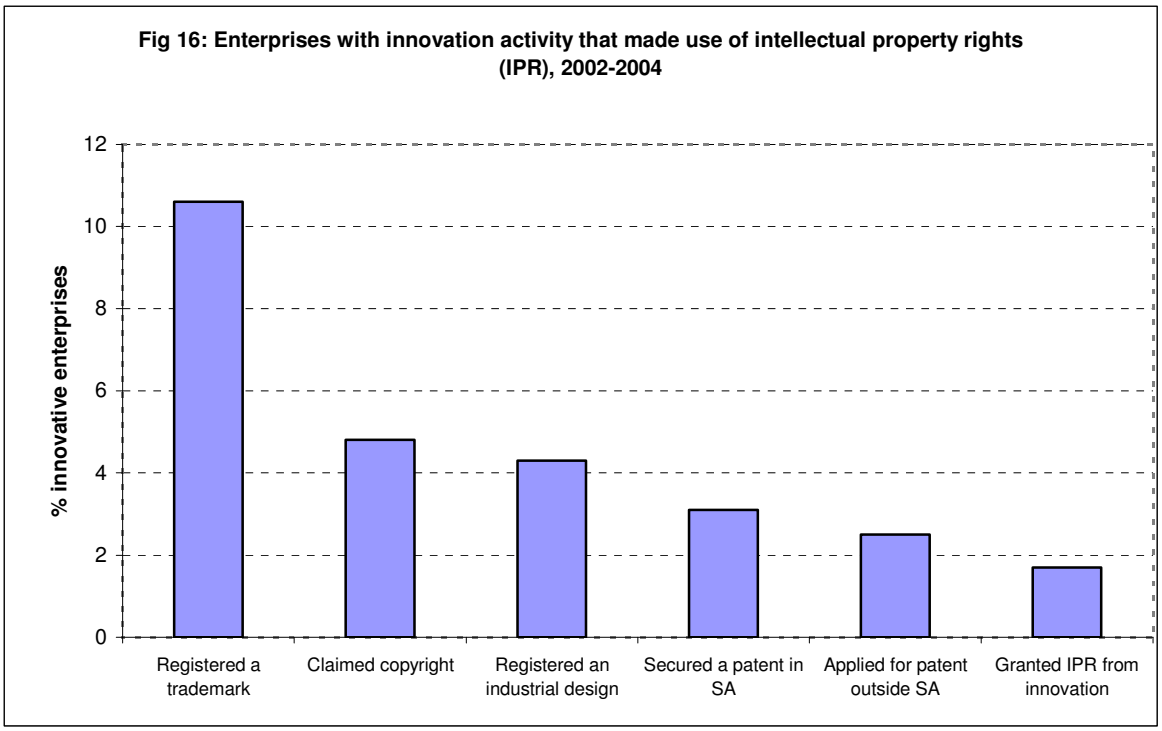
Enterprises in the Netherlands (9.8%), Denmark (9.2%) and Luxembourg (5.3%) appear to be least affected by this factor.



Source: All data except for South Africa are estimates from European Communities (2007b); South African data are from Appendix Table 13A.

INTELLECTUAL PROPERTY RIGHTS

Almost 11% of innovative enterprises registered a trademark between 2002 and 2004, while about 5% claimed a copyright (Figure 16). A total of 3.1% of innovative enterprises secured a patent in South Africa, while 2.5% applied for a patent outside South Africa. In response to a special South African question that was not used in the equivalent section in CIS4, about 1.7% of innovative enterprises granted licences or intellectual property rights, originating from their own innovation activities, to third parties.



Source: Appendix Tables 15A and 16A

Table 23 compares the use of protection methods for intellectual property by innovative and non-innovative enterprises. It is clear that non-innovative enterprises make far less use of any of these four protection methods than innovative enterprises. In France, 22.2% of innovative enterprises applied for a patent between 2002 and 2004, followed by Germany (20.1%) and Denmark (19.6%). In South Africa, only 2.5% of innovative enterprises applied for a patent outside South Africa (while 3.1% applied to the South African patent office), a higher percentage only than Cyprus (1.0%). France had the highest proportion of innovative enterprises registering trademarks (33.5%), while the corresponding South African figure was 10.6%. Greece is the leader in registering industrial design (24.8% of innovative enterprises), whereas only 4.3% of South African innovative enterprises registered designs. Luxembourg had the highest percentage of innovative enterprises claiming copyright (12.3%), compared with 4.8% of South African enterprises. The different patterns of protection methods used in the various countries are interesting and reflect differences of culture and in the manner in which enterprises go about their business.

Table 23: Protection methods used by enterprises, as a percentage of innovative enterprises and as a percentage of non-innovative enterprises, by country (EU member states, Norway and South Africa)

	Innovative enterprises				Non-innovative enterprises			
	Applied for a patent	Registered a trademark	Registered an industrial design	Claimed copyright	Applied for a patent	Registered a trademark	Registered an industrial design	Claimed copyright
France	22.2	33.5	18.4	9.7	3.2	10.7	4.5	2.3
Germany	20.1	19.1	18.0	8.0	4.0	5.1	4.7	3.0
Denmark	19.6	25.0	9.8	9.5	3.2	7.1	3.2	4.8
Finland	18.2	19.9	9.6	2.3	0.9	2.9	0.7	0.1
Norway	17.1	22.1	8.6	11.5	2.0	4.7	0.9	1.9
Ireland	16.9	5.1	20.7	9.3	0.9	0.6	3.3	1.0
Netherlands	14.4	17.3	5.7	5.1	0.8	3.7	0.5	0.7
Italy	13.4	7.3	15.8	2.1	2.2	2.0	6.4	0.7
Spain	11.8	21.5	10.2	1.7	1.9	6.1	2.3	0.2
Belgium	11.0	13.4	4.3	3.5	0.5	3.8	0.6	0.4
Malta	9.0	7.6	3.5	:c	:	1.3	:c	:c
Lithuania	8.9	6.4	22.8	6.4	0.6	0.1	4.5	0.5
Luxembourg	8.8	9.4	21.0	12.3	2.1	2.4	6.5	1.8
Bulgaria	7.6	18.5	6.8	3.9	0.8	2.8	0.4	0.3
Portugal	7.0	19.1	4.3	3.3	1.9	7.0	1.2	0.8
Romania	6.9	7.4	17.1	3.4	0.5	0.9	2.2	0.3
Hungary	6.5	4.8	9.5	1.9	0.7	0.4	2.5	0.7
Estonia	5.5	2.0	18.6	2.9	1.0	0.2	5.0	0.1
Czech Republic	5.1	7.9	20.8	4.3	0.7	1.3	5.9	0.9
Poland	4.9	18.8	9.8	6.7	0.3	3.1	0.9	0.6
Slovakia	3.7	7.1	18.4	6.0	0.6	1.1	5.5	1.4
Greece	3.0	5.5	24.8	9.0	0.0	1.6	8.9	2.6
South Africa	***2.5	**10.6**	**4.3**	**4.8**	***0.2	**2.9**	**0.0**	**0.5**
Cyprus	1.0	4.8	1.0	1.3	0.0	0.0	0.0	0.0
SA Rank (1-24)	**23**	**12**	**20**	**12**	**21**	**10**	**22**	**16**

:c confidential data

*** Applied for a patent outside SA

Source: Data for the EU-27 are from European Communities (2007d); South African data are from Appendix Table 16A.

CONCLUSIONS AND POLICY RECOMMENDATIONS

"All wealthy nations have the following in common: free markets, the rule of law and technology-based innovation" (Chait 2007). South Africa has all these characteristics, and there is a healthy outlook for the future of the economy. However, the country faces several pressing problems, particularly the underdevelopment of disadvantaged communities and associated poverty, widespread crime and violence and the HIV/AIDS pandemic. These problems are difficult and complex, and will require innovative solutions involving technology, education and appropriate approaches to the social aspects. One thing that is clear, however, is that economic growth and employment opportunities are an important basis for providing solutions to social problems. It is widely held that innovation is a primary driver of economic growth, so this report will attempt to provide some recommendations for better understanding the processes of innovation and the means of encouraging the further development and growth of innovation in the private sector.

It is acknowledged that countries are still learning to understand the determinants and processes of innovation. In contrast, the concept of R&D and its measurement in R&D surveys is far better understood. This will be readily admitted by the experienced practitioners that administer national R&D and innovation surveys and participate in the meetings, task teams and discussion groups of the OECD National Experts on Science and Technology Indicators (NESTI). A useful outcome of innovation surveys is that they provide common ground for discussing issues that affect innovation in countries. Such discussions help guide further understanding of the dynamics and processes of innovation.

In this study, we surveyed innovation only in the private sector, and the innovation survey instrument used is still fairly blunt, providing limited insight into the extent, costs and types of innovation in the country and the linkages between them. This is South Africa's first official innovation survey based on a proper random stratified sample from the official business register. It is not strictly comparable with the innovation survey covering the period 1998–2000 (Oerlemans et al. 2004), because that survey was based

on a sample from a commercial source, and the questions used in the questionnaire were mostly different from those used in the present survey. It is difficult to draw policy conclusions based on a single official innovation survey, but some more obvious conclusions can be reached.

The first two innovation surveys in the EU (CIS1 and CIS2) were carried out in the early 1990s and were largely a learning exercise for most countries that undertook them. Countries had to learn the suggested methodology and apply it to their local systems. They also had to learn to interpret the results of the surveys. Systems for statistical collection are fairly similar across EU countries, and they receive considerable assistance from Eurostat in obtaining conformance between countries. Nevertheless, there are still many unexplained and sometimes puzzling differences between the results obtained for the various countries (Abramovsky et al. 2004).

In the case of South Africa, this is the first government-commissioned national innovation survey (commissioned by the Department of Science and Technology). It is also the first time that the survey has been undertaken using the official business register of the national statistical agency (Statistics South Africa), as recommended in Eurostat's CIS4 methodology. The survey was administered as closely as possible in accordance with the core questionnaire and guidelines prescribed for EU members in order to provide direct comparability with the results from other countries. Because administering the CIS4 in South Africa is a novel experience, however, we have also had to learn along the way, as did the Europeans in CIS1 and CIS2. However, South Africa does not have the benefit of the centralised and standardised statistical systems and procedures that are being implemented in Europe. Some of the South African procedures are quite different from those in Europe. For example, our official size class classification procedures for enterprises are very different from those in Europe. Compared to European countries, the willingness of South African enterprises to engage in surveys (apart from official Statistics South Africa surveys) is very low. It required considerable persistence to obtain the eventual response rate to the Innovation Survey. Low response rates generally detract from the generalisability of survey results to disaggregated levels below national and major sectoral totals. Nevertheless, for a developing country, the survey should be

regarded as a success, and subsequent innovation surveys will benefit from the learning experience and build the database resource, as has been the experience of CeSTII with successive R&D surveys.

The outputs of innovation surveys in both developed and developing countries are seldom used to design innovation policy instruments (Mani 2007). Mani (2007) and Arundel (2006) both report that innovation surveys have not been effectively used for policy purposes. In an evaluation of 162 academic papers using CIS data and information, Arundel (2006) found that that only 13% made any policy recommendations. However, Mani believes that the results of innovation surveys in developing countries should be used to point out any systemic failures in innovation activities in the country. We discuss some of the implications and policy recommendations arising from the results of the South African Innovation Survey, given the limitations associated with having the results of only a single survey in the country. However, the richness comes from having undertaken an internationally comparable survey, the results of which are readily comparable with the results of innovation surveys in many other countries. In interpreting the South African Innovation Survey 2005, the local relevance of the findings must be taken into account, for instance, their relevance to the implementation of the Small Business Amendment Act of 2003.

Innovation is no longer regarded as the outcome only of the performance of R&D, and it is more common for a variety of non-R&D activities and expenditures to result in innovation outcomes. Activities that lead to innovation can include the acquisition of machinery, equipment, software and knowledge from outside the enterprise in the form of licences, patents or other know-how. Public funding has traditionally been provided for S&T and R&D activities in South Africa. Intramural R&D accounts for only 20% of innovation expenditure, although 51.7% of innovative enterprises engage in R&D. Public funds do not appear to have much penetration into the activities of innovative enterprises in most of the countries for which such data are available, despite the best intentions of governments to stimulate innovation through funding. The reason may be that innovation is part of the business activities of successful enterprises, which are reluctant to seek public funding if they thereby risk disclosing secret competitive information to others.

Enterprises appear to be more open about engaging in publicly funded R&D where the application of activities is possibly less obvious to those outside the business. However, government should note the low percentage of innovative enterprises receiving public funds in South Africa compared with EU countries. This finding suggests that, in consultation with industry, the current public funding programmes could be intensified and more widely publicised.

What is to be made of South Africa's relatively high rate of innovation activity compared with European countries? The high rate of innovation was noted in the previous innovation survey undertaken by the University of Pretoria in partnership with the Eindhoven University of Technology covering the period 1998–2000. The extent of national innovation activities measured in innovation surveys is entirely dependent on the collective self-assessment by enterprises of whether they are innovative or not. This assessment is partly determined by the national psyche and perceptions about how innovative and inventive the society and its enterprises actually are and the levels of business confidence in a country. The rate of innovation is also directly affected by the challenges and changes in the national business environment. In the case of South Africa, in particular, substantial new policies and regulations are changing the ways in which enterprises conduct their business. These changes range from compliance with equity and BEE regulations to stricter environmental regulation and adherence to international standards. Indeed, more than 21% of innovative enterprises in South Africa reported that a highly important effect of their innovation activity was to meet government regulatory requirements. It should also be noted that according to the Business Confidence Index of the South African Chamber of Business (SACOB), business confidence levels increased sharply between 2002 and 2004. Business confidence levels remained high during the time of the survey. When business confidence levels are high, enterprises are more likely to invest in innovative new ventures and activities. The levels of confidence in the economic climate in a country will also positively affect respondents' perceptions of levels of innovation in their enterprises.

It is clear that expenditure on innovation activities results in the sale of new and improved products for enterprises. Enterprises invested R27.8 billion in innovation

activities in 2004, including intramural R&D expenditure of R5.7 billion and extramural R&D expenditure of R2.2 billion. In the same year, they grossed R67.8 billion from the sale of products that were new to the market, and a total of R147 billion if products new to the enterprise (but not new to the market) are also included in sales. These returns on prior investment in innovation activities do not include the benefits to the enterprise of innovative processes or organisational innovations. Business and government need to be made aware of these tangible benefits of innovation in order to further encourage innovation. The close similarity between the estimate of intramural expenditure on R&D obtained in the Innovation Survey (R5.7 billion) and the 2004/05 R&D Survey for the equivalent business sectors (R5.9 billion) is encouraging. In most countries, the reported amounts of expenditure in these two surveys varied quite widely (Mortensen 2007).

A particular area of focus of policies designed to nurture national systems of innovation has been the linkages between institutions, particularly universities and industry. The results of innovation surveys both in South Africa and abroad suggest that such linkages may not be as important sources of information and collaboration for innovation as they had been considered. The most important links and collaborations for businesses are with other enterprises, including customers, suppliers and even competitors. These linkages form part of the market-driven business environment of enterprises and are less easy for government to stimulate. It appears that South Africa is far from unusual in this regard, and the lack of innovation-related linkages between public and private sector institutions in the EU is noted (European Communities 2007c).

It is apparent that it is more important for government to create an enabling environment for innovation than to attempt to boost innovation through funding programmes. For example, establishing a more efficient system for South African patents could be part of such an enabling environment. Recognition such as media coverage of innovations and awards for innovative enterprises also appears to be a means of encouraging further innovation.

In the case of Brazil, one of the government interventions in technology policy in the 1970s and 1980s was to place restrictions on importing foreign technology in order to

stimulate the development of local technology (Mani 2001). Ironically, the sanctions that resulted from the response of the international community to the South African apartheid regime had a similar effect on local technology development this country (although sanctions-busting was supported by government at the time). Most of the restrictions on importing technology into Brazil were lifted as part of the liberalisation strategy during the 1990s, which led to a general increase in expenditure on foreign technology agreements and imports (Mani 2001). In a recent paper, however, economists argue that import tariffs in Brazil are still too high and should be gradually eliminated on capital goods and intermediate imports in order to facilitate access to productivity-enhancing technologies embodied in imports (De Brito Cruz & De Mello 2006). South Africa has relatively moderate import tariffs, as recommended by the World Trade Organisation, and this generally helps stimulate technology imports and innovation in the country.

The results of the South African Innovation Survey clearly show that South African enterprises have much in common with enterprises in many European countries. For example, the closely similarities between the results for South Africa and the EU-27 profile on questions such as the factors hampering innovation and the most important outcomes of innovation for enterprises (see Tables 21, 22B and 22C and Figures 14, 15A and 15B). This is important to note and indicates that, on the one hand, South Africa can learn much from innovation-support policies that are applied in the EU and does not necessarily have to do things differently. On the other hand, it is clear that the South African Innovation Survey 2005 results have considerable local relevance and can provide insight into many of the issues that concern policymakers, such as the apparent limited collaboration in innovation between public institutions and private enterprises.

Finally the results of the Innovation Survey clearly indicate that South Africa is not a 'technology colony' – dependent on foreign technology. Most innovations are developed by enterprises in South Africa, and the influence of foreign partners is similar to the experience of other countries. South Africans should stop berating themselves and acknowledge that our industry and services are among the most innovative in the world.

REFERENCES AND ADDITIONAL READING

Abramovsky L, Jaumandreu J, Kremp E & Peter B (2004) *National differences in innovation behaviour: facts and explanations. Results using basic statistics from CIS3 for France, Germany, Spain and United Kingdom.* Paper from the European Commission Fifth Framework Programme-funded Research Project on Innovation and Employment in European Firms: Macroeconometric Evidence

Arundel, A (2006) Innovation survey indicators: Any progress since 1996?
Paper presented at the Blue Sky Conference (Ottawa 2006)

Australian Bureau of Statistics (2006) *Innovation in Australian Business 2005*

Blankley W & Kaplan D (1997) Innovation patterns in South African manufacturing firms: report on the survey of innovative activity in South African manufacturing firms. October 1997. Pretoria: Foundation for Research Development and Cape Town: Industrial Strategy Project

Chait G (2007) Zim's only hope lies in restoring global funders' confidence, *Cape Argus*, 20 July 2007, 18

Chudnovsky D, Lopez A & Pupato G (2006) Innovation and productivity in developing countries: a study of Argentine manufacturing firms' behaviour (1992–2001). *Research Policy* 35(2): 266–288

De Brito Cruz CH & De Mello L (2006) *Boosting innovation performance in Brazil.* Economics Department Working Paper No. 532. Economics Department, OECD, December 2006. ECO/WKP (2006)60

Department of Enterprise, Trade and Investment (2006) *UK Innovation Survey 2005: Northern Ireland results*

DST (Department of Science and Technology) (2006) *National Survey of Research and Experimental Development (R&D) 2004/05.* Centre for Science, Technology and Innovation Indicators (CeSTII) for DST

OECD (Organisation for Economic Cooperation and Development) (2005) *Oslo manual.* http://www.oecd.org/dataoecd/35/61/2367580.pdf

EC (European Commission) (2004) *Innovation in Europe: results for the EU, Iceland and Norway. Data 1998 – 2001.* Eurostat, Theme Nine: Science and Technology

European Communities (2004) Sources and resources for EU innovation. *Statistics in Focus: Science and Technology*, 5/2004. Author: Paul Crowley, Eurostat

European Communities (2007a) Community Innovation. Statistics: Is Europe growing more innovative? *Statistics in Focus: Science and Technology*, 61/2007, Author: Sergiu-Valentin Parvan, Eurostat

European Communities (2007b) Community Innovation. Statistics: More than half of the innovative enterprises in the EU do inhouse R&D. *Statistics in Focus: Science and Technology*, 72/2007, Author: Sergiu-Valentin Parvan, Eurostat

European Communities (2007c) Community Innovation. Statistics: Weak link between innovative enterprises and public research institutes/universities. *Statistics in Focus: Science and Technology*, 81/2007, Author: Sergiu-Valentin Parvan, Eurostat

European Communities (2007d) *Innovative enterprises and the use of patents and other intellectual property rights: Patents and Community Innovation Survey (CIS) Statistics.* Statistics in Focus: Science and Technology, 91/2007, Author: Bernard Félix, Eurostat

European Communities (2007e) Community Innovation . Statistics: Innovation activities and their effects. *Statistics in Focus: Science and Technology*, 113/2007. Author: Sergiu- Valentin Parvan, Eurostat

Forfas Innovation Survey (2006) *The Fourth Community Innovation Survey: First Findings.* September 2006

Gaude, M (2007) Eurostat: from the CIS3 to the CIS2008. Keynote address at the 32nd CEIES Seminar (European Advisory Committee on Statistical Information in the Economic and Social Spheres), Aarhus, Denmark (5–6 February 2007)

Kremp E & Rousseau, S. (2006) One-fourth of enterprises are innovation active; innovation-active enterprises are often mid-sized or large; they account for 60% of total turnover. *Le 4-Pages*, 222

Mani, S (2001) *Government, innovation and technology policy: an analysis of the Brazilian experience during the 1990s*. Discussion Paper No. 11, United Nations University, Institute for New Technologies

Mani, S. (2007) Innovation surveys in developing countries: what can we learn from it for public innovation policies. Paper presented at the Conference on Micro Evidence on Innovation in Developing Countries 2007, UNU-MERIT. Maastricht: The Netherlands

Mortensen PS (2007) Response ability and willingness. Paper presented at the 32nd CEIES Seminar (The European Advisory committee on Statistical Information in the Economic and Social Spheres), Aarhus, Denmark (5-6 February 2007)

OECD/EC (Organisation for Economic Cooperation and Development/European Commission (2005) *Oslo manual* (3rd edition). Paris: OECD Publishing. http://www.oecd.org/dataoecd/35/61/2367580.pdf

Oerlemans LAG, Pretorius TP, Buys A & Rooks G (2004) *Industrial Innovation in South Africa, 1998–2000*. Pretoria: University of Pretoria

Robson S & Ortmans L (2006) First findings from the UK Innovation Survey, 2005. *Economic Trends*, 628, Office for National Statistics

Statistics South Africa (2004) *Final Sample Innovation Survey 2004: Quality and Methodology*. Document created by Dr DF Molefe, Analysis and Consulting Department, Statistics South Africa, 20 November 2004.

Statistics New Zealand (2007) *Innovation in New Zealand 2005*

Statistik Austria (2006) Main results of the 4th Community Innovation Survey (CIS4) in Austria

Trendchart Innovation Policy in Europe (2006) *Hungary: almost one in five enterprises are innovative, reveals CIS4*. *Trendchart Newsletter*, October

APPENDICES

Appendix 1: Main Tabular Results of the South African Innovation Survey 2005 (A Tables)

Appendix 2: Main Tabular Results of the South African Innovation Survey 2005 (B Tables)

Appendix 3: Open Letter from the European Commission, Eurostat to non-EU member states

Appendix 4: The Fourth Community Innovation Survey (CIS4): methodological recommendations and core questionnaire

Appendix 5: South African Innovation Survey 2005 questionnaire

Appendix 6: South African Innovation Survey 2005: frequently asked questions (FAQ) booklet