# TOMORROW'S LEADERS CONVENTION 2013

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# R&D AND INNOVATION IN SOUTH AFRICA

# OUTLINE

- Background - CeSTII
- Scientific method and what we measure
- What R&D Surveys tell us
- What Innovation Surveys tell us
- Links and differences between R&D and Innovation
- Importance of R&D and innovation and international comparisons
- Summary

# BACKGROUND

- In 2002 the Centre for Science, Technology and Innovation Indicators (CeSTII) was established in the HSRC and commissioned by the Department of Science and Technology (DST) to conduct Annual R&D Surveys and regular Innovation Surveys
- The aim was to establish a baseline set of indicators for DST to monitor progress in achieving the National System of Innovation and R&D Strategy goals
- This aim has now been achieved and CeSTII is building up the series of data and indicators and progressing with more analytical work

# BACKGROUND

- CeSTII has now undertaken eight R&D Surveys since the first one for 2001/02 and is finalising a ninth one in for 2010/11 with a tenth one in the field for 2011/12
- We have also  two innovation surveys (Innovation Surveys 2005 and 2008) with a third about to be launched
- Also Biotechnology and Agricultural R&D Surveys
- Produce national STI data and indicators
- Annual submissions of data to OECD and UNESCO
- Active in the African Science, Technology and Innovation Indicators (ASTII) Initiative

# SCIENTIFIC METHOD

- The Scientific Method consists of systematic observation, measurement and experimentation, and the formulation, testing and modification of hypotheses

- *Criticism is the backbone of the scientific method* – the concept of falsification reduces confirmation bias by attempting to disprove hypotheses rather than prove them

  - *Hypothesis:* a tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation

# SCIENTIFIC METHOD

- We all use scientific method in our daily life to some extent
- However when you formalise this approach in order to increase knowledge or understanding this then becomes measurable as Research and Experimental Development or R&D

# R&D AND INNOVATION

- When this R&D/experimental development results in new product development and the introduction of a new product to the market then this constitutes an innovation

- But only 20-40% of innovation in South Africa takes place in this idealised way of R&D leading to innovation

# WHAT IS R&D?

- Research and Experimental Development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications

*Source: OECD Frascati Manual, 6th Ed., 2002*

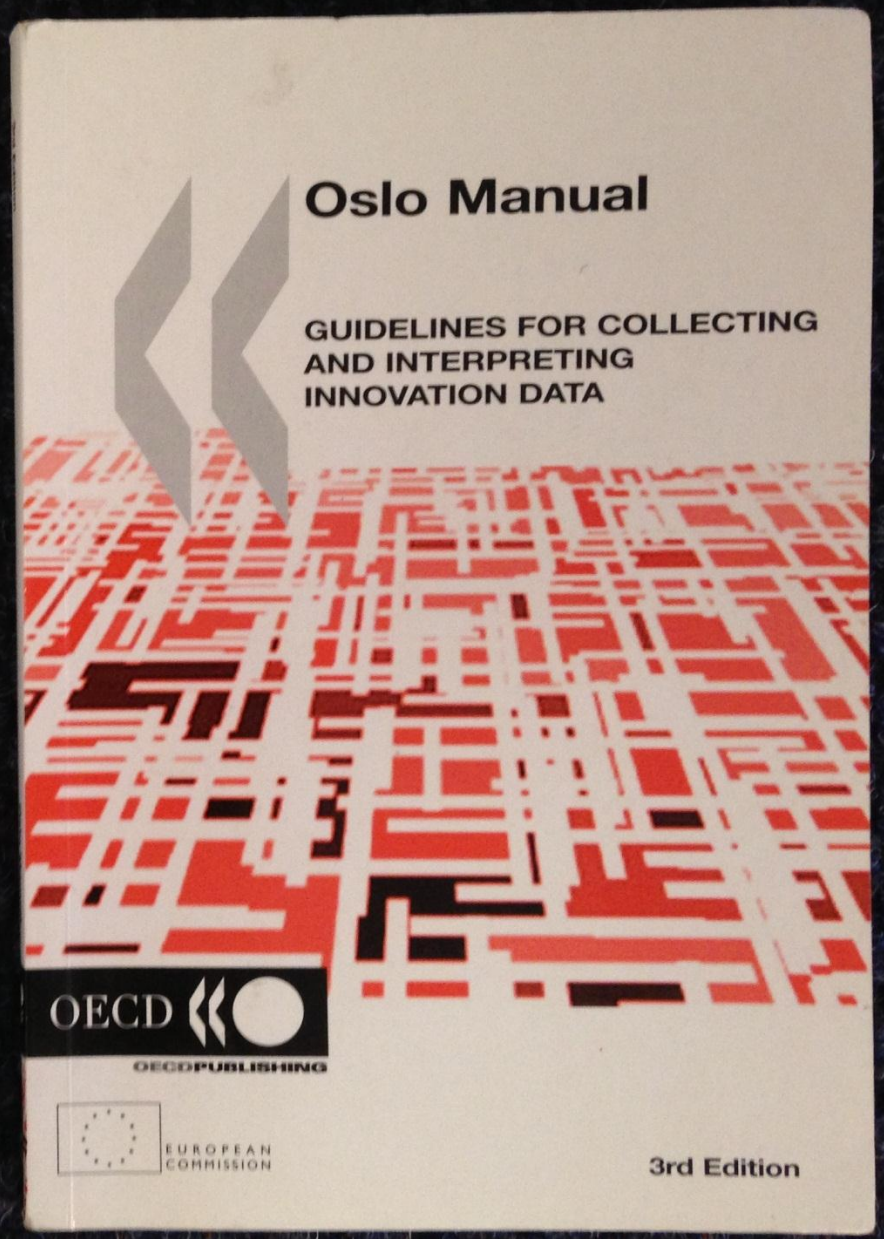
# WHAT IS INNOVATION? (INNOVATION SURVEY DEFINITIONS)

- Product innovation is the introduction of new or significantly improved products (goods or services) to the market
- Process innovation is the use of new or significantly improved methods for the supply of goods or services

  - The innovation must at least be new to the enterprise and must have improved capabilities
  - The innovation can be developed by the enterprise or outside the enterprise

*Above based on OECD/Eurostat Oslo Manual, 3rd Ed., 2005, and Eurostat CIS4 Core Questionnaire*

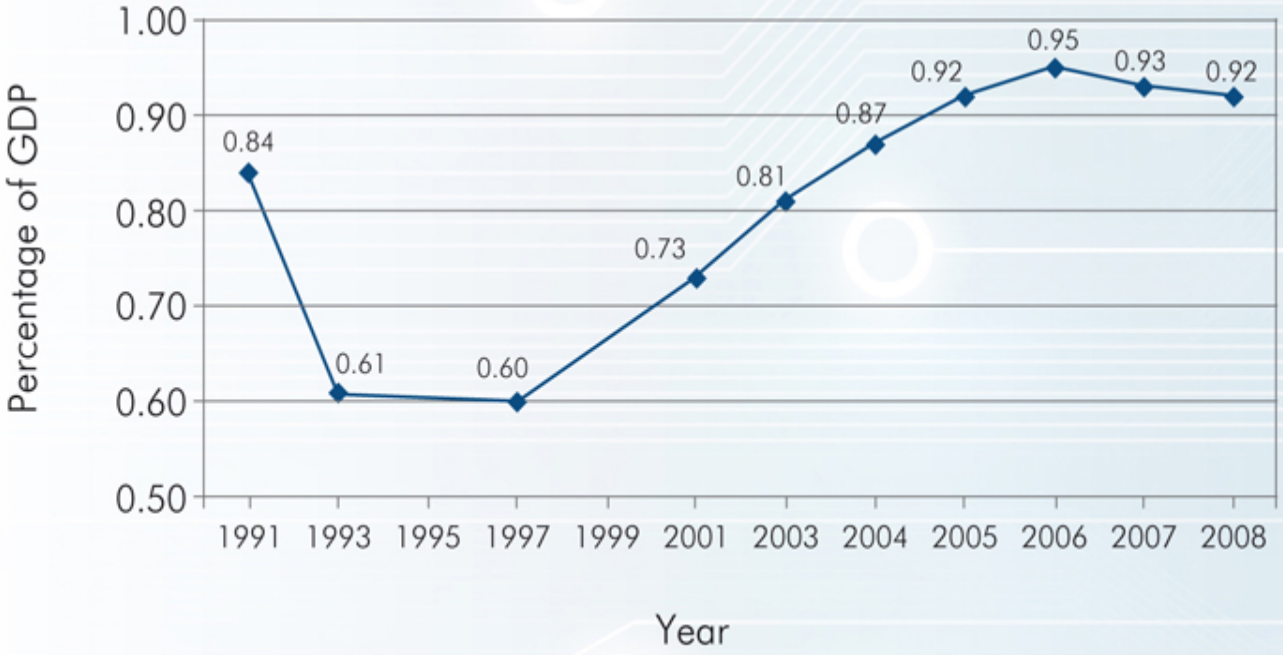

Frascati Manual
PROPOSED STANDARD PRACTICE FOR SURVEYS ON RESEARCH AND EXPERIMENTAL DEVELOPMENT
OECD
2002


Oslo Manual
GUIDELINES FOR COLLECTING AND INTERPRETING INNOVATION DATA
OECD
OECDPUBLISHING
EUROPEAN COMMISSION
3rd Edition

# R&D SURVEYS

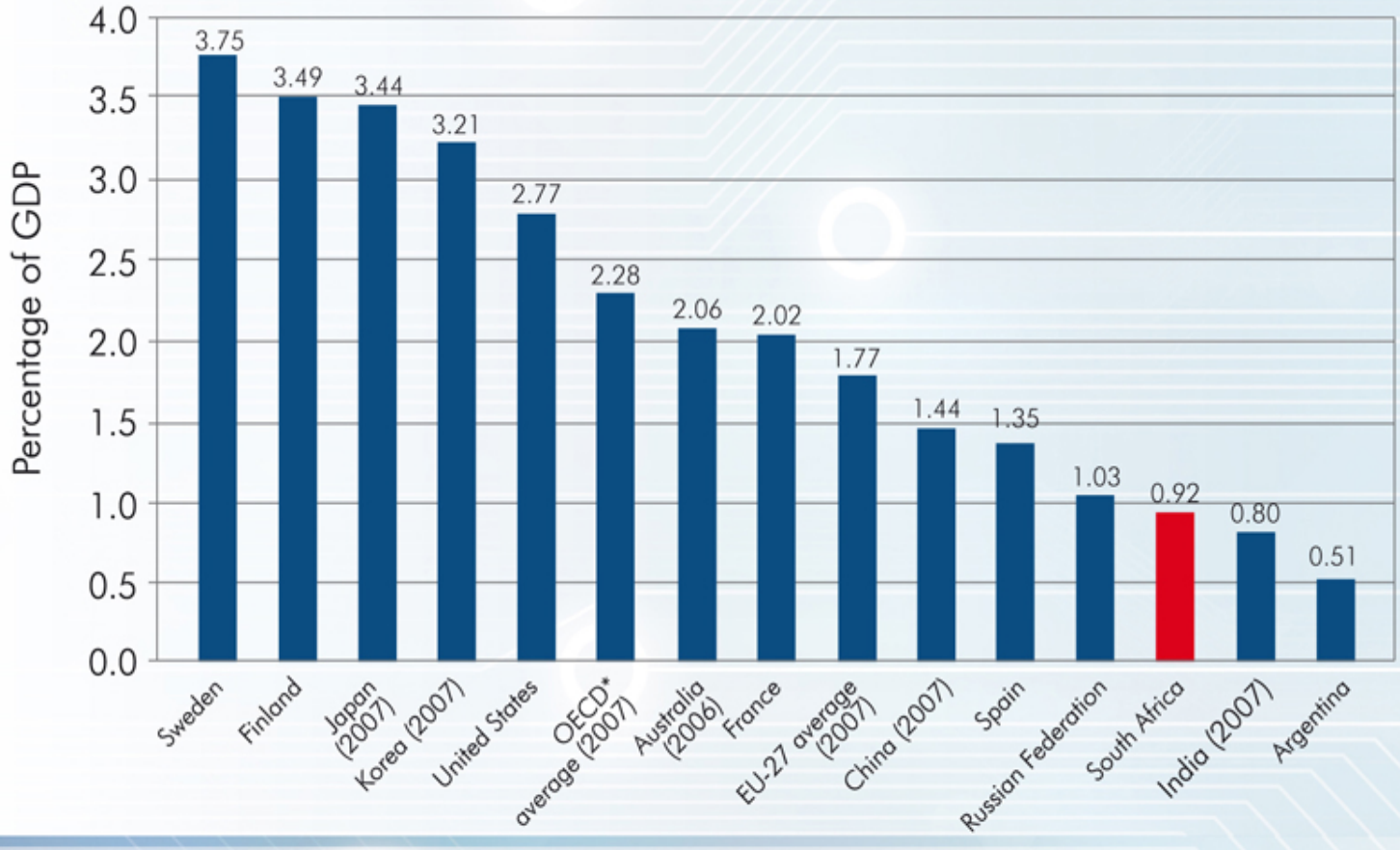
# Figure 2

Gross Expenditure on R&D as a percentage of GDP
(South Africa, 1991-2008



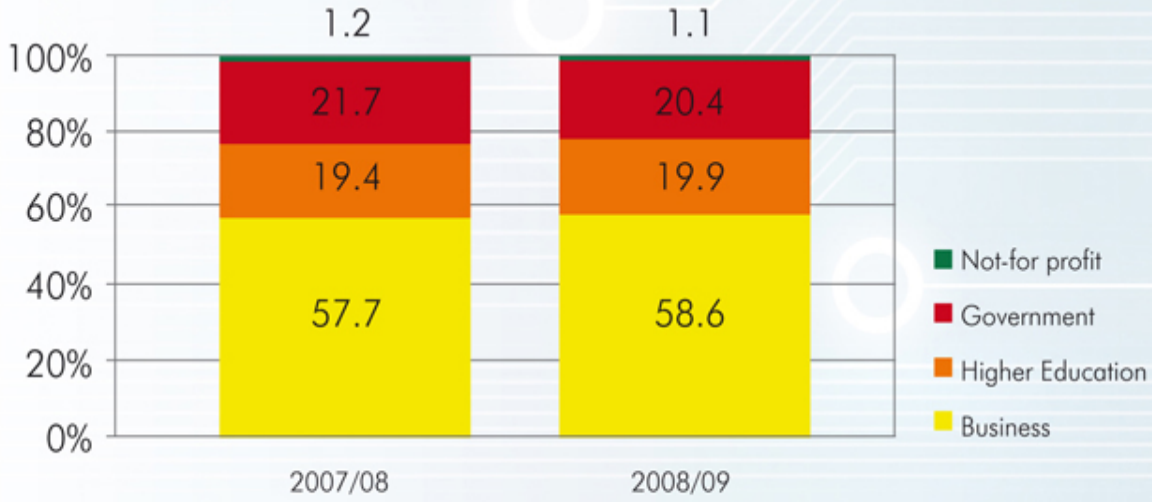
# Figure 3

Gross Expenditure on R&D as a percentage of GDP
2008* (*or latest year available)



# Figure 7

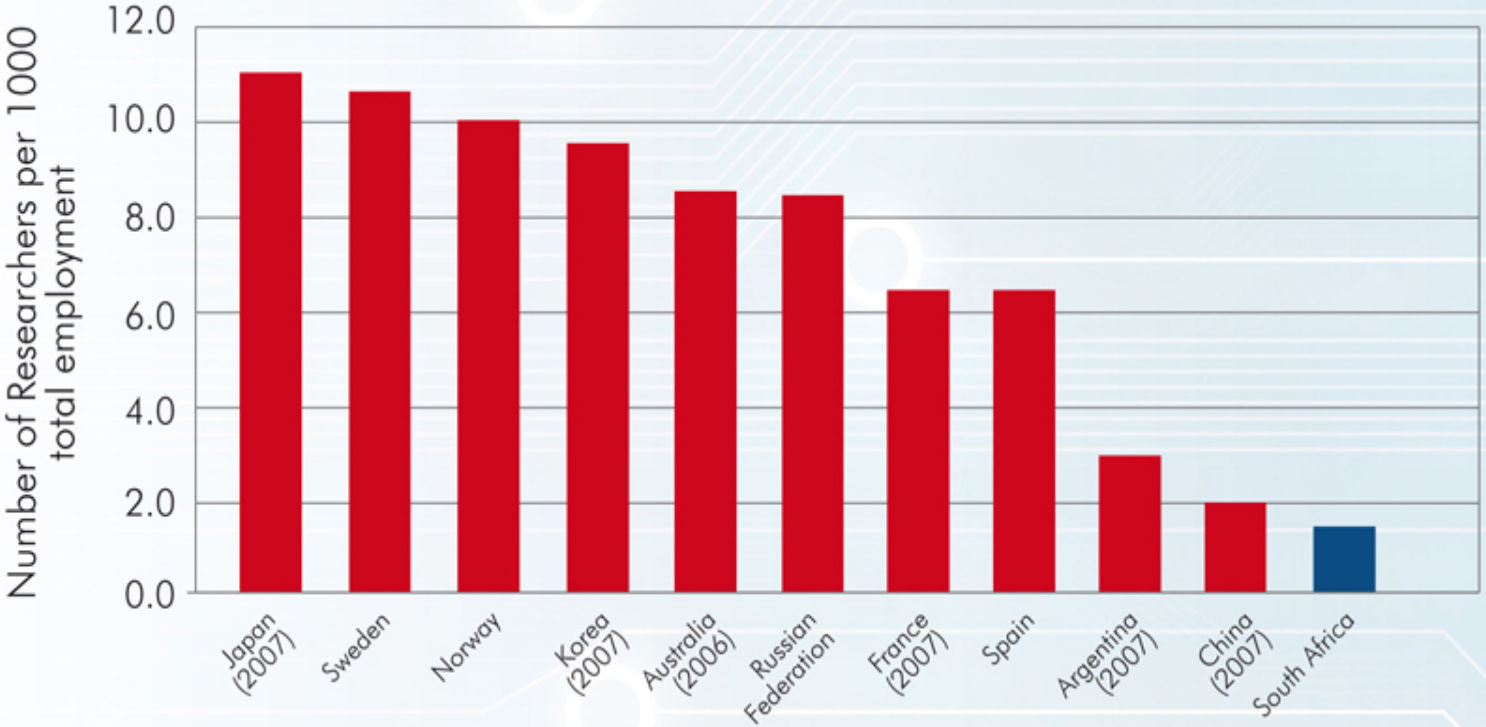
Performance of R&D by Sector
(South Africa, 2007/08 & 2008/09)

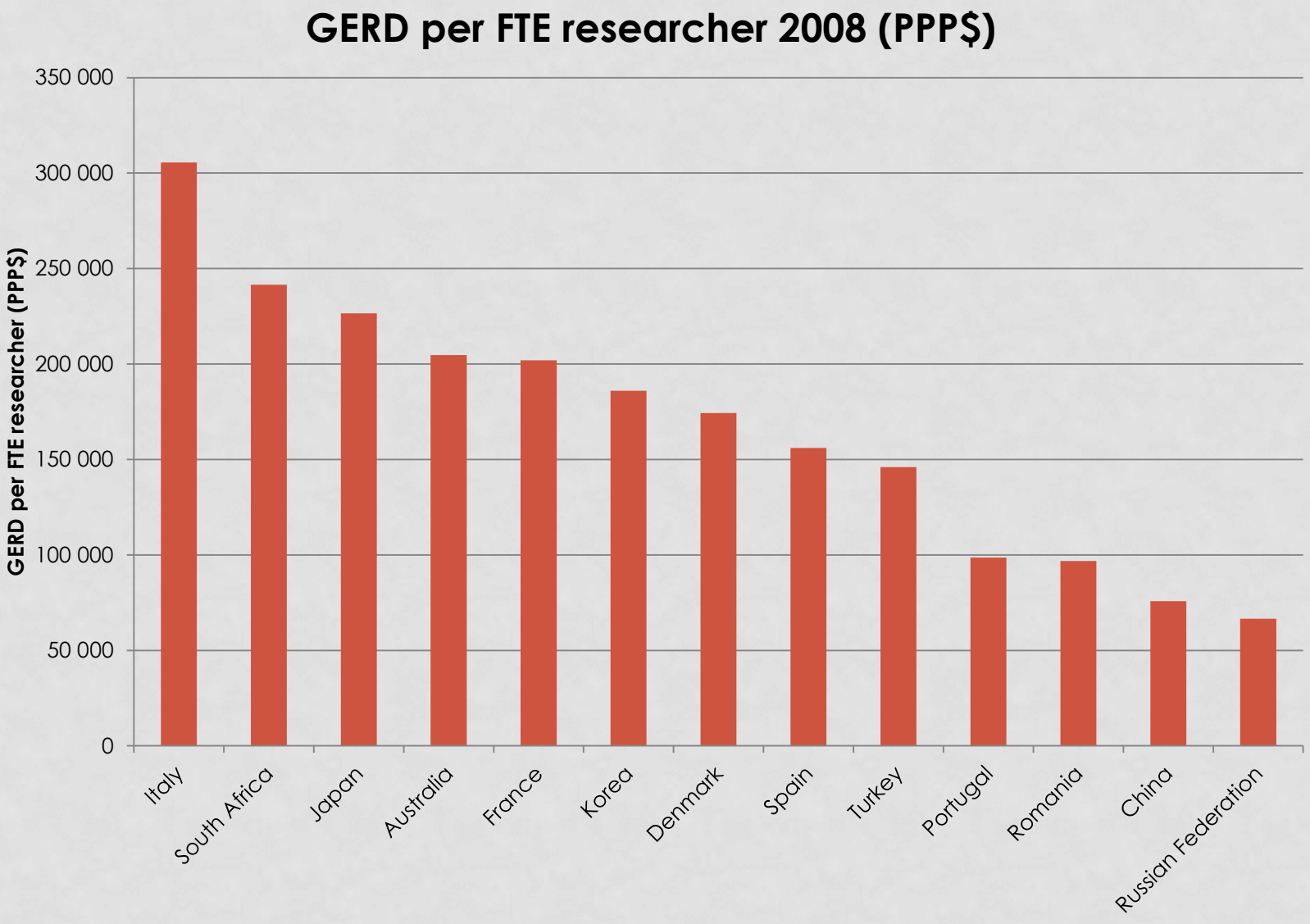


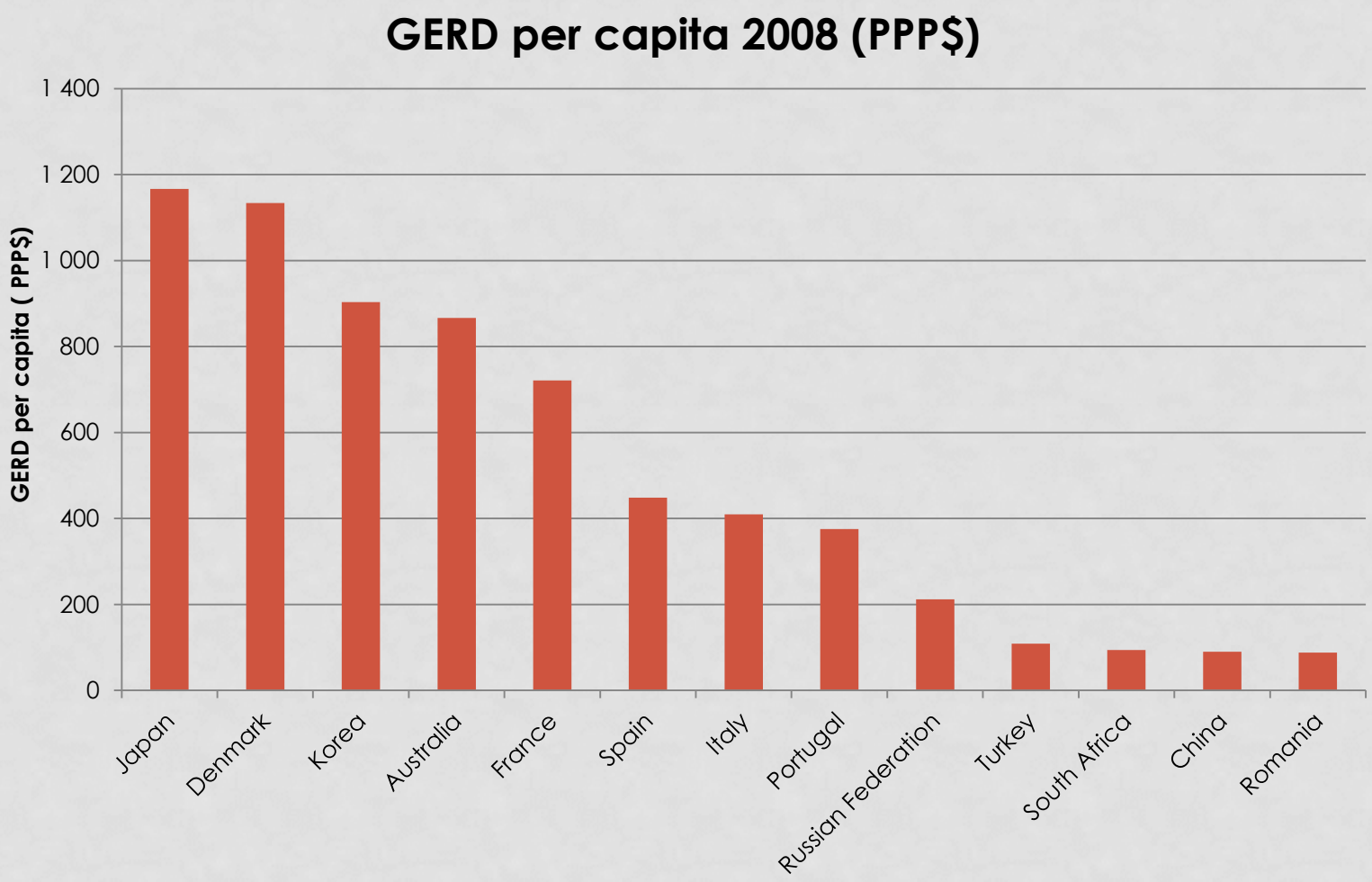

| Expenditure (R 000s) | Business | Higher Education | Government | Not-for Profit | Total |
|---|---|---|---|---|---|
| 2007 | 10,738,456 | 3,631,473 | 4,040,493 | 223,202 | 18,633,624 |
| 2008 | 12 332 012 | 4,191,366 | 4 277 019 | 240 649 | 21 041 046 |

# Figure 4

Number of Full Time Equivalent (FTE) researchers per 1000 total employment in 2008*
*or latest year available

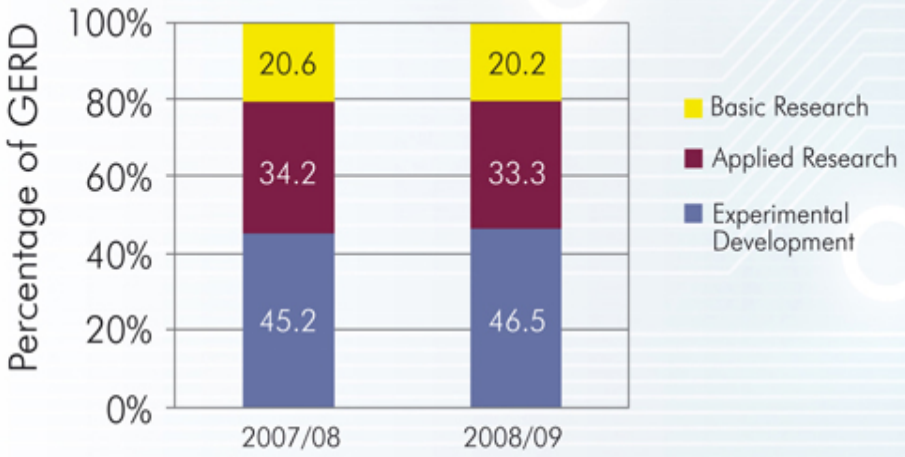



GERD per FTE researcher 2008 (PPP$)
GERD per FTE researcher (PPP$)
350 000
300 000
250 000
200 000
150 000
100 000
50 000
0
Italy
South Africa
Japan
Australia
France
Korea
Denmark
Spain
Turkey
Portugal
Romania
China
Russian Federation


GERD per capita 2008 (PPP$)
GERD per capita ( PPP$)
1 400
1 200
1 000
800
600
400
200
0
Japan
Denmark
Korea
Australia
France
Spain
Italy
Portugal
Russian Federation
Turkey
South Africa
China
Romania

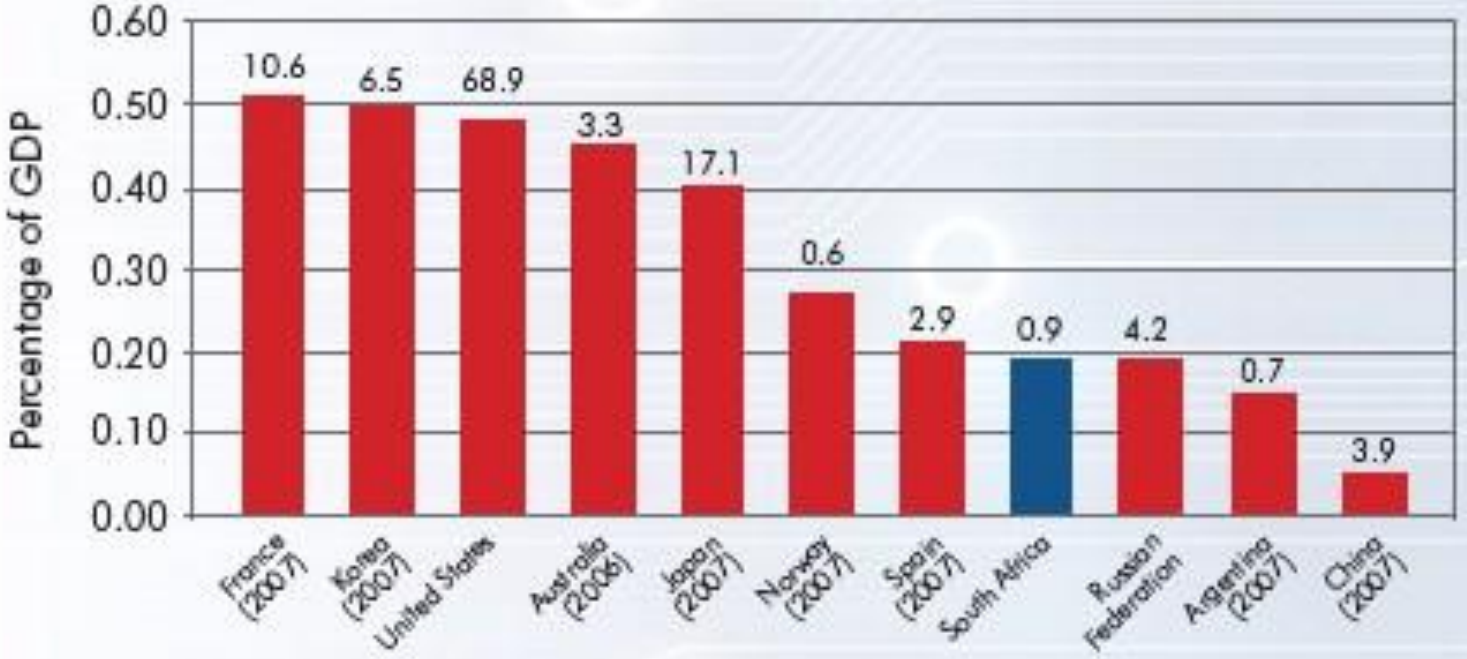
# Figure 10

Gross Expenditure on R&D by type of R&D (South Africa, 2007 & 2008)



## Figure 11

Basic Research as a percentage of GDP 2008/09*
*or latest year available




*NB: Figures above bars show R&D expenditure on basic research in million current PPP$*

| Top 5 BERD performing Industries* in South Africa (2008/09) | BERD (%) | BERD (R billion) |
|---|---|---|
| Financial intermediation and business services | 27.4% | 3.4 |
| Electricity, gas and water supply | 18.7% | 2.3 |
| Manufacture of chemicals and chemical products (including pharmaceuticals and refined petroleum) | 18.4% | 2.3 |
| Manufacture of transport equipment | 8.0% | 1.0 |
| Mining and quarrying | 4.7% | 0.6 |
| Total of Top 5 industries | 77.2% | 9.5 |
| *All manufacturing accounted for 38.8% of BERD: | | |

# BERD CONCENTRATION

- BERD is concentrated by industry in South Africa with the top five industries in 2008 accounting for some 77% of BERD
- BERD is also concentrated by firms with the top 10.0% of firms contributing about 75% of BERD
- About 3% of R&D performing business enterprises report annual R&D expenditures exceeding R100 million while 32% of R&D performing firms have R&D expenditures of less than R1 million

# INNOVATION SURVEYS

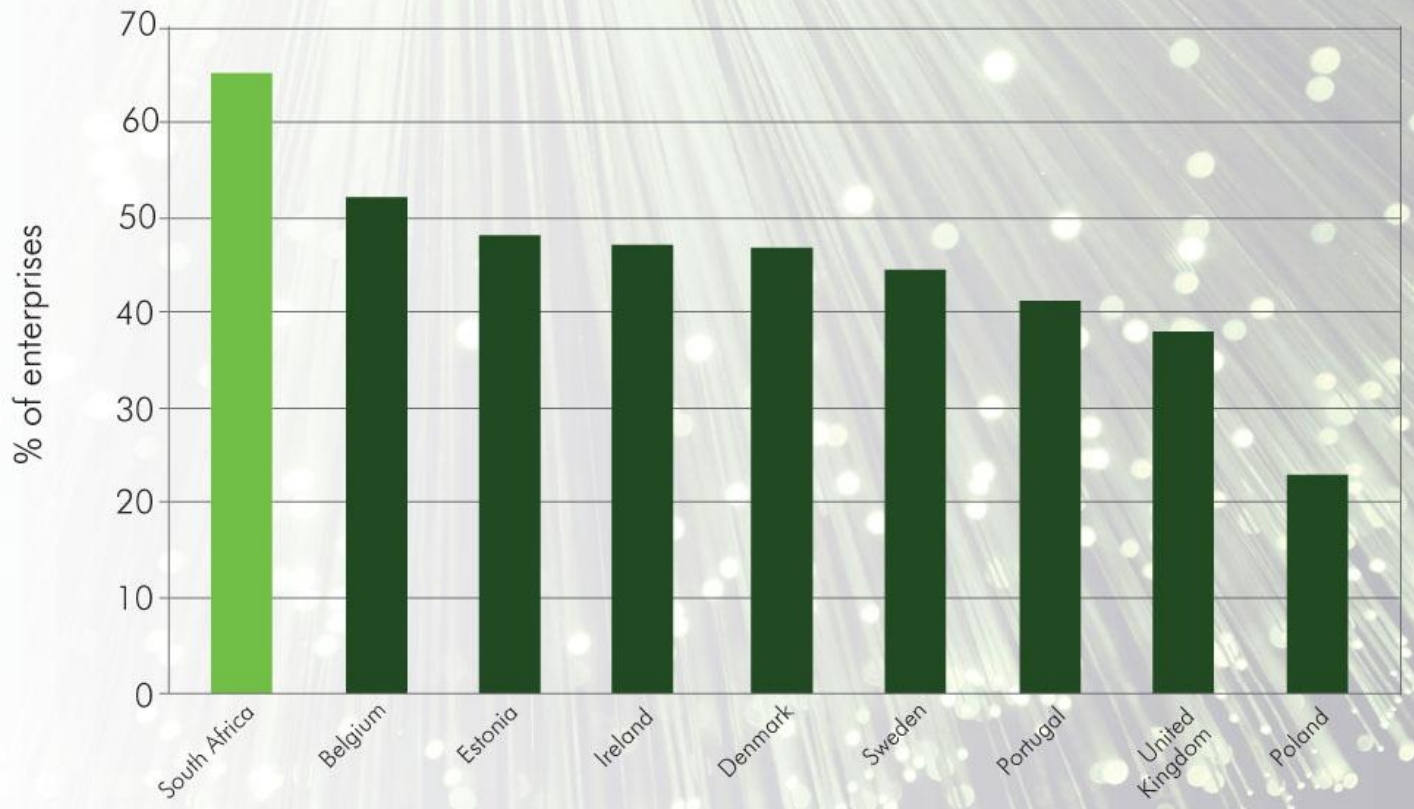
# INNOVATION ACTIVITIES AND EXPENDITURES

Innovation activities and expenditures can comprise:

- Intramural (in-house) R&D
- Extramural or outsourced R&D
- Acquisition of machinery, equipment and software
- Acquisition of other external knowledge
- Training
- Market introduction of innovations
- Other activities (including design)

## Figure 2

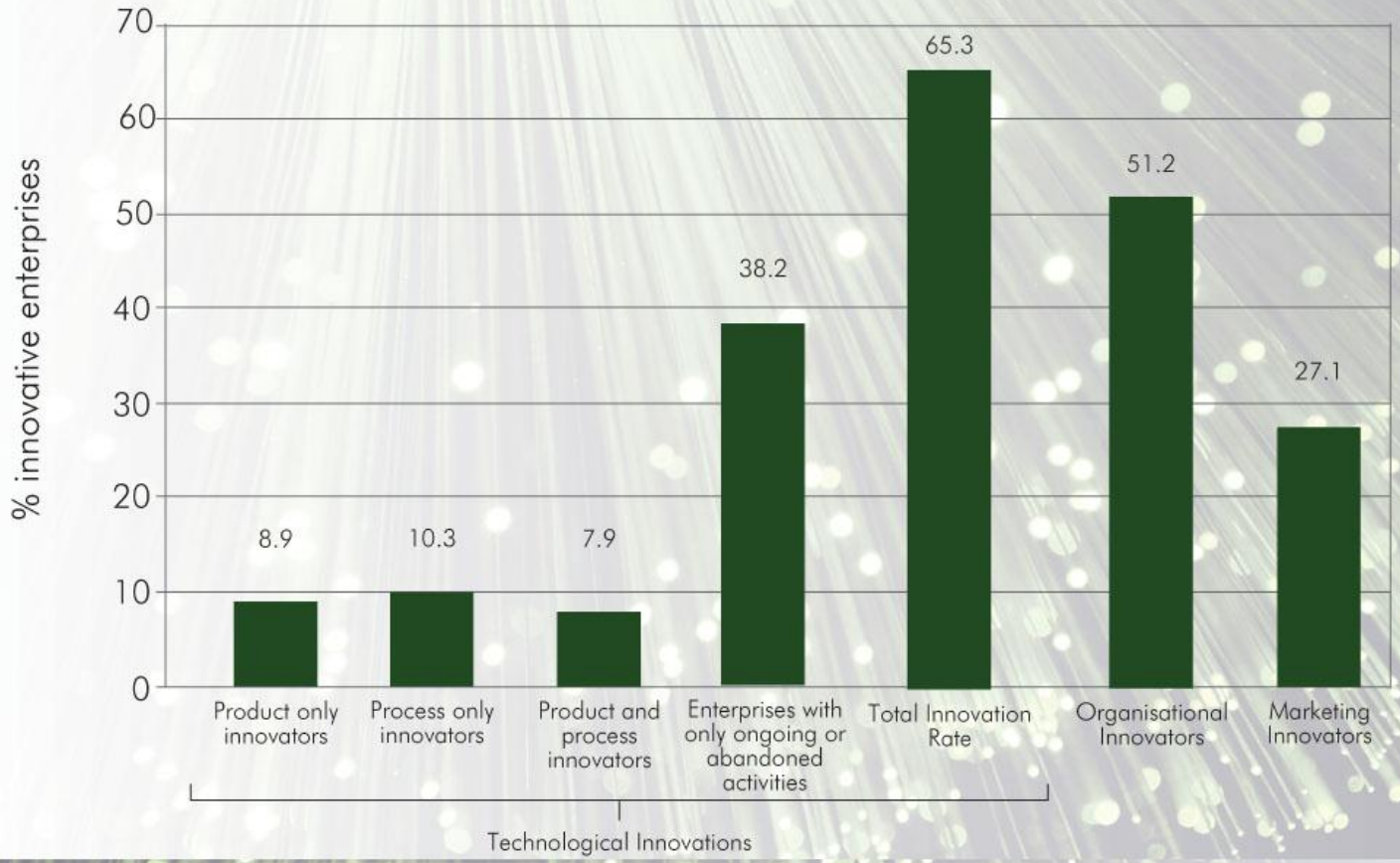
South African share of enterprises with innovation activities compared to selected EU-countries (%), 2005 – 2007




* EU-countries data are for the time period 2004 - 2006

# Figure 1

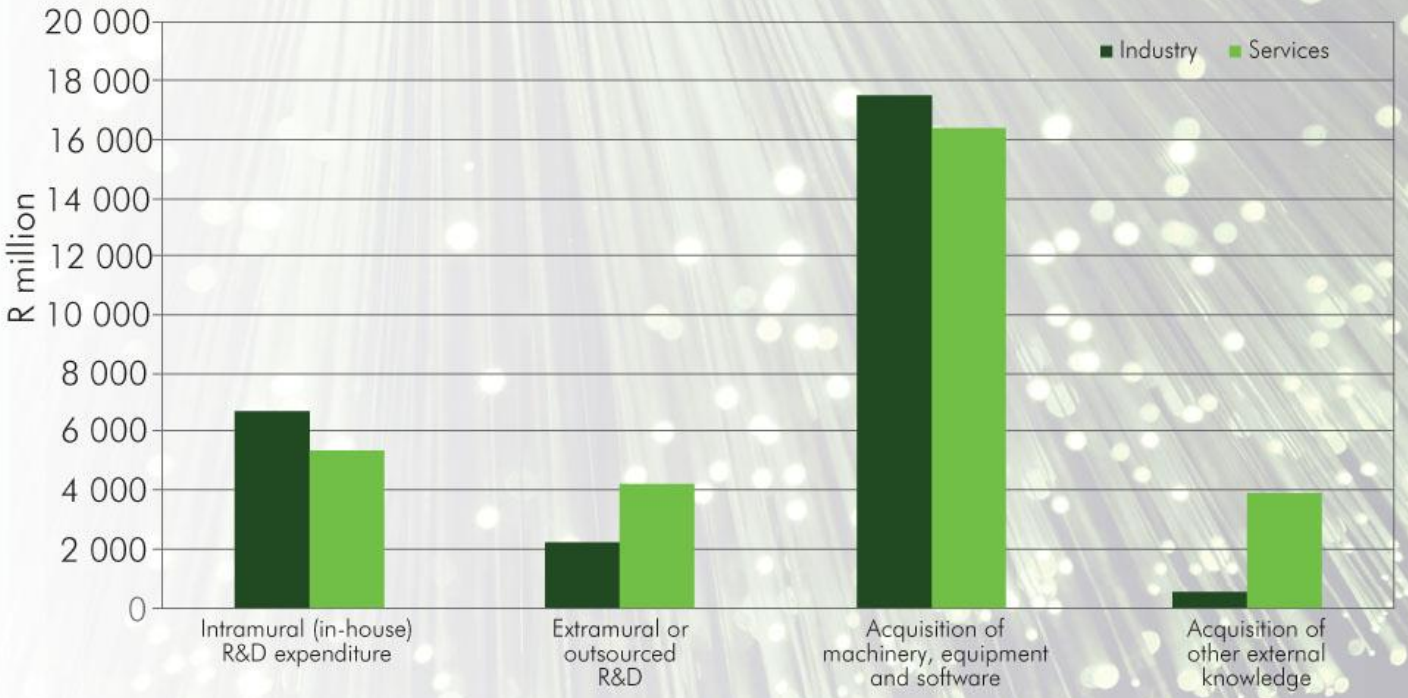
Innovation rate by type of innovation, 2005 - 2007



# Figure 3

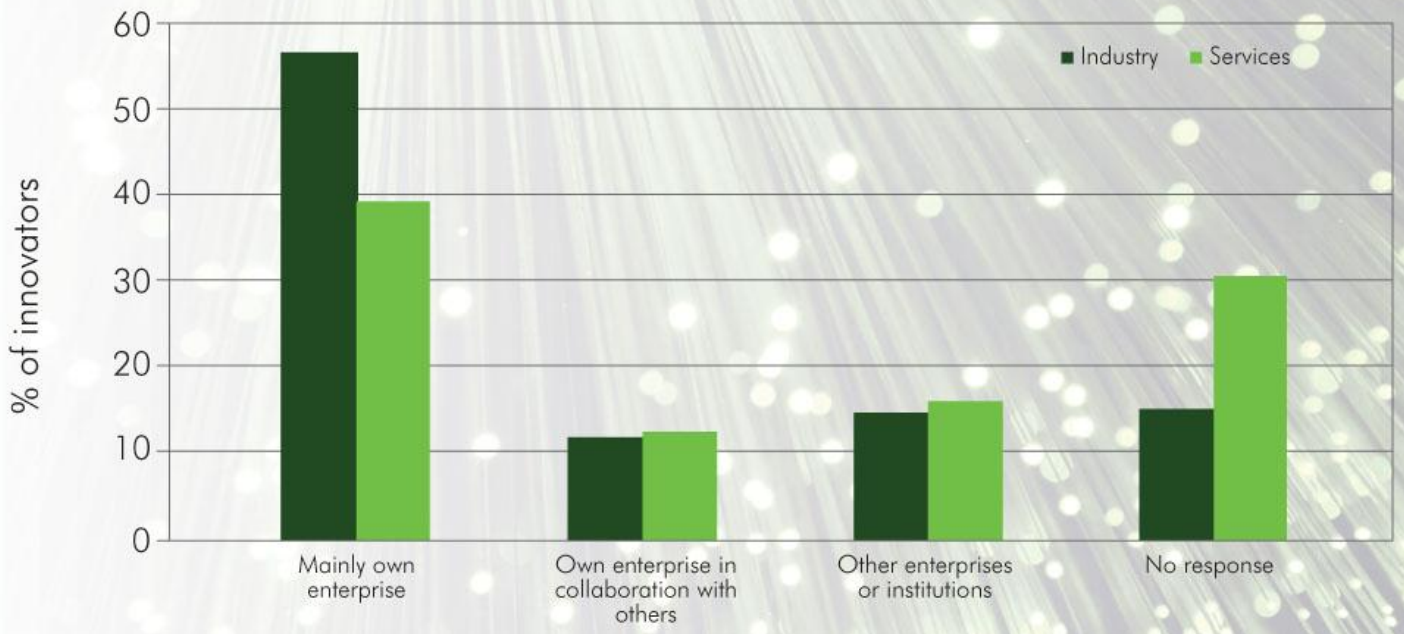
Expenditure (in million rands) of enterprises on innovation activities, 2007

Total = 56.9 billion
Industry = 27.0 billion
Services = 29.9 billion



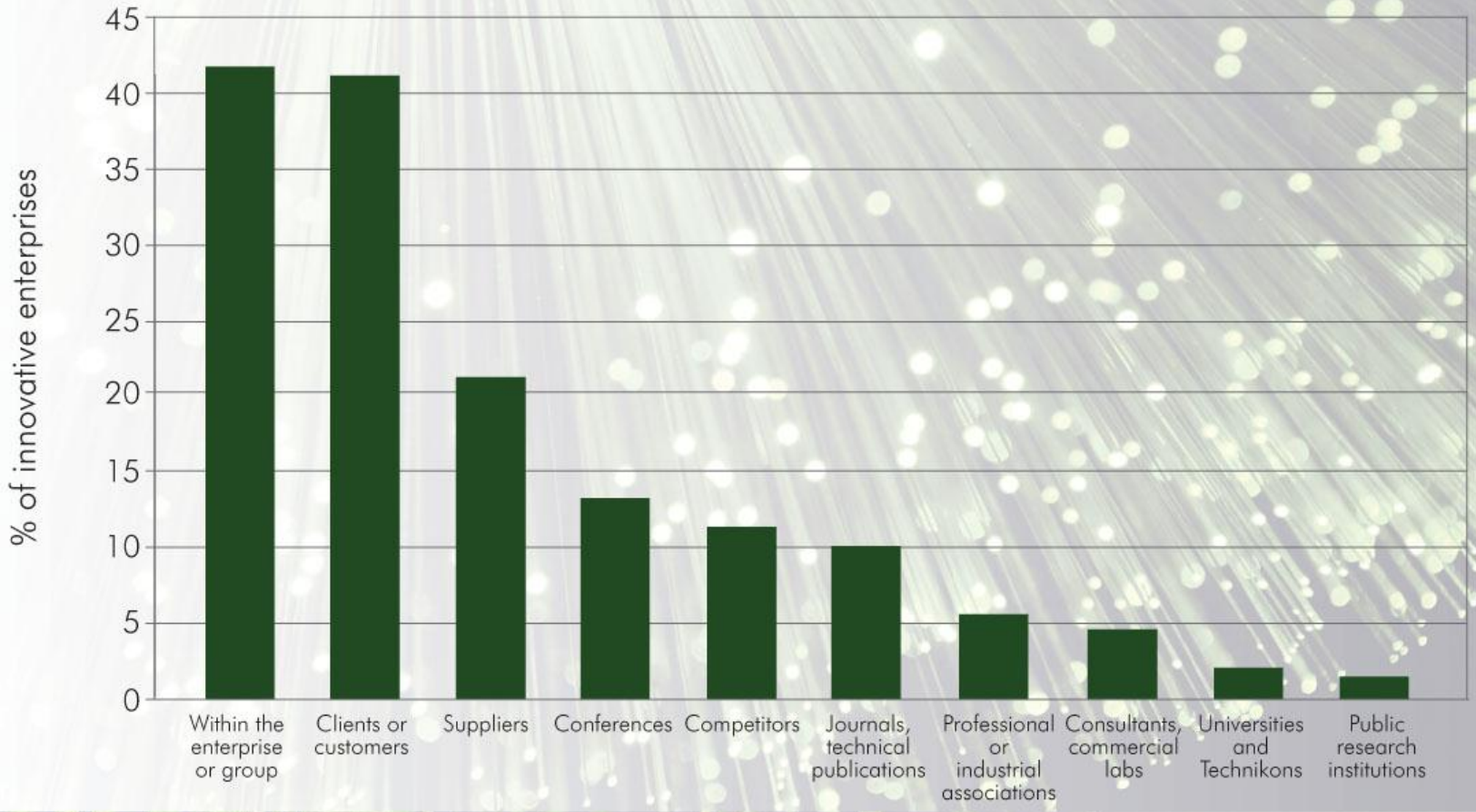
## Figure 5

Innovative enterprises (%) – responsibility for the development of product innovations, 2005 – 2007



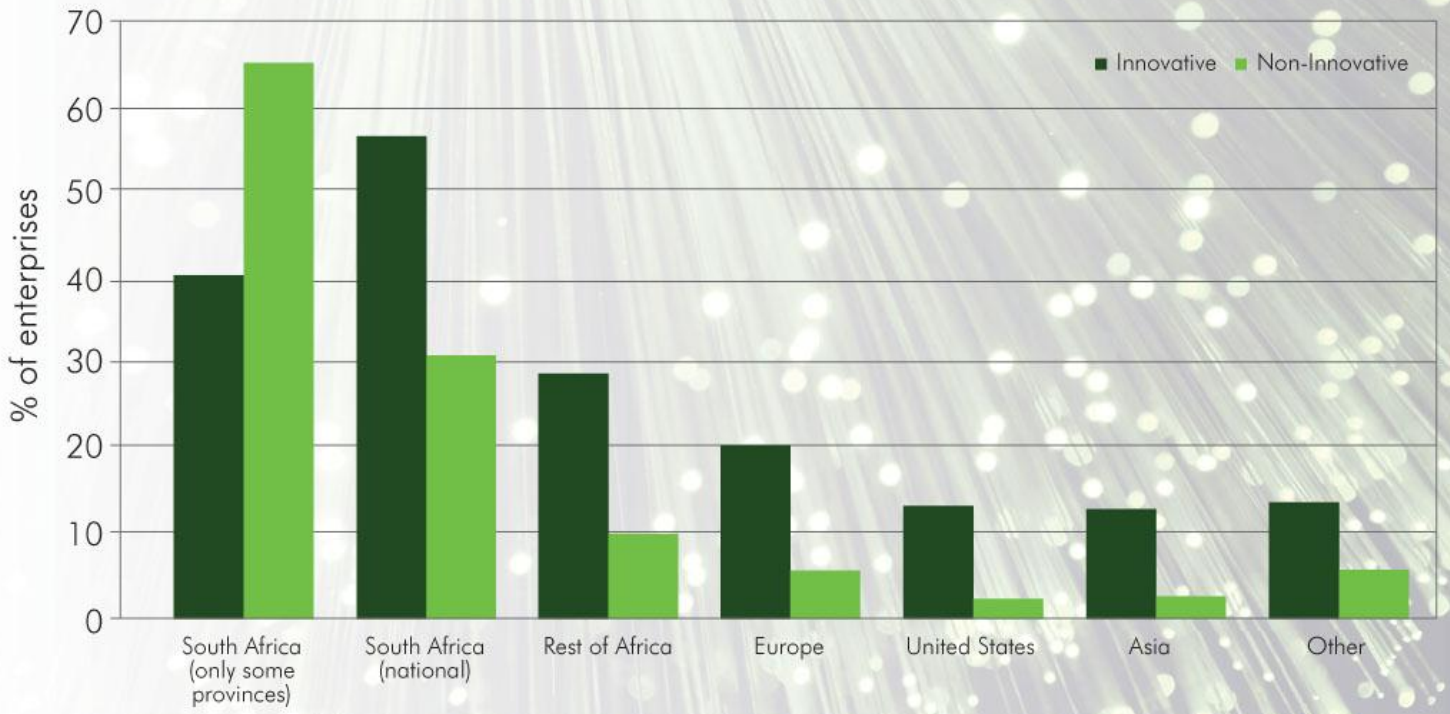
## Figure 7

Sources of information rated as "highly important" by innovative enterprises, 2005 – 2007



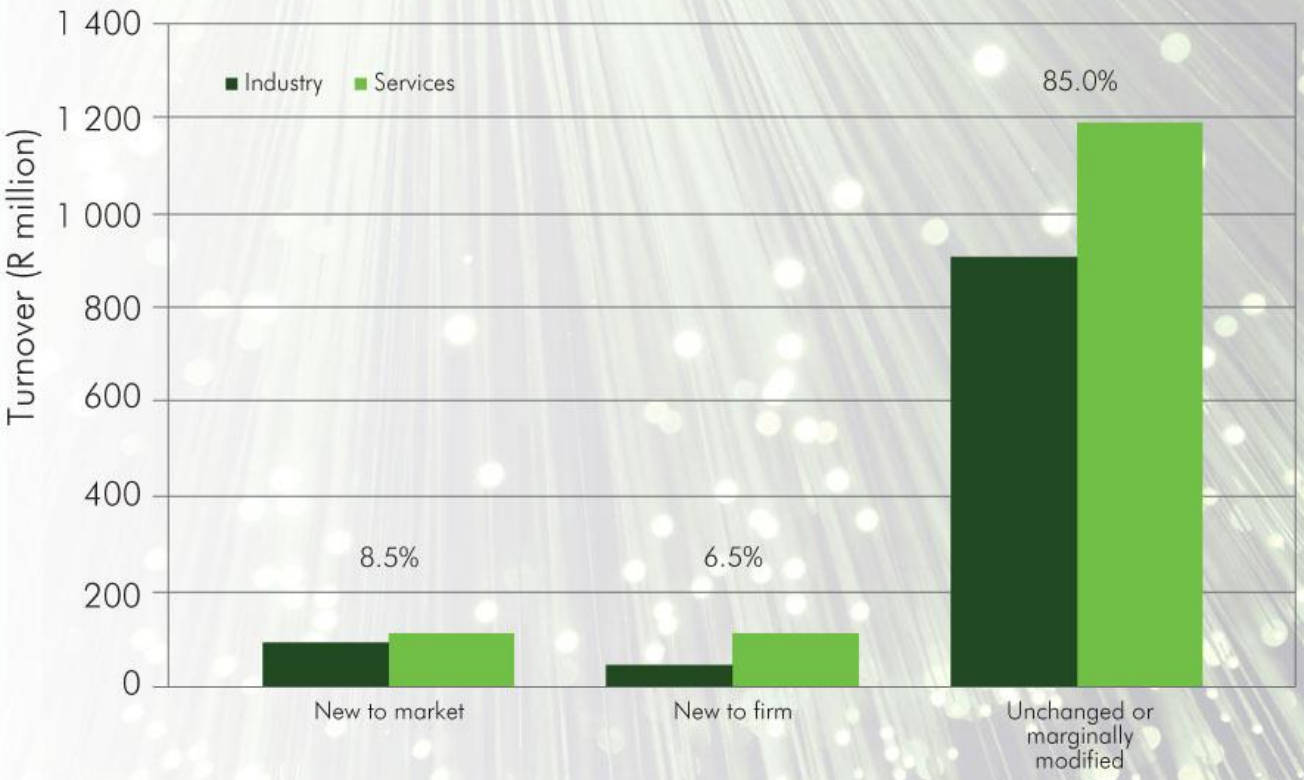
## Figure 12

Geographic distribution of goods and services sold by innovative and non-innovative enterprises, 2005 – 2007



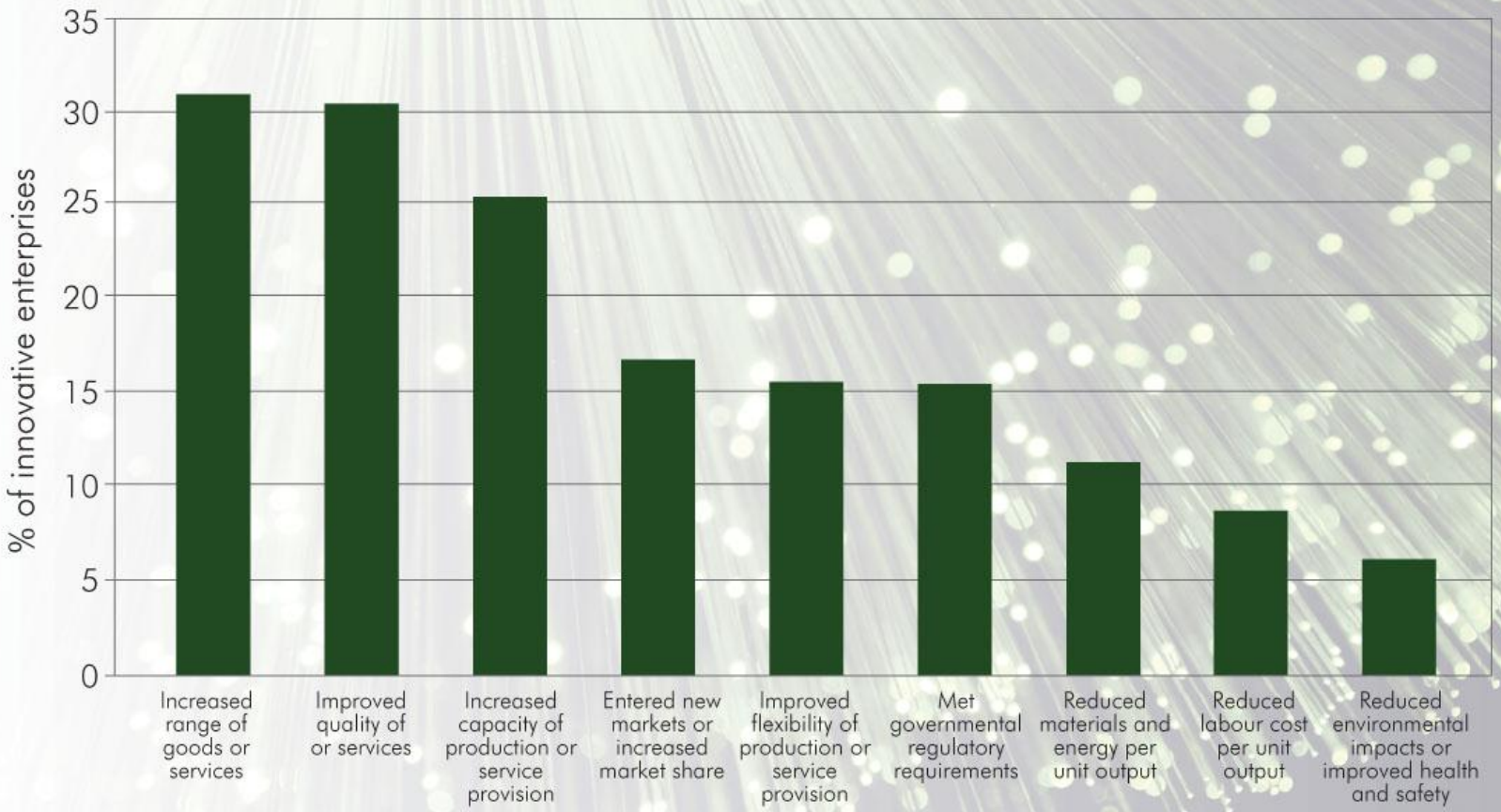
## Figure 4

Product (goods and services) innovators – breakdown of turnover by product type, 2007

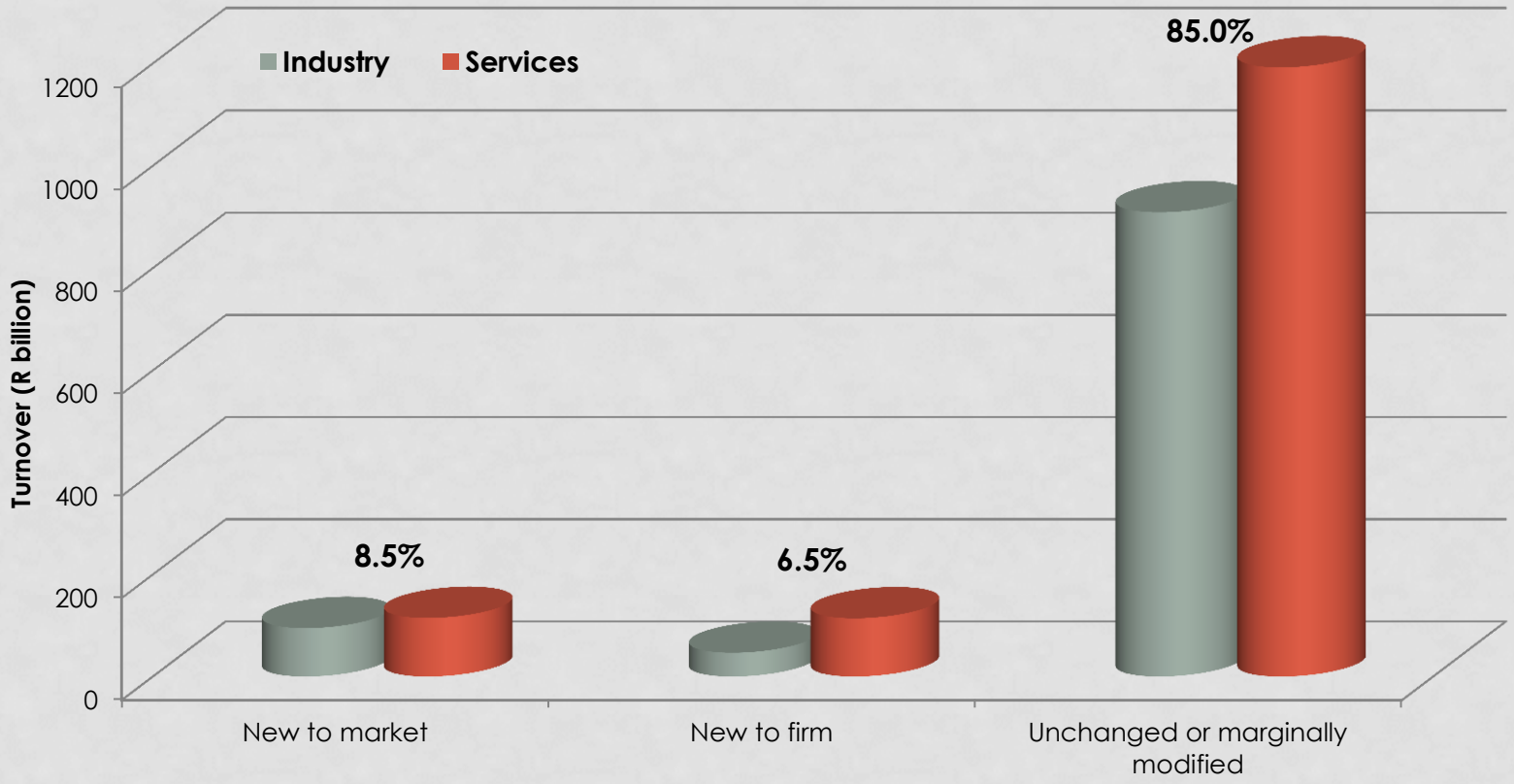


## Figure 9

"Highly important" effects of innovation on outcomes for enterprises, 2005 – 2007



# Turnover generated by 'new to market' and 'new to firm' products = R370 billion



# IMPORTANCE OF INTERNATIONAL COMPARISONS

- R&D Surveys mostly provide quantitative data which is amenable to international comparisons and league tables (e.g. OECD MSTI)
- Innovation Surveys are not inherently useful as stand alone exercises and also need to be compared to results from other countries
- International comparability adds richness to SA Innovation Survey results and allows us to benchmark and understand our position better

# IMPORTANCE OF INTERNATIONAL COMPARISONS

- Through OECD, UNESCO and NEPAD, South Africa can be included in international comparisons of R&D and Innovation – using internationally recommended methods (OECD NESTI allows us to keep abreast of state-of-the-art changes and trends)

- South Africa can only be taken seriously in S&T if we have regular and reliable survey based data on Innovation & R&D to report on the development of the NSI

# SUMMARY

- R&D produces new knowledge
  - if conducted in-house provides the organisation with unique understanding and insight into a problem or phenomenon
  - if a partnership or joint venture provides new ideas and/or products/technologies to strategise around
- Innovation is the end point of new product or process development when it reaches the market or is implemented in production