INNOVATION IN THE SOUTH AFRICAN **MANUFACTURING SECTOR**, 2010-2012

A micro-data analysis report based on the 2010-2012 South African Business Innovation Survey undertaken by the Centre for Science, Technology and Innovation Indicators on behalf of the Department of Science and Technology

HSRC Human Sciences Research Council | CeSTII Centre for Science, Technology & Innovation Indicators

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LIST OF ABBREVIATIONS AND ACRONYMS

CEO	Chief Executive Officer
CeSTII	Centre for Science, Technology and Innovation Indicators
CIS	Community Innovation Survey
DST	Department of Science and Technology
EU-27	Expanded European union (27 countries)
FRD	Foundation for Research Development
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 Co-operation and Development
R&D	Research and Experimental Development
SARB	South African Reserve Bank
S&T	Science and Technology
SEDA	Small Enterprise Development Agency
SIC	Standard Industrial Classification
SPII	Support Programme for Industrial Innovation
THRIP	Technology and Human Resources for Industry Programme

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EXECUTIVE SUMMARY

Innovation is an important driver of competitiveness among firms and nations and a function of knowledge and its diffusion. This is the reason why innovation is receiving increasing attention in the development debate and many countries are placing a greater emphasis on policies that spur it. Better understanding of the innovation process and its economic and development impact is crucial for all the actors involved in its realisation. In South Africa, the measurement of innovation is an essential part of policy management and needed to inform the evaluation of progress and refinements to national policies and strategies, particularly in the domains of science and technology and industrial development.

Innovation takes place through a variety of practices, and however complex and multifaceted it may be it can be measured. Several methodologies have been developed to produce indicators to measure innovation within an enterprise or in an economy or region. The Organization for Economic Cooperation and Development's (OECD) Oslo Manual defines innovation as "the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organizational method in business practice, workplace organization or external relations" (OECD, 1997; 2005). So far five innovation surveys have been undertaken in South Africa following the approach recommended in the Oslo manual.

This report provides a sense of the profile of the innovation patterns in the South African manufacturing sector, using data drawn from the South African Business Innovation Survey, 2010-2012. It is based on 328 manufacturing enterprises that responded to the survey questionnaire. Available data was used to compute standard indicators covering technological innovation; new or significantly improved goods or services; the implementation of new or significantly improved processes; or ongoing/abandoned innovation for products and processes.

Results Highlights[1]

Table 1 Key Innovation indicators of manufacturing enterprises

Indicator	Value
Innovative manufacturing enterprises (with successful technological innovations)	61.3%
Innovation-active manufacturing enterprises (technological innovation)	68.0%
Technological innovations	
Manufacturing enterprises that produced new-to-the-market products	24.8%
Non-technological innovations	
Manufacturing enterprises with marketing innovations	35.1%
Manufacturing enterprises with organisational innovations	51.8%
Inputs	
Expenditure on innovation activities in manufacturing enterprises	R 3 287 million
Innovation expenditure as % of turnover in manufacturing enterprises	0.3%
Manufacturing enterprises that engaged in intramural research and development (R&D) activities	77.6%
Manufacturing enterprises with successful innovations that engaged in intramural R&D activities	70.9%
Outputs	
Turnover from sales of new-to-the-market products (technological innovators)	9.7%
Support for innovation	
Percentage of innovation-active enterprises that were aware of government financial support	60.5%
Percentage of non-innovative enterprises that were aware of government financial support	2.9%
Percentage of innovation-active manufacturing enterprises receiving financial support from government sources	25.1%

Proportion of innovative enterprises

Of the 328 manufacturing enterprises that were studied, 61.3% had engaged in technological innovations which were successful. Proportions of this are 11.9% with 'product only' innovations; 9.8% with 'process only' innovations; and 39.6% with both product and process innovations. A further 6.7% of the manufacturing enterprises surveyed have reported either abandoned and/or ongoing innovation activities. About 24.8% of the manufacturing enterprises engaged in technological product innovations that were new to the market. This category of innovations has a higher level of novelty compared to those that are new to the enterprise concerned or those that involve marginal modifications.

[1] A distinction is made in this report between an **innovation-active enterprise** and an **innovative enterprise**. An innovation active enterprise is one that has undertaken any form of innovation activities during the period under review, including those with ongoing and abandoned activities. In other words, enterprises that have had innovation activities during the period under review, regardless of whether the activity resulted in the implementation of an innovation, are ***innovation-active***. Such innovation activities would include the acquisition of machinery, equipment, software, licences, engineering and development work, training, marketing and R&D. A common feature of an innovation is that it must have been ***implemented***. Thus, an ***innovative enterprise*** is one that has ***implemented*** an innovation during the period under review. Two types of innovations are recognised, namely technological innovations (which cover product and process innovations) and non-technological innovations (which cover marketing and organizational innovations). A new or improved product is implemented when it is introduced on the market. New processes, marketing methods or organisational methods are implemented when they are brought into actual use in the enterprise's operations.

In terms of non-technological innovations, 51.8% of manufacturing enterprises introduced organisational innovations and 35.1% had marketing innovations.

The above findings indicate that innovation is pervasive in the South African manufacturing sector. The patterns of innovation noted in this report confirm a key finding in the previous series of the South African Innovation surveys reports namely that a large number of manufacturing enterprises in South Africa are innovation-active.

Type of innovation activities undertaken

The acquisition of new machinery, equipment or software was the most important innovation activity (78.9%). There is a high number of manufacturing enterprises depending on R&D to introduce innovations. In fact, 77.6% of manufacturing enterprises with innovative activities and 70.9% of those that had successful innovations engaged in intramural R&D activities.

Expenditure on innovation activities

Manufacturing enterprises with innovation activities spent a total of R3 287 million on innovation activities, which is 0.3% of their turnover during the reference period. Expenditure on the acquisition of new machinery, equipment and software accounted for 71.0% of total expenditure on all innovation activities. Almost 20% of total expenditure was devoted to intramural R&D and about 6.6% to outsourced R&D and 2.5% devoted to the acquisition of other external knowledge.

Government financial support for innovation in the manufacturing sector

At least 60.5% of the manufacturing enterprises with innovation activities were aware of government funding opportunities. Of the successful innovators, 56.5% were aware of government funding whilst only 2.9% of non-innovators were aware that government offers financial support for innovation activities. About 25.1% of the innovation-active manufacturing enterprises received funding support from government sources to undertake their innovation activities.

The Department of Trade and Industry (dti) was the main funding source of innovation, with 19.3% of innovation-active enterprises indicating that they had received funding for innovation from this government department. This was followed by the Department of Science and Technology (DST) with 4.9%. Other government departments combined were reported by 2.2% of innovation-active enterprises as a source of funding for their innovation activities.

Sources of information and ideas for innovation

Enterprises source most of their innovative ideas from their immediate market. About 50.7% of innovation-active manufacturing enterprises rated sources of information with clients or customers as 'highly important' for innovation activities. This was followed by sources within the enterprise group (46.6%) and then suppliers (45.7%). Competitors were rated as important sources of information by 22.9% of enterprises. Universities and technikons (5.4%) and government or public research institutes (2.2%) were considered important sources of information by fewer manufacturing enterprises.

Collaborations and their nature

Innovation is a connected activity. Partners that manufacturing enterprises principally cooperated with on their innovation activities, apart from enterprise itself or enterprise groups (18.4%), were clients or customers (20.2%) followed by suppliers of equipment, materials, components and software (19.3%). Collaborative partnerships with universities or higher education institutions and government or public research institutions received lower rankings, namely 11.2% and 9.9%, respectively. The pattern was

generally observed across all geographic regions of the world where the proportions for South Africa and Europe were generally higher than the corresponding proportions for the rest of the world.

Effects of innovations

The effects of innovation that were principally cited by enterprises as highly important were 'Improving quality of goods or services' (37.7% of innovation-active enterprises) and 'increasing the range of goods and services' (35.9%). This was followed by 'Increased capacity of production or service provision' (30.5%) and 'improved flexibility of production or service provision' (26.0%).Other 'highly important' effects of innovation mentioned were reduced environmental impacts or improved health and safety (25.1%), and meeting government regulatory requirements (mentioned by 25.6% of innovators). 'Entering new markets or increasing market share' was mentioned as a highly important outcome by 29.1% of innovation-active enterprises.

Perceptions of factors hampering innovation

Innovation activities do not always proceed as intended. While others succeed, some can be redirected, scaled down or cancelled altogether due to a variety of factors, which can be internal to an enterprise or external.

All cost factors were principally perceived by both innovation-active and non-innovation-active manufacturing enterprises as barriers to innovation: 'lack of funds within the enterprise or enterprise group' (23.8% for innovation-active enterprises, and 15,2% for non-innovation-active enterprises), 'lack of finance from sources external to the enterprise' (24.7%, 11.4%) and 'innovation costs too high' (18.8%, 14.3%). Knowledge factors generally ranked lower, though 'lack of qualified personnel' stood out and ranked high (22.9%, 8.6%), followed by 'difficulty in finding cooperation partners' (11.7%, 2.9%). Among market factors, 'market dominated by established enterprises' (19.3%, 11.4%) ranked higher than 'uncertain demand for innovative goods or services' (13.9%, 10.5%). Among reasons for not innovating, 'no need because of no demand for innovations' (5.4%, 13.3%) ranked higher than 'no need due to prior innovations' (2.7%, 8.6%).

The pattern for barriers to innovation for non-innovation-active manufacturing enterprises was similar to that for innovation-active manufacturing enterprises with generally lower proportions for the former type of enterprises, except in the case of reasons for not innovating where the converse was true, with non-innovation-active enterprises, naturally, having higher proportions of enterprises reporting reasons not to innovate.

CHAPTER 1: BACKGROUND AND INTRODUCTION

This is a micro-data analysis report, drawing from the dataset of the 2010-2012 South African Business Innovation Survey, to provide a sense of the profile of the innovation patterns in the South African manufacturing sector.

The results of innovation surveys can assist government to identify policy measures on a range of issues relating to innovation, targeted at the promotion of economic and social growth for competitiveness. Examples include policies for science and technology, industrial development, financial as well as other types of incentives for encouraging enterprises to innovate, and the legislation that encourages private sector collaboration and cooperation with universities and research organisations and international partners (see, for example, World Bank, 2006, Chapter 6). The impact of innovation-related policies can be evaluated by the enterprises' responses to their frequency, and importance, of access to services, programmes or financial tools that have been designed to support or promote innovation-related activities. The results of innovation surveys have been used to develop models that identify determinants of decisions of whether to innovate or not among manufacturing enterprises. Innovation surveys also inform the degree of impact which specific constraints have on innovation in industry.

Innovation in the business sector is very important in boosting growth in the economy and contributing to the quality of life. Innovation takes place through a wide variety of business practices and a range of indicators can be used to measure its level within the enterprise or in the economy as a whole. These include the levels of effort employed (measured through resources allocated to innovation) and of achievement (the introduction of new or improved products and processes). Innovations comprise several types of activities and expenditures, including intramural and extramural (or outsourced) R&D; acquisition of machinery, equipment and software; acquisition of other external knowledge and know-how; training; market introductions and other activities (including significant design changes). Four types of innovations are distinguished: technological innovations which consist of *product innovations* and *process innovations;* and non-technological innovations which consist of *marketing innovations* and *organisational innovations*. The defining element for these various activities to be classified as innovations is that they result in improved products or services being introduced to the market.

There are four broad levels of novelty of innovations that are defined in relation to the enterprise and the market. In levels of increasing novelty, these are:

1. Innovations that are only new to the firm.
2. Innovations that are new to the market of the firm (and its competitors).
3. Innovations that are new to South Africa.
4. Innovations that are a world first.

While some innovations are directly based on the results of R&D, some innovations by the enterprises concerned are based on non-R&D activities aimed at producing new or improved products and/or processes. These non-R&D activities include the acquisition of external knowledge or new equipment and machinery.

Mario and Sirilli (1997, 1998) showed that, based on enterprises' responses to the relevance of various government support programmes for innovation, the largest enterprises in high-technology sectors were the major recipients of most public support and funding, while many smaller innovating enterprises reported that these government policy tools were insufficient to support their innovation requirements. In South Africa, various forms of financial and non-financial support are available, primarily through the dti and the DST and their agencies to support various types of innovation activity. Targeted enterprises for these support measures range from Small, Medium and Micro Enterprises (SMMEs) to large enterprises.

The way in which the process of innovation is managed within the enterprise is a significant area of investigation because it provides information on the enterprise's internal factors that shape choices about whether each enterprise decides to innovate, their type of innovation and by what means to innovate.

There are various approaches available in the literature for measurement of innovation, some of which draw the data from innovation surveys. The scopes of measurement differ widely and are usually applied in different contexts and levels. Form the contextual perspective, examples include economic, social and inclusive development, while in terms of levels, analysis could include global or regional comparisons, or could be at country or sector level. The Organization for Economic Cooperation and Development (OECD) uses innovation micro-data analysis to examine a range of issues relating to innovation and firm level performance, focusing on the development of indicators that could aid in informing policy makers about the changing nature of innovation and its relation to economic growth and social well-being.

Therefore, it is important to note that the Innovation Survey on which the micro-data analysis in this report was based, which focuses on innovation in the South African manufacturing sector, was a survey of businesses which was informed by the guidelines of the OECD Oslo Manual (Eurostat/OECD, 1997, 2005). More specifically, it was guided by the methodological recommendations for round four of the Community Innovation Survey (CIS 4) of 2006 for European Union (EU) countries as provided by Eurostat (see Appendix 1).

The present chapter (Chapter 1) introduces the report and the next chapter (Chapter 2) presents the methodology, while Chapter 3 gives the profile of the manufacturing sector including its contribution to the South African economy. Chapter 4 presents the results and recommendations and conclusions are presented in Chapter 5.

CHAPTER 2: METHODOLOGY

2.1 Data Source

The data that was used for the production of this report was extracted from the Business Innovation Survey (BIS) 2010 - 2012 database as built from the data collected from the South African National Business Innovation Survey 2010 - 2012. The results reported here are not intended to represent the population of all business enterprises in the South African manufacturing sector. Instead, only the realised sample of 328 enterprises in the manufacturing sector that responded to the survey is represented. Thus the generated statistics are purely descriptive.

The survey design was based on the guidelines of the Oslo Manual (OECD/Eurostat, 1997, 2005). The survey questionnaire was directly comparable with the core questionnaire for round 4 of the OECD Community Innovation Survey (CIS 4). Sampling was informed by the structure of the Business Register of Statistics South Africa, from which a stratified random sample by sector determined on the basis of Standard Industrial Classification (SIC) and size of the business enterprise based on turnover was drawn.

Note that determining enterprise size classes on basis of turnover is a departure from the CIS guidelines, which recommend that the enterprise size classes be the number of employees so that the survey can target only enterprises that have ten or more employees. The Business Register of Statistics South Africa that was available at the time of sample design did not enable size stratification by number of employees.

For the reasons explained above, a cut-off point for the sample frame was set to be enterprises above the 30.5 percentile of very small enterprises (those with a turnover of less than or equal toR5 million per year, for the manufacturing sector). These enterprises employ less than 20 employees according to a schedule prescribed in the National Small Business Amendment Act, 2003 (No. 26 of 2003). In this schedule, enterprises are divided into four size classes (large, medium, small and very small).

2.2 Statistical analysis

The statistical analysis comprised computing descriptive statistics, such as the numbers and proportions of enterprises involved in various types of innovation activities, classified by sector and size class. For quantitative indicators, such as turnover, expenditure on innovation and number of employees, totals and proportions were also computed, based on a similar categorisation. All these statistics were estimates based on the realised sample, as the response rate was too low for generalisation of the results to the population of South African business enterprises.

2.3 Using the results

The size classes used in this report are in accordance with the National Small Business Amendment Act, and therefore are biased towards representing the extent of the turnovers of enterprises rather than the number of employees. This does not detract from the nature of the survey population results, particularly those for the largest two size classes which are generally more robust because they are based on a relatively large sample size and hence have better sector coverage. Countries such as China and Malaysia also use turnover as a proxy for size of enterprises in their innovation surveys.

The results of this survey, therefore, may differ from those collected in the EU where size class is based only on the number of personnel. Note that the size classes prescribed in the National Small Business

Amendment Act also differ from those used in the EU. Any comparisons with countries that base their size classes on employee numbers, as recommended by CIS 4 methodology, should be viewed in the light of these differences.

Users must also note that the survey response rate was less than targeted to produce national aggregates of overall innovation indicators as intended initially with the national Innovation Survey. It was determined, in the final analysis of responses, that a series of analytical products are possible from the data that was collected, particularly for the manufacturing sector and selected industries within the services sector, namely wholesale and retail trade, financial intermediation, and transport, storage and communication.

2.4 Characteristics of enterprises in the manufacturing sector covered by the survey

This section reports on the characteristics of manufacturing enterprises that responded to the South African Business Innovation Survey 2010-2012. The Survey covered the three year period, from 2010 to 2012.

The 328 enterprises that responded to the survey employed about 124 166 employees, 87.4% of whom worked in enterprises with innovation activities (Table 3.1). About 89.6% of the staff employed by large manufacturing enterprises was accounted for by innovation-active large enterprises.

Total turnover of the enterprises was recorded as R979billion. Enterprises with innovation activities accounted for about 98.2 % of this turnover (Table 3.1). In the large manufacturing enterprises at least 98.0% of the total turnover was generated by innovation-active enterprises and at least 99.3% of total turnover of medium manufacturers was generated by innovation-active enterprises.

Table 3.1 Total enterprises, number of employees and turnovers: comparison of manufacturing enterprises with innovation activities, 2010-2012

	Total (number)	Total (%)	Large (%)	Medium (%)	Small (%)	Very Small (%)
Total number of enterprises	*328*	100.0	100.0	100.0	100.0	100.0
Enterprises with innovation activities	*223*	68.0	78.5	67.7	48.0	36.2
Number of employees	*124 166*	100.0	100.0	100.0	100.0	100.0
Number of employees in enterprises with innovation activities	*108 554*	87.4	89.6	69.0	58.6	20.3
Turnover (R billion)	*979*	100.0	100.0	100.0	100.0	100.0
Turnover (R billion) of enterprises with innovation activities	*961*	98.2	98.0	99.3	62.1	40.2

Source: Appendix 4 Tables A1.1, A2 and A3
*Numbers do not always add up because of rounding effects

Most of the manufacturing enterprises (58.8%) reported that they were independent enterprises and not part of a larger group (Table 3.2). At least 40.5% were part of a larger group. However most of the larger enterprises seem to be part of a larger group.

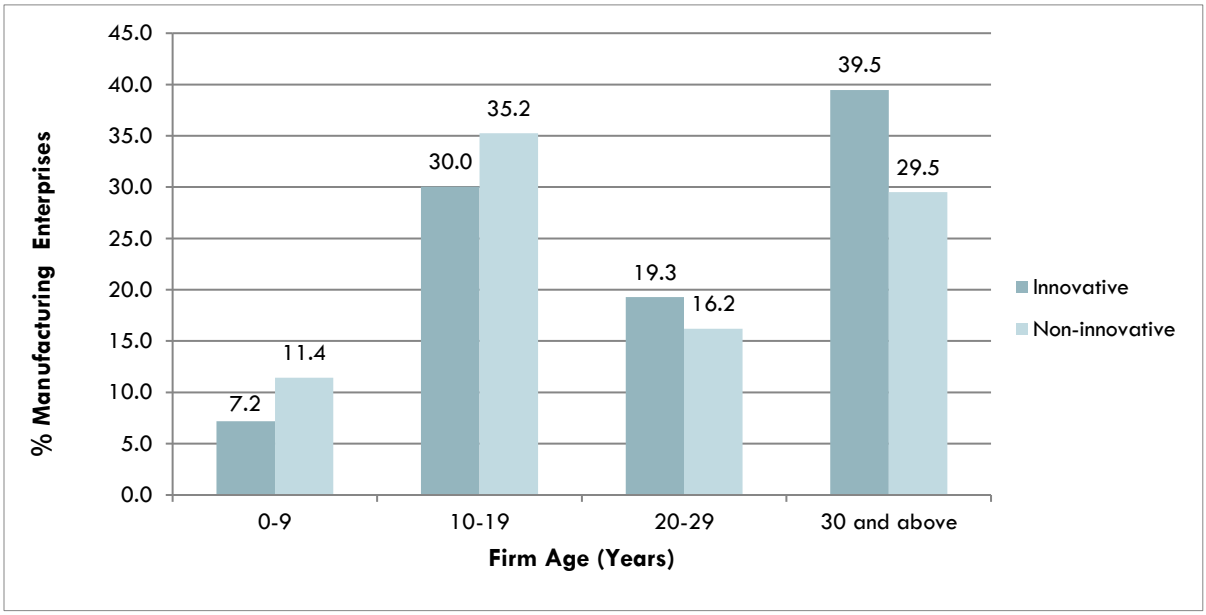
Table 3.2 Number and percentage of enterprises that stated they were part of a larger group

	Total	Large	Medium	Small	Very Small
Enterprise group status (number)					
Part of a larger group	133	109	18	1	5
Not part of a larger group	193	80	47	24	42
Non-response	2	2	0	0	0
Enterprise group status (%)					
Part of a larger group	40.5	57.1	27.7	4.0	10.6
Not part of a larger group	58.8	41.9	72.3	96.0	89.4
Non-response	0.6	1.0	0.0	0.0	0.0

Source: Appendix 4 Tables A27
*Numbers do not always add up because of rounding effects

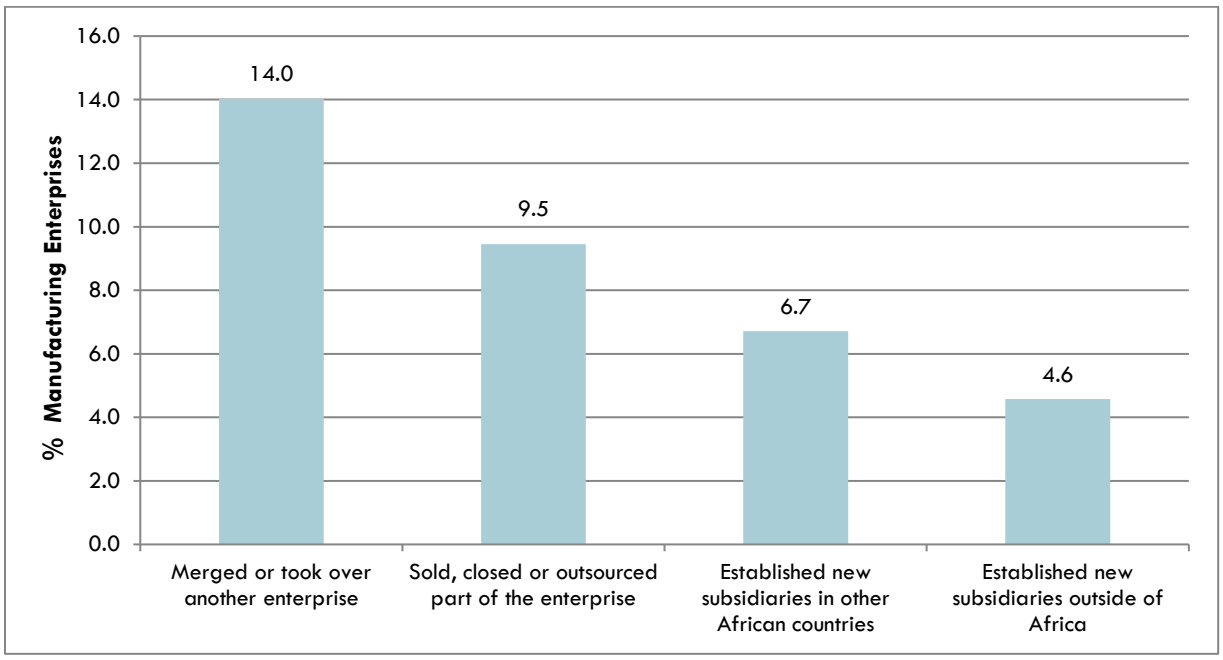
Figure3.1 shows that enterprises that are more established are more innovation-active than younger enterprises. About 14.0% of manufacturing enterprises reported that they had merged with, or taken over, another company (Figure 3.2) while 9.5% reported that they had sold, closed or outsourced parts of their enterprise. Not many enterprises had established new subsidiaries in other African countries or outside of Africa (6.7% and 4.6% respectively).

Figure 3.1 Age of innovation-active and non-innovative manufacturing enterprises



Source: Appendix 4 Table A28

Figure 3.2 Enterprises that merged with others, closed or established subsidiaries



Source: Appendix 4 Table A27

Table 3.3 shows that 87.4% of the total number of staff employed in the manufacturing sector was in innovation-active enterprises. Innovation-active enterprises employed about 108 554 staff of whom 13 374 employees, or 12.3%, had a tertiary education qualification (degree or diploma).

Table 3.3 Employees in the manufacturing sector

	Total	Large	Medium	Small	Very Small
Number and percentage of employees by innovation activity					
All enterprises - number of employees	124 166	114 381	7 373	1 283	1 129
Enterprises with innovation activity (%)	87.4	89.6	69.0	58.6	20.3
Enterprises without innovation activity (%)	12.6	10.4	31.0	41.4	79.7
Employees with tertiary qualification in innovation-active enterprises (%)	12.3	12.7	6.7	3.7	10.3

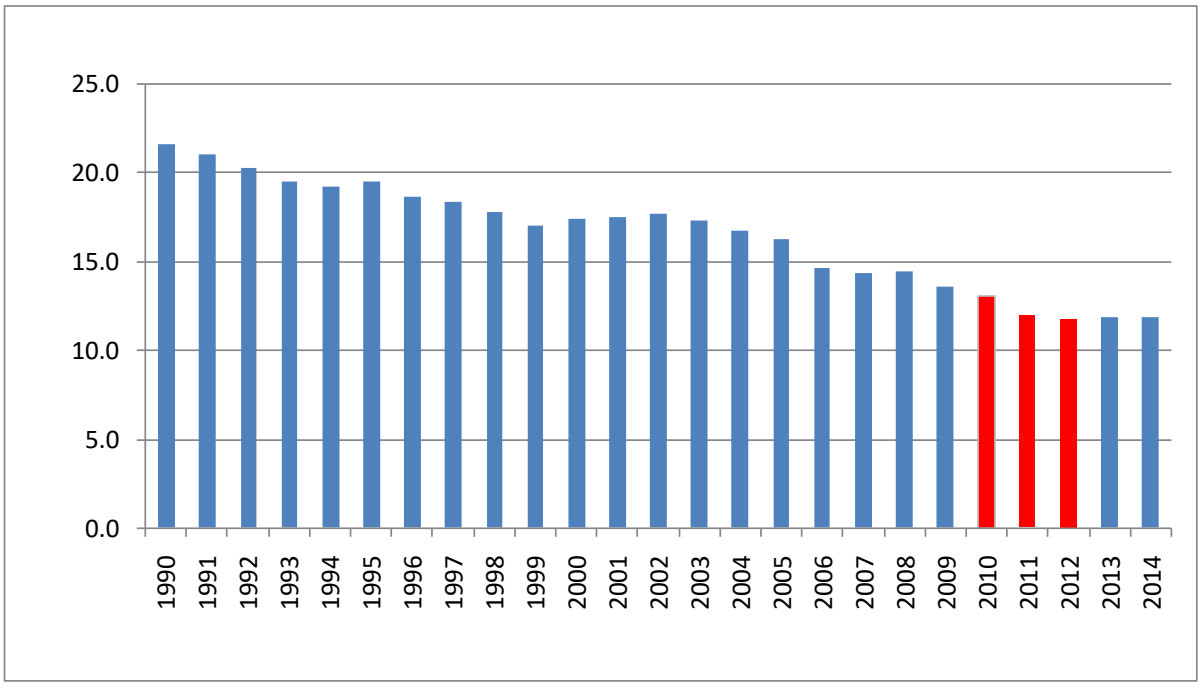
Source: Appendix 4 Tables A2 and A19
*Numbers do not always add up because of rounding effects

CHAPTER 3: PROFILE OF THE SOUTH AFRICAN MANUFACTURING SECTOR

Manufacturing is a key contributor to a country's ability to grow its economy, to innovate and build intellectual capital and create wealth. In the year 2012, the manufacturing sector accounted for 11.8% of South Africa's gross domestic product (GDP) and employed at least 1,8 million members of the labour force. Besides its contribution through value addition, the sector has labour-absorbing capacity and provides a locus for stimulating the growth of other economic activities, such as services, and assists in achieving specific outcomes, such as export competitiveness and economic empowerment. The sector has the highest economic and employment multipliers, primarily due to its various linkages with other sectors.

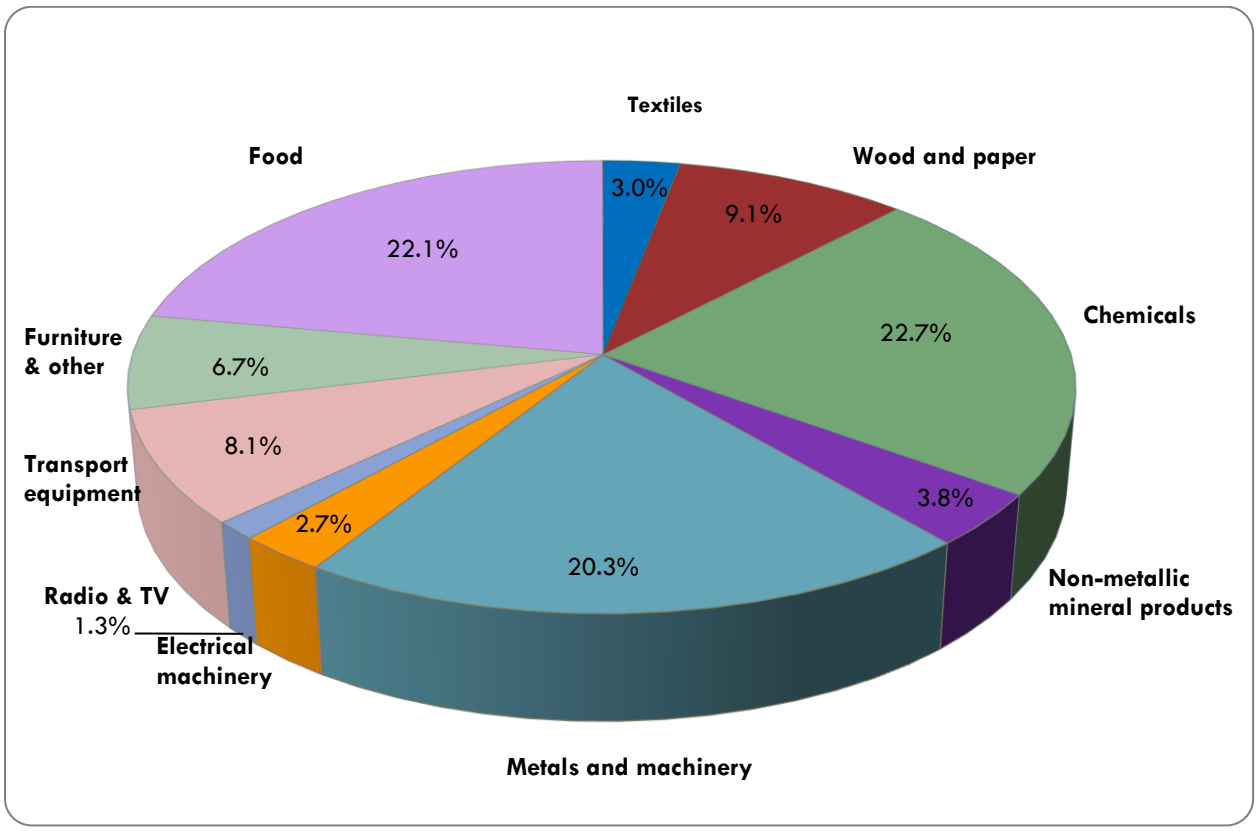
In South Africa, growth in the manufacturing sector has been slower than growth in the overall economy over the period 1994 to 2012. Over this time, the structure of the economy has changed as other sectors (e.g. services and mining) achieved higher rates of growth (IDC, 2013). As a result the contribution of the manufacturing sector declined from about 19.3% of GDP in l994 to 11.8% in 2012 (Figure 3.3).

Figure 3.3 Manufacturing value add as a percentage of Gross Domestic Product (GDP), 1990-2014



Source: SARB

Figure 3.4 Sub-sectoral contribution to manufacturing GDP in 2012



Source: SARB

Amongst the manufacturing sub-sectors, there is variation in terms of how they contribute to the shifting composition of economic activity in South Africa (Figure 3.4). Chemicals, metals and machinery, transport equipment and electrical machinery are some of the sub-sectors that have experienced stronger growth than others over the past two decades, while subsectors like textiles and clothing experienced a decline.

The declining contribution of manufacturing to the economy has been observed in many countries, with the exception of some developing countries, e.g. China, India, South Korea, Mexico and Brazil, that have benefited immensely from manufacturing jobs in the recent past (WEF, 2012).
During the period under review (2010 - 2012), the South African manufacturing sector was still experiencing the effects of the global economic crisis. Indicators of manufacturing production volumes have shown some improvements but have remained low.

Innovation is critical to increase productivity and ensure growth of manufacturing activity. In an economy like South Africa's, innovation can help accelerate the transformation of the economy, by enabling further diversification and continuing the transition from a resource exporting economy to an industrialised, value adding, and knowledge-based one. Innovation becomes even more crucial considering the increasing openness of the local manufacturing sector to global trends. Manufactured goods made up 51.6% of South Africa's total merchandise exports in 2012, having increased from 41.2% in 1994. New arrangements for manufacturing in the global system are gaining prominence, revealing new sources of competitive advantages (Mckinsey and Company, November 2012: 45). The increasing phenomenon of global value chains demands that enterprises respond appropriately, sometimes by leading the trend (Gereffi and Fernandez-Stark, 2011).

It is critically important that South African manufacturing remain in touch with these new frontiers, energetically leveraging its potential to drive up productivity, competitiveness and employment creation. Equally, the government and the business sector need to recognise these dynamics. Various innovation activities mentioned by enterprises during the interviews show that the business sector embraces these trends. New approaches that are being promoted through policies such as the Industrial Policy Action Plan (IPAP), the Ten Year Innovation Plan (TYIP 2008-2018) and others are meant to assist the local manufacturing sector in building new capabilities required in this changing environment. The support for local manufacturing as a whole should also seek to create and strengthen dynamic linkages between production and services, as well as the primary sectors of the economy.

CHAPTER 4: RESULTS

4.1 Introduction

This section shows the results of the analyses of the trends in innovation performance in the Manufacturing sector. The focus will be on identifying some of the main innovation indicators such as:

- Product (goods or services), process, organisational and marketing innovation
- Innovation expenditure and financial support
- Sources of information for innovation activities and cooperation for innovation
- Effects of innovation
- Barriers and Constraints of Innovation
- Use of intellectual property rights
- Environmental benefits of innovation.

The survey distinguishes between technological and non-technological innovations. This report represents the activities of a total of 328 manufacturing enterprises, of which 68.0% reported undertaking technological innovation activities (Table 4.1).The majority (73.8%) of all enterprises introduced product, process, organisational or marketing innovations. Of all the innovation-active enterprises, 61.3% had successful technological innovations, meaning that they completed and implemented product and/or process innovations during the three years covered by the survey. The proportions of innovation-active enterprises that implemented product and process innovations were 75.8% and 72.6%, respectively. The large manufacturing enterprises reported the most innovation activity (78.5% of enterprises) and 70.7% of these enterprises reported successful innovations. Of all the manufacturing enterprises that responded, 6.7% indicated that they had 'only ongoing or abandoned' innovation activities. The technological innovative enterprises comprised 11.9% with 'product only' innovations; 9.8% with 'process only' innovations; and 39.6% with both product and process innovations. In terms of non-technological innovations, 51.8% of enterprises had organisational innovations and 35.1 % had marketing innovations.

Table 4.1 Innovation rate: percentage innovation for innovative and non-innovative manufacturing enterprises 2010-2012

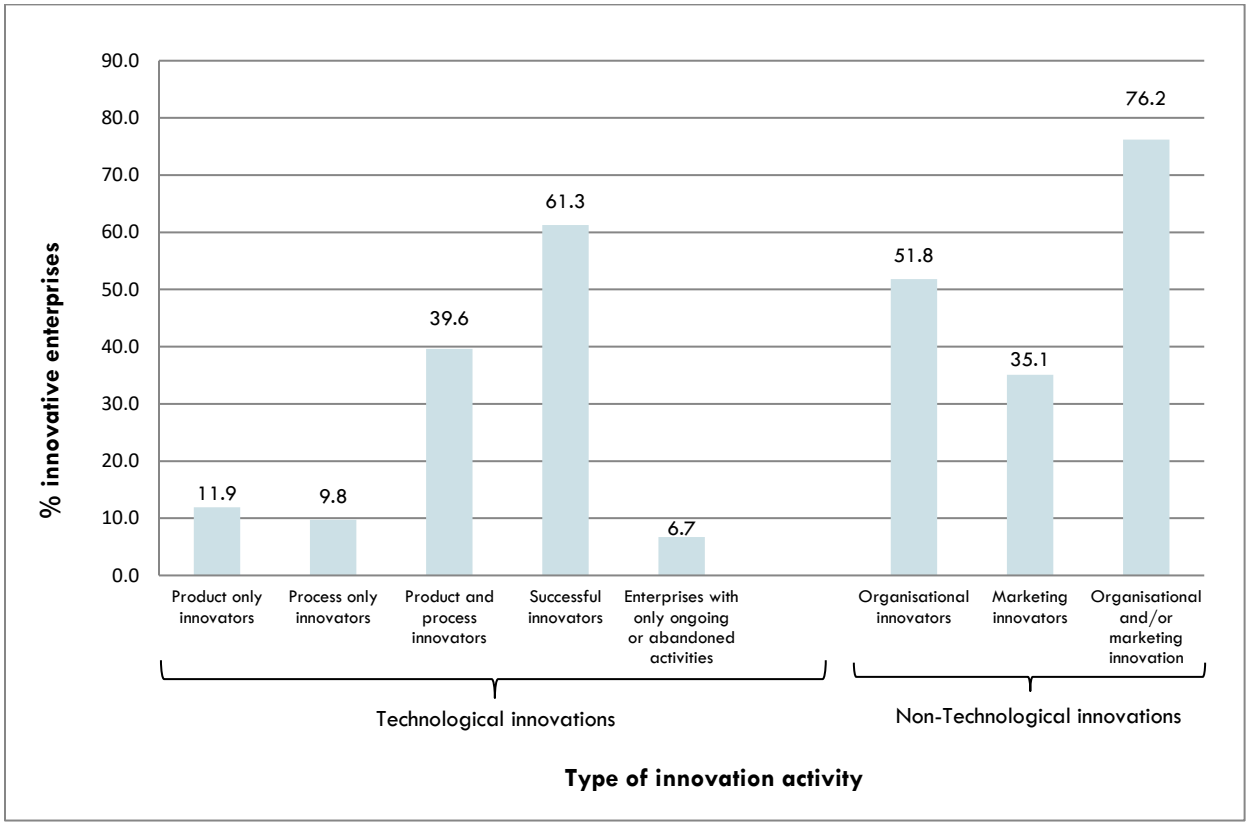
	Manufacturing (%)	Large (%)	Medium (%)	Small (%)	Very Small (%)
Enterprises with innovation activity	***68.0***	**78.5**	**67.7**	**48.0**	**36.2**
Enterprises with successful innovation	***61.3***	**70.7**	**63.1**	**44.0**	**29.8**
Product only innovators	11.9	13.1	10.8	12.0	8.5
Process only innovators	9.8	12.6	6.2	12.0	2.1
Product and process innovators	39.6	45.0	46.2	20.0	19.1
Enterprises with abandoned and/or ongoing innovation	***6.7***	**7.9**	**4.6**	**4.0**	**6.4**
Product innovation activities only	0.9	1.0	1.5	0.0	0.0
Process innovation activities only	*5.5*	6.3	3.1	4.0	6.4
Product and process innovation activities only	0.3	0.5	0.0	0.0	0.0
Enterprises without innovation activity	***32.0***	**21.5**	**32.3**	**52.0**	**63.8**

Source: Appendix 4 Tables A1.1 and A1.2
*Numbers do not always add up because of rounding effects

4.2 Types of technological innovation

As innovation is a key driver of economic growth, information about four types of innovation activities namely product, process, organisational and marketing innovation was collected. Innovation activities include the development, introduction or implementation of new or significantly improved goods, services or processes. During the reference period 2010-2012, the rate of innovation in the manufacturing sector for different types varies as shown in Figure 4.1. Most enterprises in the manufacturing sector had both product and process innovations (39.6%), whilst only 6.7% of enterprises had only ongoing or abandoned activities. Organisational innovations were found in 51.8 % of enterprises and 35.1% of enterprises were also marketing innovators. The total percentage of successful innovators reported in this sector was 61.3%, and includes all technological innovations.

Figure 4.1Manufacturing innovation rate by type of innovation, 2010-2012



Sources: Appendix 4 Table A1.1 and A20

4.2.1 Product (goods or services) innovation in the manufacturing sector

A total of 62 of the innovative manufacturing enterprises that responded had introduced product innovations that were new to the market and new to the firm, and 56 innovative manufacturing enterprises had introduced product innovations that were new to the firm and 39 were new to the market. Small, very small and large enterprises mostly introduced both new-to-the-market and firm product innovations (71.4%, 58.3% and 37.7% respectively). The medium-sized enterprises mostly introduced product innovations that were new to the firm (43.8%)(Table 4.2).

Table 4.2 Product (goods and services) innovators: number of manufacturing enterprises by product type, 2012 (year-specific question)

Size class	Total (%)	Large (%)	Medium (%)	Small (%)	Very small (%)
All product innovators	***100***	***100.0***	***100.0***	***100.0***	***100.0***
Product innovations new to the market	**24.8**	27.4	25.0	0.0	16.7
Product innovations new to the firm	**35.7**	34.9	43.8	28.6	25.0
Product innovations new to the market and new to the firm	**39.5**	37.7	31.3	71.4	58.3

Source: Appendix 4 Table A5.3 and A5.4

Enterprises that had product innovations (comprising innovation in either goods or services produced) generated 9.7% of their total turnover from innovations that were new to the market (Table 4.3). Turnover of 11.8% was generated by the sale of products that were new to the enterprise concerned but not new to the market. Overall, a higher percentage of enterprises (78.5%) reported unchanged or marginally modified product innovations.

Table 4.3 All product innovators: proportion of turnover attributed to types of product innovation, by size of enterprises, 2012 (year-specific question)

Type of product innovation	Turnover generated (R million)	Percentage turnover generated %
Product innovations new to the market	44 975	9.7
Product innovations new to the firm	54 914	11.8
Products unchanged or only marginally modified	364 240	78.5
Total (All product innovators)	**464 128**	***100***

Source: Appendix 4 Table A5.1 and A5.2

Table 4.4 shows that very small and small enterprises generated the highest percentage of turnover based on product innovations that were new to the market (25.2%and 19.1% respectively), and product innovations that were new to the firm were also highest in small enterprises (25.0%) and very small enterprises (18.6%). Overall, large enterprises generated the highest turnover from product innovations (66.1%).

Table 4.4 Product (goods and services) innovators: percentage breakdown of turnover by product type, 2012

Size class	Total (%)	Large (%)	Medium (%)	Small (%)	Very small (%)
Type of product innovation					
Product innovations new to the market	9.7	14.5	0.3	19.1	25.2
Product innovations new to the firm	11.8	15.2	5.2	25.0	18.6
Products unchanged or only marginally modified	78.5	70.3	94.6	55.9	56.2
Total (% of turnover produced by product innovators by enterprise size class)	***100.0**	**66.1**	**33.9**	**0.0**	**0.0**

Source: Appendix 4 Table A5.2
*Numbers do not always total because of rounding effects

Table 4.5 shows that product innovations by innovative enterprises were developed mainly by own enterprise (58.0%), followed by own enterprise in collaboration with other enterprises or institutions (16.0%). About 14.0% of innovative enterprises reported that they had adapted and modified goods or services by other institutions, while 8.9% of innovators relied on other enterprises or institutions to develop their innovations for them. At least 67.5% of product innovations originated in South Africa as shown in Table 4.6 indicating that South African enterprises are very capable of producing their own products. A total of 30.8% of product innovators stated that their innovations originated abroad. This shows that enterprises in the manufacturing sector are capable of introducing their own product innovations.

Table 4.5 Responsibility for the development of product innovations in innovative enterprises, 2010-2012

Product innovations developed mainly by:	Number of enterprises	Percentage of enterprises (%)
Mainly own enterprise	98	58.0
Own enterprise in collaboration with other enterprises or institutions	27	16.0
Adapting and modifying goods or services developed by other institutions	24	14.2
Other enterprises or institution	15	8.9
Non-responsive enterprises	5	3.0
Total	169	100.0

Source: Appendix 4 Table A6

Table 4.6 Origin of product innovation, 2010-2012

Origin	*Number*	%
All product innovative enterprises (number of enterprises)	***169***	***100.0***
South Africa	114	67.5
Abroad	52	30.8
Non-responsive enterprises	3	1.8

Source: Appendix 4 Table A7

4.2.2 Process innovation

New or significantly improved methods of manufacturing or production were reported by 52.0% of process innovators (Table 4.7). This was followed by new or significantly improved supporting activities for processes (43.0%). Only 27.4% of process innovators spent time improving their delivery and distribution methods.

Table 4.7 Enterprises involved in specific process innovations, 2010-2012

Process innovation	Number of enterprises	%
New or significantly improved methods of manufacturing or producing goods or services	***116***	52.0
New or significantly improved logistics, delivery or distribution methods for inputs, goods or services	***61***	27.4
New or significantly improved supporting activities for processes such as maintenance and operating systems for purchasing, accounting or computing	***96***	43.0

Source: Appendix 4 Table A23

Process innovations were mostly developed in-house: 50.0% of enterprises reported that innovations were mainly developed by their own enterprise, while 27.2% of enterprises developed process innovations in collaboration with other enterprises or institutions (Table 4.8). Only 13.6% of enterprises relied mainly on other enterprises or institutions for the development of process innovations.

The majority of process innovations (62.3%) were developed within South Africa (Table 4.9) while 35.80% of process innovations originated mainly from abroad. This indicates that South African manufacturing sector enterprises appear to be quite capable of developing their own new processes.

Table 4.8 Responsibility for the development of process innovation in innovative enterprises, 2010-2012

Process innovators	Number of enterprises	%
Mainly own enterprise	81	50.0
Own enterprise in collaboration with other enterprises or institutions	44	27.2
Adapting or modifying process developed by other enterprises or institutions	13	8.0
Mainly other enterprises or institutions	22	13.6
Non-responsive enterprises	2	1.2
Total	***162***	***100***

Sources: Appendix 4 Table A24

Table 4.9 Origin of process innovation, 2010-2012

Process Innovators	Number of enterprises	%
South Africa	*101*	62.3
Abroad	*58*	35.8
Non-responsive enterprises	*3*	1.9
Total	***162***	**100.0**

Sources: Appendix 4 Table A25

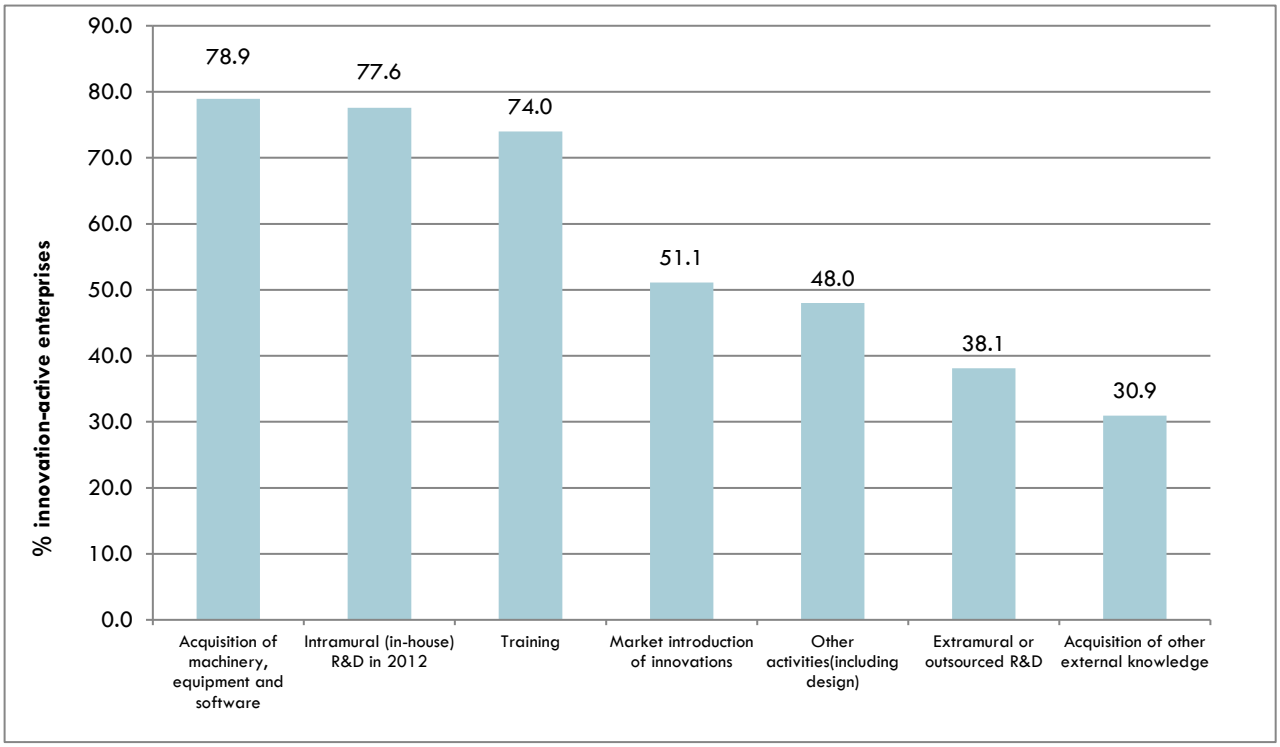
4.3 Innovation expenditures and financial support for innovation activities

4.3.1 Innovation expenditures

Innovation may be related to any scientific, technical, organisational, financial or commercial activities, including investment in new knowledge that leads to, or is intended to lead to, the implementation of innovations. The activities measured by the survey include, among others, the acquisition of machinery, equipment and software, training, in-house and outsourced expenditure, and the acquisition of other external knowledge.

Figure 4.3 shows that most innovation-active enterprises were involved in the acquisition of machinery, equipment or software (78.9%). The second most important innovation activity was intramural R&D, (77.6%). and 74.0% of all innovation-active enterprises spent money on training as part of the innovation activity. "Market introduction of innovation" which includes activities such as market research was reported by 51.1% of innovation-active enterprises. About 48.0% of innovation-active enterprises reported "other activities".

Figure 4.2 Types of innovation activities amongst enterprises, 2010-2012



Source: Appendix 4 Table A4.2

Expenditure by manufacturing enterprises on the acquisition of new machinery, equipment and software accounted for 71.0% of total expenditure on all innovation activities (Table 4.10). Almost 20% of total expenditure was devoted to intramural R&D and 6.6% to outsourced R&D. Only 2.5% accounted for acquisition of other external knowledge. Table 4.10 clearly shows that the large innovation-active manufacturing enterprises were responsible for the bulk (R3 184 million or 97.0%) of innovation expenditure in the manufacturing sector.

Table 4.10 Enterprises that declared innovation expenditure for manufacturing sector, 2012 (year-specific question)

Type of innovation expenditure	*Total R millions*	% of total expenditure of all enterprises	Large *R millions*	Medium *R millions*	Small *R millions*	Very small *R millions*
Intramural (in-house) R&D	656	19.9	620	32	3	1
Extramural or outsourced R&D	215	6.6	206	9	0	0
Acquisition of machinery, equipment and software	2 333	71.0	2 276	35	20	1
Acquisition of other external knowledge	83	2.5	82	1	0	0
Total	**3287**	***100.0***	**3 184**	**77**	**23**	**3**

Sources: Appendix 4 Table A4.1

4.3.2 Innovation and R&D

Comparing the number of innovating enterprises with innovation activity and those with successful innovations to the number that did R&D is an important and essential undertaking when developing innovation policy. The results of this analysis for the manufacturing sector are summarised in Table 4.11. The results show that more enterprises innovated (90.1%) rather than perform R&D (77.6%), which is an indication that, apart from using R&D, enterprises used other methods to implement their innovations.

Table 4.11 Enterprises with technological innovation activity that performed R&D, 2012

	Number of enterprises	*%*
Enterprises with successful innovations	201	90.1
Enterprises that engaged in intramural R&D	173	77.6
Enterprises with successful innovations and engaged in intramural R&D	158	70.9

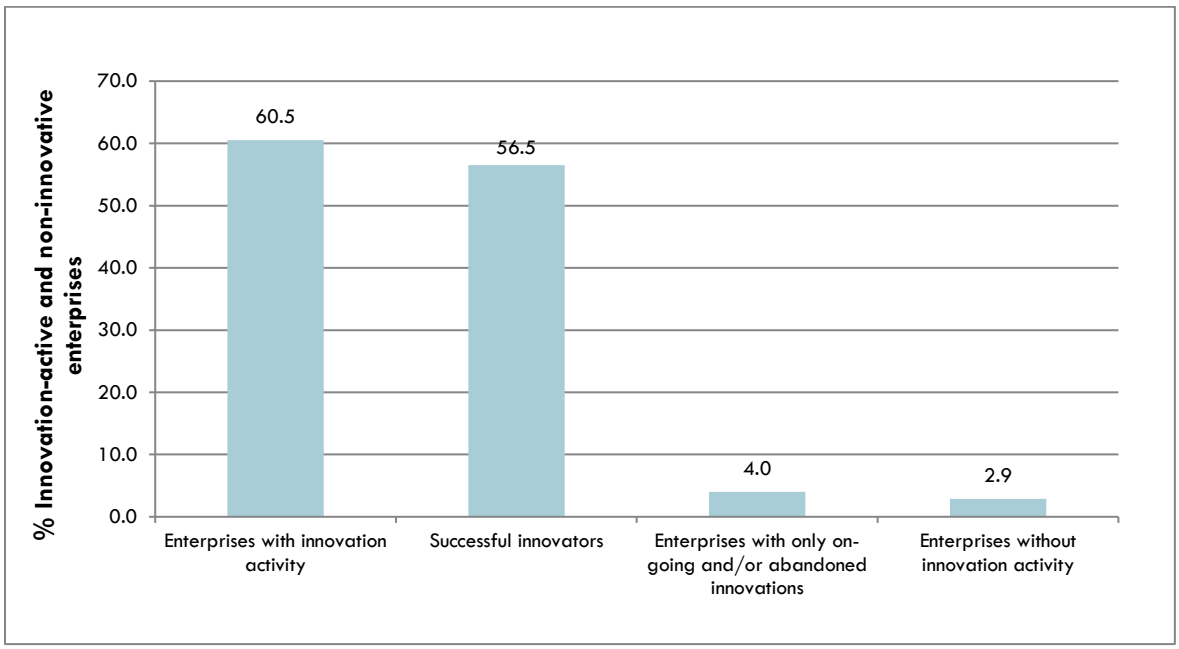
Sources: Appendix 4 Table A4.3

4.3.3 Financial support for innovation activities

Adequate funding is a prerequisite for innovation activities and enterprises should make use of the funding sources made available for them. In South Africa funding is available for innovation activities from national government, national funding agencies as well as foreign government/public sources.

Figure 4.3 indicates that at least 60.5% of enterprises with innovation activities were aware of government funding opportunities. Of the successful innovators, 56.5% were aware of government funding whilst only 2.9% of non-innovators were aware that government gives financial support for innovation activities.

Figure 4.3 Enterprises' awareness of government funding, 2010-2012



Source: Appendix 4 Table A10.1

The dti supported 19.3% of enterprises financially whilst the DST aided about 5% of enterprises (Table 4.12). National funding agencies such as the Industrial Development Cooperation (IDC) gave funding to 7.2% of enterprises and only 0.9% of enterprises received financial assistance from foreign government/public sources.

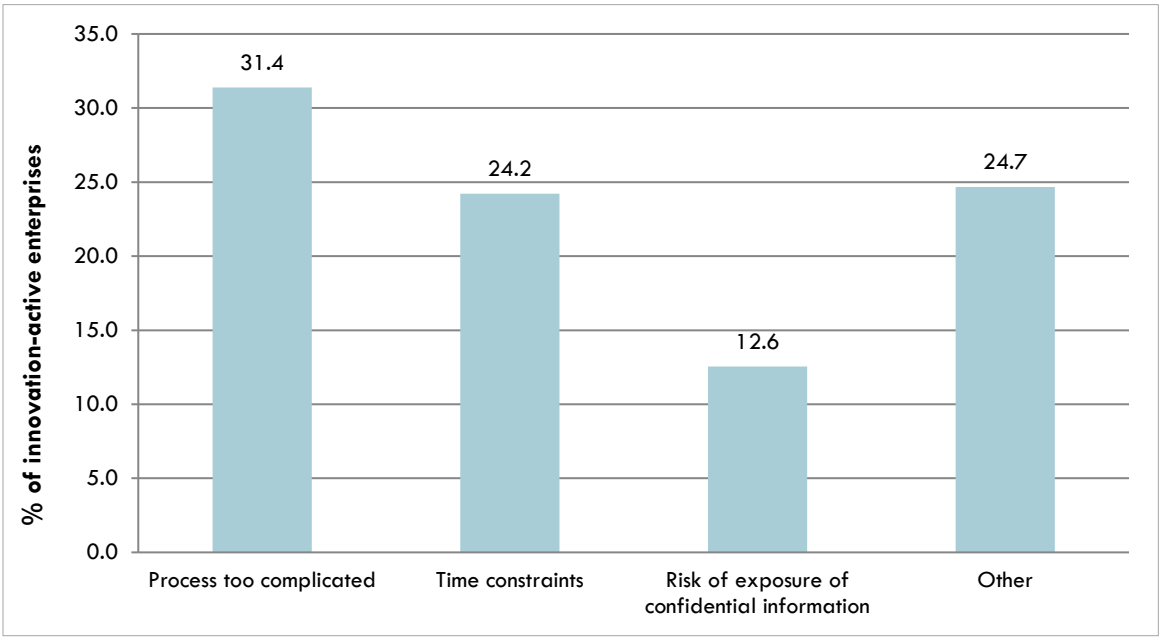
Table 4.12 Number and percentage of innovation-active manufacturing enterprises that received financial support for innovation activities from government sources, 2010-2012

Source of financial support	Number of enterprises	Percentage of enterprises (%)
National government:		
Department of Science and Technology (DST)	11	4.9
Department of Trade and Industry (the *dti*)	43	19.3
Other	5	2.2
National funding agencies:		
National Research Foundation (NRF)	1	0.4
Medical Research Council (MRC)	0	0.0
Industrial Development Cooperation (IDC)	16	7.2
Technology Innovation Agency (TIA)	2	0.9
Other	0	0.0
Foreign government/public sources	2	0.9

Source: Appendix 4 Table A18

Figure 4.4 gives an indication of the reasons why innovation-active enterprises did not access government funds. The process is too complicated said 31.4% enterprises and 24.2% indicated that there were time constraints on the process of applying for financial support from government. The risk of exposing confidential information was a concern for 12.6% of enterprises.

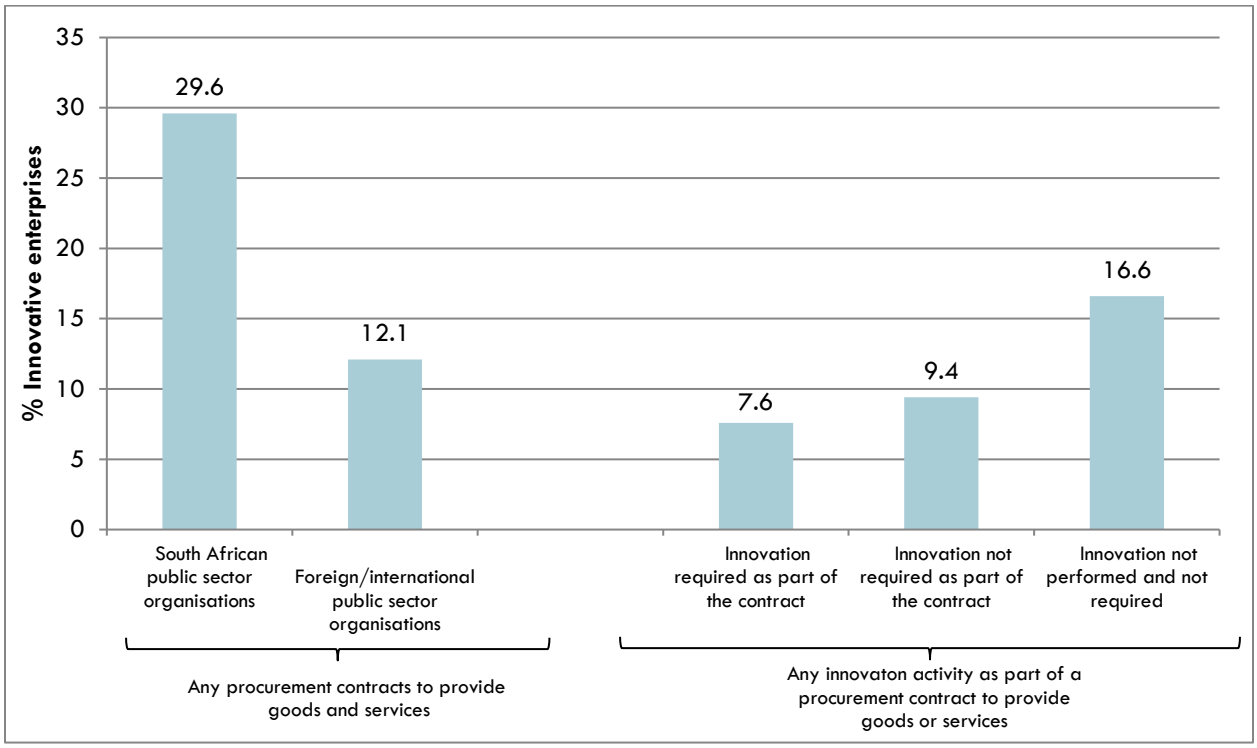
Figure 4.4 Reasons why innovation-active enterprises did not access government funds 2010-2012



Source: Appendix 4 Table A10.3

A total of 29.6% of innovation-active enterprises had procurement contracts from South African public sector organisations to provide goods and service and 12.1% had contracts from foreign/international public sector organisations (Figure 4.5). For 7.6% of innovation-active enterprises innovation was required as part of the contract whilst for 9.4% innovation was not a requirement. For 16.6% of innovation-active enterprises, innovation was not a requirement and was not performed.

Figure 4.5 Innovation-active enterprises that had public sector procurement contracts to provide goods and services, 2010-2012

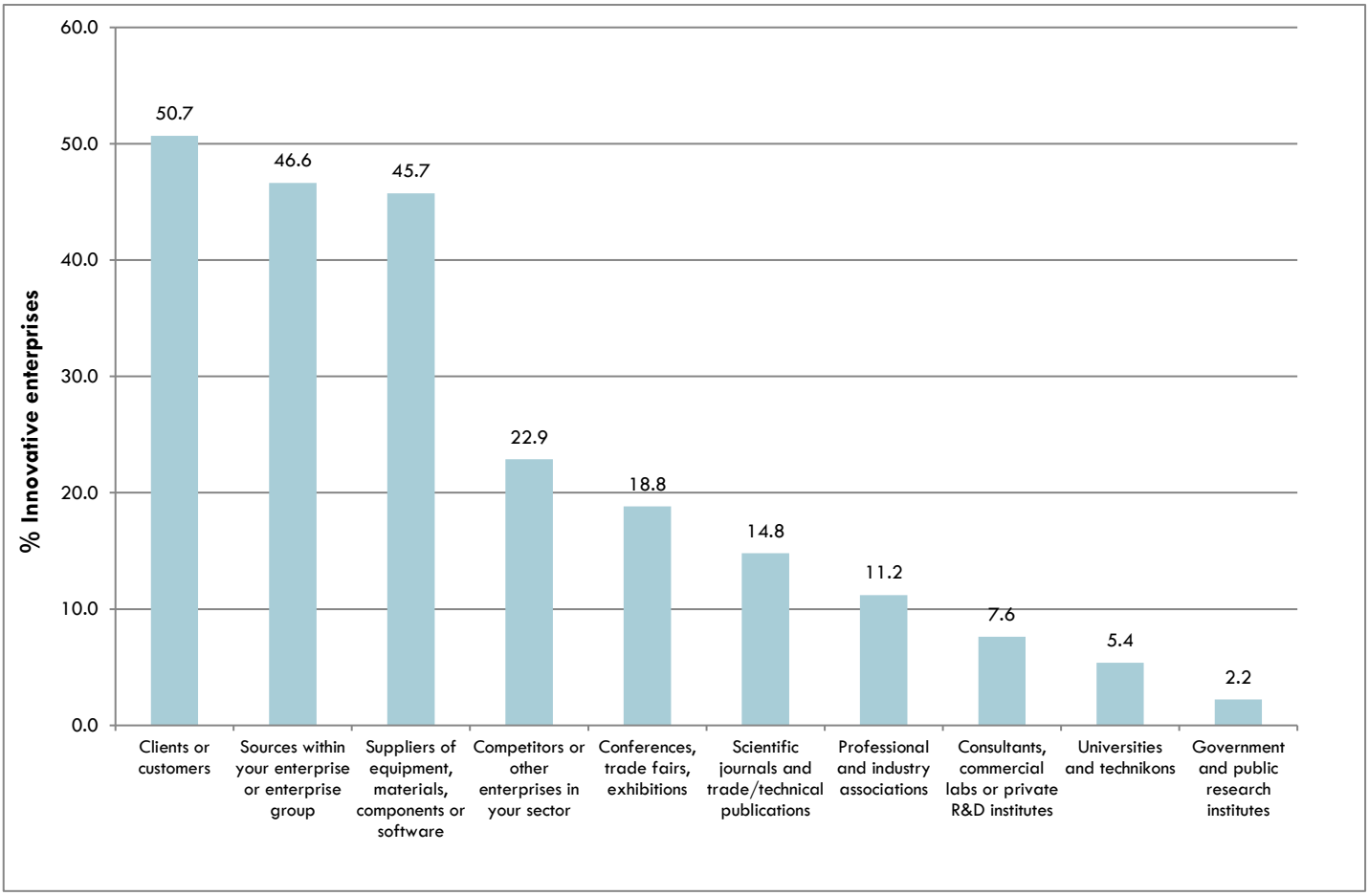


Source: Appendix 4 Table A10.4

4.4 Sources of information and co-operation partners for innovation activities

Of the innovation-active enterprises surveyed 50.7% rated sources of information with clients or customers as 'highly important' for innovation activities (Figure 4.6). This was followed by sources within the enterprise group (46.6%) and then suppliers (45.7%). Competitors were rated as important sources of information by 22.9% of enterprises. Universities and technikons (5.4%) and government institutes (2.2%) were considered the least important sources of information.

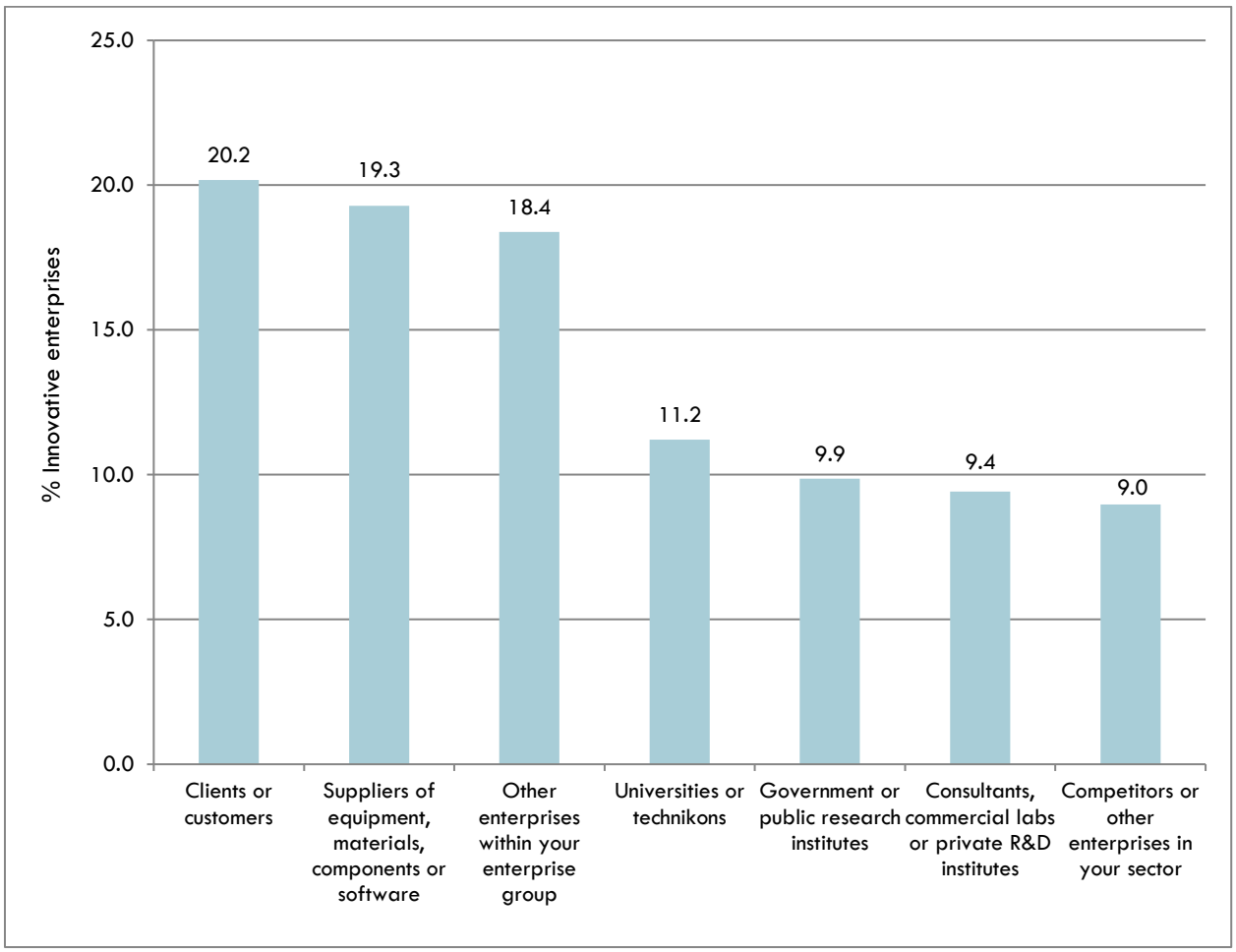
Figure 4.6 Sources of information for innovation rated as "highly important" by innovation-active enterprises



Sources: Appendix 4 Table A11.1 and A11.2

Manufacturing enterprises are well attuned to both the demand and supply aspects of the market. Figure 4.7 shows that the most important collaborative partnerships for innovation activities were between enterprises and their clients or customers, which comprised 20.2% of collaborative partnerships. Collaboration efforts between enterprises and their suppliers were at 19.3%. Manufacturing enterprises collaborated with at least 18% of enterprises within their own group and 11.2% of innovation-active enterprises collaborated with universities and technikons and 9.9% of enterprises with innovation activity collaborated with government institutes.

Figure 4.7 Innovation-active collaborative partnerships by type of partner, 2010-2012



Sources: Appendix 4 Table A21.1

4.5 Effects of innovation

Innovation-active enterprises in the manufacturing sector were required to rank the importance of various market and operational outcomes resulting from both product and process innovations. 'Improving quality of goods or services' as well as 'increasing the range of goods and services' were ranked as 'highly important' by 37.7% and 35.9% of innovation-active enterprises respectively (Table 4.13). 'Increased capacity of production or service provision' was mentioned as having a highly important effect on innovation by about 30.5% of innovation-active enterprises, and about 26.0% enterprises reported that 'improved flexibility of production or service provision' was highly important. 'Entering new markets or increasing market share' was mentioned as a highly important outcome by only 29.1% of innovation-active enterprises. Other highly important effects of innovation mentioned were 'meeting government regulatory requirements' (mentioned by 25.6% of innovators) and 'reduced environmental impacts or improved health and safety' (25.1%).

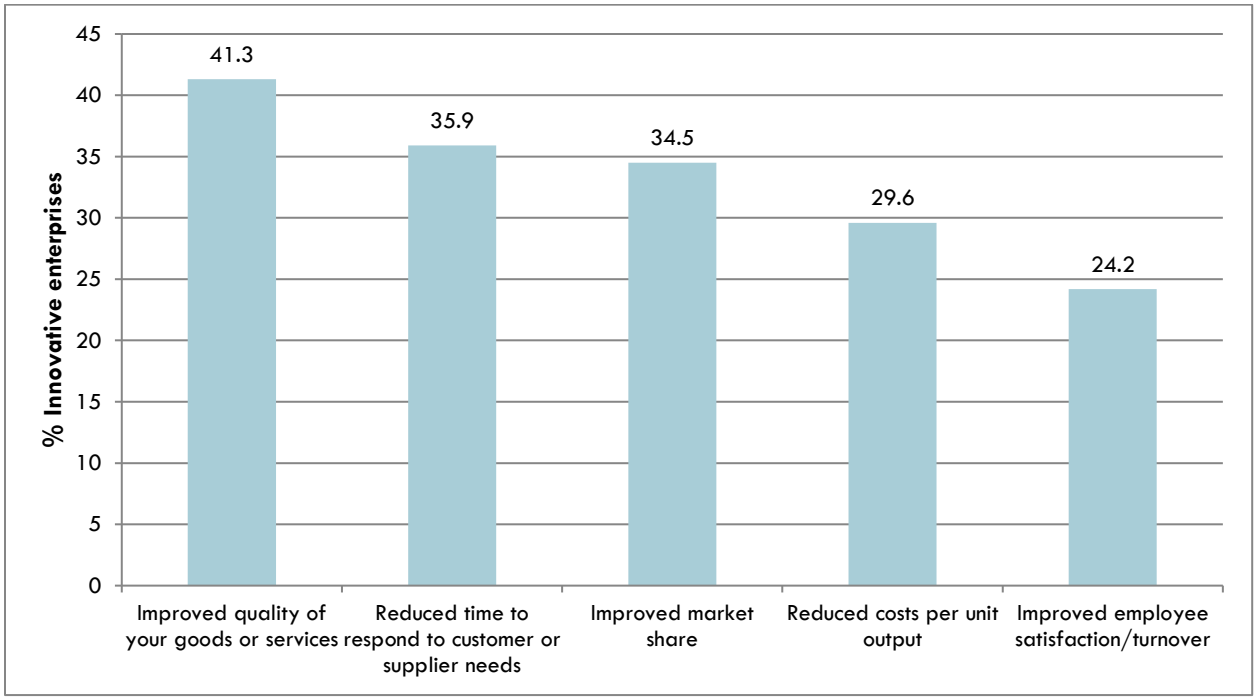
Table 4.13 "Highly important" effects of innovation on outcomes for innovation-active enterprises, 2010-2012

Effects of innovation	Number of enterprises	%
Product outcomes		
Increased range of goods and services	80	35.9
Entered new markets or increased market share	65	29.1
Improved quality of goods or services	84	37.7
Process outcomes		
Improved flexibility of production or service provision	58	26.0
Increased capacity of production or service provision	68	30.5
Reduced labour costs per unit output	36	16.1
Reduced materials and energy per unit output	31	13.9
Other outcomes		
Reduced environmental impacts or improved health and safety	56	25.1
Met governmental regulatory requirements	57	25.6

Source: Appendix 4 Table A8.1 and A8.2

Figure 4.8 shows that innovation-active enterprises that introduced organisational innovations reported 'improved quality of goods and services' as 'highly important (41.3%). This was followed by 'reduced time to respond to customer or supplier needs' (35.9%) and 'improved market share', which 34.5% of enterprises rated as highly important.

Figure 4.8 Innovation-active enterprises that introduced organisational innovation and rated various results as highly important, 2010-2012



Sources: Appendix 4 Table A17

4.6 Factors hampering innovation

Table 4.14 provides more detail on the factors hampering innovation activities in innovation-active and non-innovative enterprises in the manufacturing sector. Both innovation-active and non-innovative enterprises appeared to be most hampered in their innovation activities by a lack of funds in their enterprise or group (23.8% and 15.2% respectively). The lack of funding from sources outside as well as the lack of qualified personnel also presented a barrier to innovation activities of innovation-active enterprises (24.7% and 22.9% respectively). Innovation-active enterprises also reported that the market was dominated by established enterprises which impacted on innovation performance for almost 20.0% of the innovators that responded. Non- innovators also reported that innovation costs were too high (14.3%) and that there was no need to innovate because there was no demand for innovations (13.3%).

Table 4.14 Highly important factors that hampered innovation activities of innovation-active and non-innovative manufacturing enterprises, 2010-2012

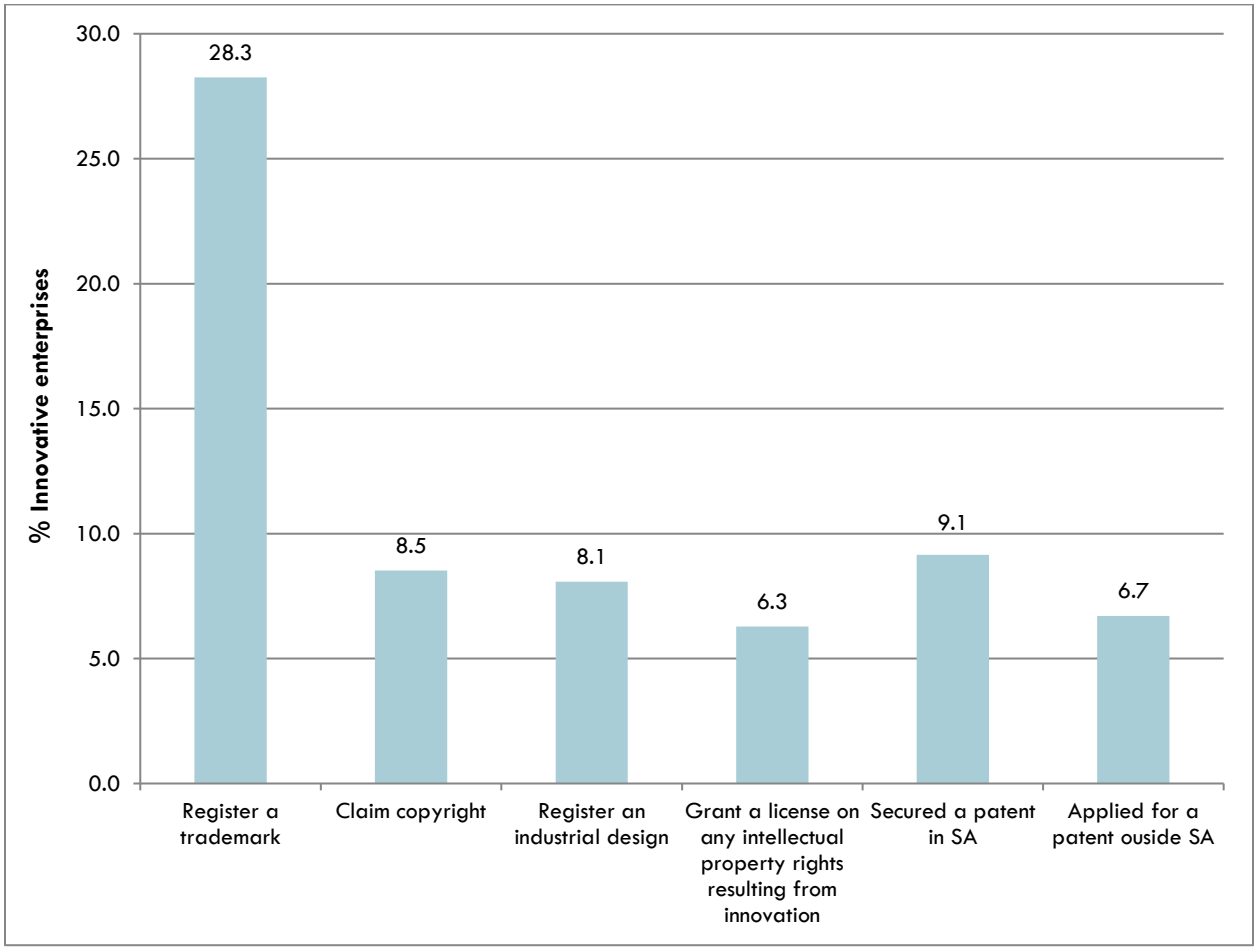
Percentage of enterprises (%)		
	Innovation-active	Non-Innovation active
Cost factors		
Lack of funds within your enterprise or group	23.8	15.2
Lack of finance from sources outside your enterprise	24.7	11.4
Innovation costs too high	18.8	14.3
Knowledge factors		
Lack of qualified personnel	22.9	8.6
Lack of information on technology	9.0	1.9
Lack of information of markets	9.4	1.9
Difficulty in finding co-operation partners	11.7	2.9
Market factors		
Market dominated by established enterprises	19.3	11.4
Uncertain demand for innovative goods or services	13.9	10.5
Reasons not to innovate		
No need due to prior innovations	2.7	8.6
No need because of no demand for innovations	5.4	13.3

Sources: Appendix 4 Table A1.1, A12.1, A 12.2, A12.3 and A12.4

4.7 Intellectual property rights

In the manufacturing sector, about 28.3% of innovation-active enterprises registered a trademark between 2010 and 2012, while 8.5% of innovators claimed a copyright. Approximately 8% of innovators registered an industrial design and 6.3% granted a license on intellectual property rights resulting from their innovation activities to third parties (Figure 4.9). A total of 9.1% of innovation-active enterprises secured a patent in South Africa, while 6.7% applied for a patent outside South Africa.

Figure 4.9 Innovation-active manufacturing enterprises that made use of intellectual property rights (IPR), 2010-2012



Sources: Appendix 4 Table A14 and A15

4.8 Innovation with environmental benefits

Environmental innovation is a new or significant improved product (good or service), process, organisational methods or marketing methods that creates environmental benefit compared to other alternatives. Environmental innovations can be defined as innovations that consist of new or modified processes, practices, systems and products which benefit the environment and contribute to environmental sustainability (Rennings, 2000).

Innovation-active enterprises in the manufacturing sector were required to indicate whether their innovation activities created environmental benefits. A total number of 242 manufacturing enterprises reported that they had introduced product, process, organisational and marketing innovation with environmental benefits. About 42.1% of enterprises reported reducing energy use per unit output and 34.7% reported reducing material use per unit output as creating benefit from their technological or non-technological innovations (Table 4.15). Reducing the carbon footprint was reported by 35.5% of enterprises. Manufacturing enterprises were also asked to report on their environmental benefits from the after sales use of a good or service by the end user. About 31.0% of enterprises reported reduced energy usage, 28.9% reported improved recycling of product after use and 22.3% reported reduced air, water, soil and noise pollution.

Table 4.15 Introduction of innovations with environmental benefits, 2010-2012

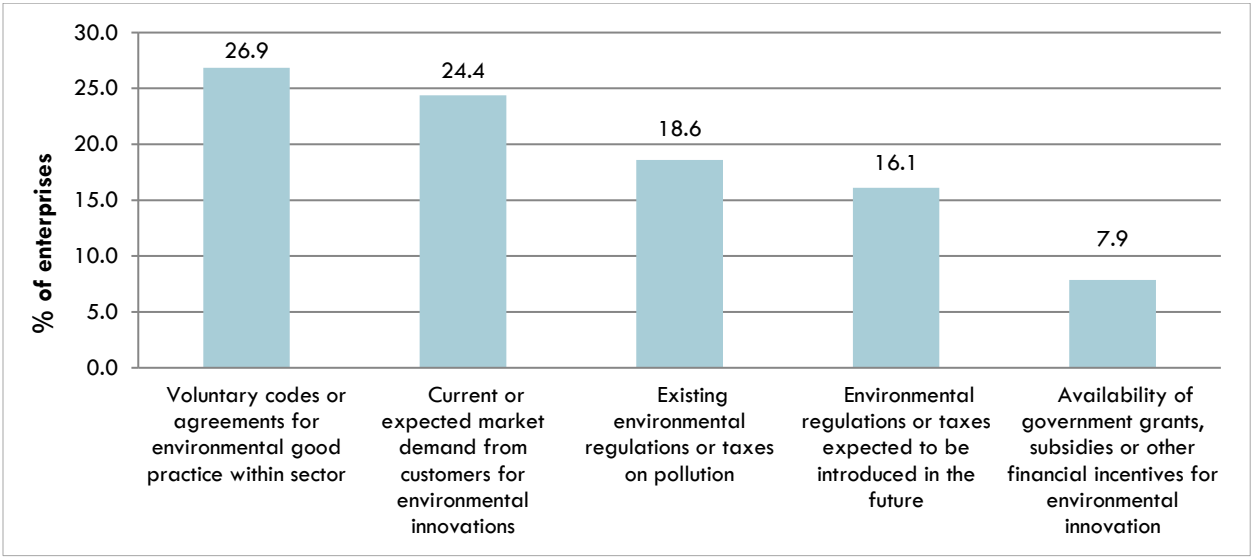
Environmental benefit	Number of enterprises	Percentage of enterprises (%)
Enterprises that introduced product, process, organisational or marketing innovation	242	100.0
Enterprises that had environmental benefits from the production of goods or services:		
Reduced material use per unit output	84	34.7
Reduced energy use per unit output	102	42.1
Reduced carbon dioxide 'footprint' (total carbon dioxide production) by the enterprise	86	35.5
Replaced materials with less polluting or hazardous substitutes	74	30.6
Reduced soil, water, noise, or air pollution	79	32.6
Recycled waste, water or materials	102	42.1
Enterprises that had environmental benefits from the after sales of a good or service:		
Reduced energy use	75	31.0
Reduced air, water, soil or noise pollution	54	22.3
Improved recycling of product after use	70	28.9

Source: Appendix 4 Table A29

Figure 4.10 shows that environmental innovations were produced by 26.9% of manufacturing enterprises in response to voluntary codes or agreements for environmental good practice within their sector. Of manufacturing enterprises 24.4% introduced an environmental innovation in response to environmental benefits based on the current or expected demand from their customers for environmental innovations. A total of 18.6% of enterprises responded to existing environmental regulations or taxes on pollution, while 16.1% responded to environmental regulations or taxes expected to be introduced in future. Only 7.9% of manufacturing enterprises responded with the introduction of and environmental innovation because of availability of government grants, subsidies or other financial incentives for environmental innovations.

More than half (55.0%) of the innovation-active manufacturing enterprises included in this analysis also responded positively to having procedures in place to regularly identify and reduce the enterprise's environmental impacts e.g. environmental audits, setting environmental performance goals, etc. (Table 4.16).

Figure 4.10 Enterprises that introduced environmental innovation in response to environmental benefits from the production of goods or services, 2010-2012



Source: Appendix 4 Table A30

Table 4.16 Procedures to identify and reduce environmental impacts

	Total	Large	Medium	Small	Very small
Number of innovation-active manufacturing enterprises that had procedures in place to regularly identify and reduce their environmental impact	**133**	106	18	7	2
Percentage of innovation-active manufacturing enterprises (%) Enterprises that had procedures in place to regularly identify and reduce their environmental impact	**55.0**	67.9	33.3	58.3	10.0

Source: Appendix 4 Table A31

4.9 Non-technological innovation

4.9.1 Organisational and marketing innovation

Table 4.17 shows that 51.8% of innovation-active enterprises had organisational innovations whilst 35.1% had marketing innovations. A total of 76.2 % of innovation-active enterprises reported that they also had organisational and/or marketing innovations. About 11% of 'product only' innovators had organisational and/or marketing innovations and 9.4% of 'process only' innovators had organisational and/marketing innovations. A total of 48.9% of product and process innovative enterprises also had organisational and/or marketing innovations.

Almost 10% of enterprises with non-technological innovation reported 'organisational only' innovations and 3.8% reported 'marketing only' innovations. Organisational **or** marketing innovations were reported by 24.8% non-technological innovators and organisational **and** marketing by 11.4% innovators.

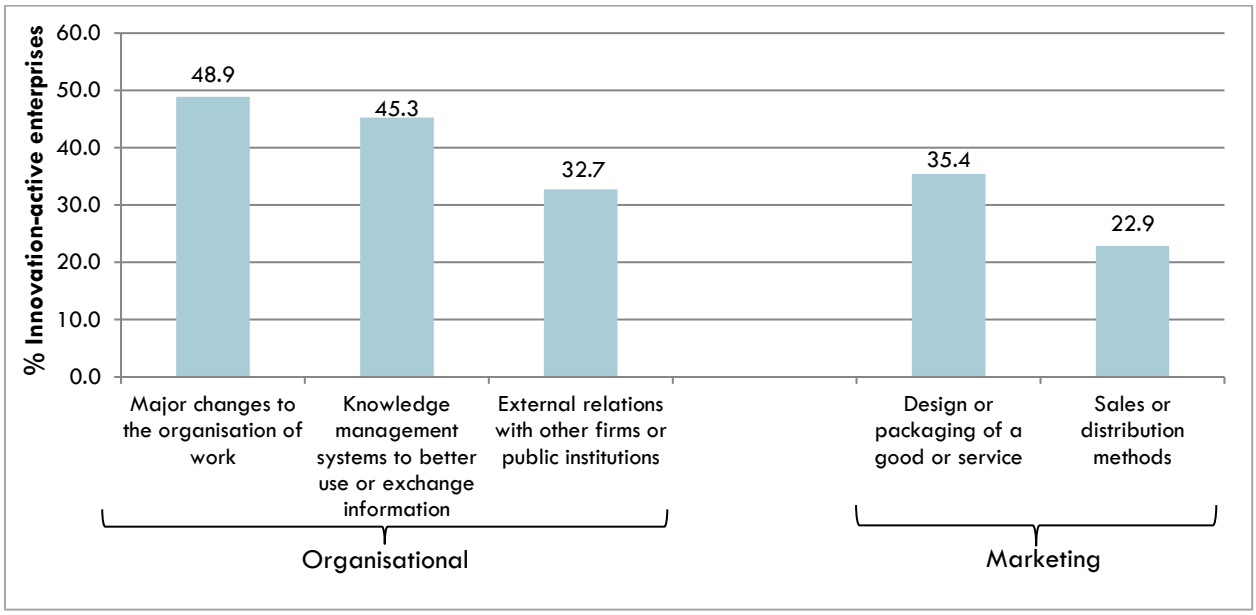
Table 4.17 Enterprises with organisational and/or marketing innovations, 2010-2012

Innovation type	Number of enterprises	%
Enterprises with organisational innovation	*170*	51.8
Enterprises with marketing innovation	*115*	35.1
Innovation-active enterprises with organisational and/or marketing innovation	***170***	**76.2**
Product Only Innovative enterprises with organisational and/or marketing innovation	*25*	11.2
Process Only Innovative enterprises with organisational and/or marketing innovation	*21*	9.4
Product and Process Innovative enterprises with organisational and/or marketing innovation	*109*	48.9
Non-technological innovation active enterprises with:		
Organisational innovation only	*10*	9.5
Marketing innovation only	*4*	3.8
Organisational or marketing innovation	*26*	24.8
Organisational and marketing innovation	*12*	11.4

Source: Appendix 4 Table A20

Figure 4.11 shows that more enterprises reported organisational innovation activities than marketing innovation activities. Around 48.9% of enterprises reported that they made 'major changes to the organisation of work' whilst 45.3% of enterprises reported involvement in creating 'knowledge management systems to better use or exchange information'. The 'design or packaging of goods or services and changes in 'sales distribution methods' were reported by 35.4% and 22.9% of marketing innovators respectively.

Figure 4.11 Percentage of innovation-active enterprises that introduced organisational or marketing innovation, 2010-2012



Sources: Appendix 4 Table A 13.2

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

This report gives a sense of innovation patterns in the South African manufacturing sector. It is meant to provide evidence to enhance understanding of innovation performance in the country, and thus improve policy analysis and implementation.

Innovation is widely recognised as one of the key drivers of sustained economic development and growth. However, even though the concept of R&D measurement is easy to understand, the same cannot be said for innovation, as it is complex, dynamic and non-linear, making its measurement a challenging and continuous learning process.

Although the findings are based on limited responses that were originally targeted for a national innovation survey, the analysis offers useful insight regarding the innovation activities undertaken by enterprises, the modes of innovation and the nature of outcomes achieved as well as factors impacting on their innovation performance. The following conclusions are made:

5.1 Innovation in the South African manufacturing sector is pervasive

An innovation is an implementation by putting on the market a new or significantly improved product (goods or services) or process or a new organisational or marketing method. The majority (73.8%) of all enterprises introduced product, process, organisational or marketing innovations and 68.0% of all enterprises had technological (product and/or process) innovation activity including abandoned and/or ongoing innovation activities) (innovation-active). The proportions of innovation-active enterprises that implemented product and process innovations were 75.8% and 72.6%, respectively. Of all enterprises, 61.3% had successful technological innovations (i.e. did not have only abandoned and/or ongoing innovation activities), while 51.8% had introduced organisational innovations and 35.1% had marketing innovations.

5.2 While some planned innovations proceeded as planned, others did not succeed

A variety of factors, which can be internal to an enterprise or external, impact on the success rate of innovation activities. A total of 6.7% of all enterprises that had innovation activity (with product and/or process innovations) in the manufacturing sector had abandoned and/or ongoing only innovation activities. It should be noted, however, that innovations take considerable time to implement and some may have started towards the end of the reference period.

5.3 Acquiring machinery, equipment and software accounted for the largest share of expenditure on innovation

Acquiring machinery, equipment and software carried the largest proportion (71.0%) of expenditure on innovation activities. The second largest proportion was that of intramural R&D (19.9%), which could be indicative of the commitment to innovation.

5.4 A significant number of manufacturing enterprises undertake R&D to innovate

An important finding for the development of innovation policy is that more enterprises had successful innovations (90.1% of enterprises with innovation activity) than intramural R&D (77.6%) and some had both (70.9%). This could indicate that a significant proportion of manufacturing enterprises had alternative ways of implementing innovations, including through formal R&D.

5.5 Many manufacturing enterprises were aware of government funding for innovation but only a few manage to receive such funding

The proportions of enterprises with innovation activity (60.5%) and those with successful innovations (56.5%) that were aware that the South African government funds innovation activities were much higher than the corresponding proportion of enterprises with no innovation activity (2.9%) and those with abandoned and/or ongoing innovation activities (4.0%). The Government should sharpen its awareness campaign programmes to ensure that the entire business community is well aware of such funding.

Higher proportions of enterprise reported that they had received more government funding for innovations from the dti (19.3%) and the DST (4.9%) than other government departments (2.2%). Mostly the larger manufacturing enterprises received funding from the dti (23.3%). This compares to some extent with the findings of Mario and Sirilli (1997, 1998),who reported that the largest high technology sectors were the major recipients of most public support and funding.

5.6 To some extent, manufacturing enterprises find an incentive to innovate from procurement contracts to provide goods or services for the South African public sector

Although a considerable proportion (12.1% of innovation-active enterprises) of enterprises had procurement contracts to provide goods or services for international public sector organisations, a larger proportion (29.6%) of enterprises had such contracts with South African public sector organisations. Some of these enterprises undertook innovation as part of a procurement contract or voluntarily (9.4%).

5.7 Innovation is a connected activity

Aside from the enterprise or enterprise group itself (18.4%), enterprises principally collaborated with clients or customers (20.2%) followed by suppliers of equipment, materials, components and software (19.3%) on their innovation activities. Collaborative partnerships with universities or higher education institutions (11.2%), and government or public research institutions (9.9%), ranked relatively low. This pattern held for all the world's geographic regions with higher proportions of enterprises that cooperated with partners from South Africa and Europe than the rest of the world. Therefore, improving the ability for bidirectional exchange of information and the ability of higher education institutions and public research institutions to engage with the private sector, entrepreneurs and communities become important policy objectives (Kruss, 2012; Kruss et al, 2013).

5.8 Innovation has specific impacts, including environmental benefits

In terms of product outcomes, the principally perceived benefit of innovation was 'improved quality of goods or services' (37.7%), followed by 'increased range of goods and services' (35.9%). Among process outcomes, the most prominent was 'increased capacity of production or service provision' (30.5%), followed by 'improved flexibility of production or service provision' (26.0%). Among other outcomes, 'met governmental regulatory requirements' (25.6%) was the principally perceived benefit.

Enterprises in the manufacturing sector introduced goods or services (product), process, organisational and marketing innovations with environmental benefits from the production of goods or services as well as from the after sales use of products. It is also evident that the enterprises introduced these innovations in response to regulations or taxes on pollution as well as governmental financial incentives for environmental innovation. At least 55.0% of all enterprises with innovation activity had procedures in place to regularly identify and reduce their environmental impact.

5.9 Enterprises experience specific barriers to innovation

All cost factors were prominent hampers of innovation, though lack of qualified personnel dominated among knowledge factors (22.9% among innovation-active enterprises and 8.6% among enterprises with no innovation activity). Market factors were also prominent barriers of innovation in the manufacturing sector. However, among reasons not to innovate, 'no need because of no demand for innovations' was more prominent (5.4% among innovation-active enterprises, and 13.3% among enterprises with no innovation activity) than 'no need to innovate due to prior innovations' (2.7% among innovation-active enterprises, and 8.6% among enterprises with no innovation activity).

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APPENDICES*

*Available on request from cestiidata@hsrc.ac.za.

Appendix 1: Community Innovation Survey 2006 (CIS 2006): Methodological recommendations and Core questionnaire

Appendix 2: South African Business Innovation Survey 2010-2012 Questionnaire

Appendix 3: South African Business Innovation Survey 2010-2012: Frequently Asked Questions

Appendix 4: List of Tables