

# *The Asian Boom and Australia's Proximity*

Potentialities for Collaboration:

## An Overview of the Research & Development System in South Australia

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## 1. INTRODUCTION

The main purpose of this research project is to describe South Australia's Research and Development (R&D) system. In the last few years, the South Australian Government, universities and research centres have placed a lot of effort into increasing and improving the State's R&D structure. This engagement highlights the significance that South Australia gives to the expansion and enhancement of R&D and technological transfer. These are crucial elements for the future sustainable development of the State.

As emphasised in the report, South Australia's R&D system is remarkable and can boast strong international connections that facilitate the exploitation of distinctive and notable competencies and resources. In particular, through this analysis, the main research areas are identified and which ones can be portrayed as outstanding and excellent research centres of the State. This investigation may benefit the internationalisation process of South Australia in the fields of research and development, technological transfer, and cooperation. In fact, this elaborations may be useful for foreign organisations who are seeking to collaborate with institutions abroad, to develop cooperative relationships and the creation of innovative ideas and products (both goods and services). International cooperation may be crucial to achieve research outcomes that would be hard to obtain by single organisations working in their respective countries<sup>1</sup>.

The representation of the South Australian research system is conducted in an objective perspective according to the collected data, without being inclined to anyone, since this project aims at identifying the potentialities of South Australia's research system.

The remained of the report is organised as follows. In Section 2, some theoretical notions regarding the importance of research and development in an economic perspective are presented. Moreover, the typical features of R&D investments are underlined, which justify the Government intervention in this field.

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<sup>1</sup> For an extensive discussion of the importance of cooperation in R&D, see: Kokkinou, A. (2010).

In Section 3 the report discusses the initiatives undertaken by the Australian Government in order to support and stimulate R&D activities in Australia. In particular, an analysis of the Commonwealth Government funding system is presented and this includes the Department of Innovation, Industry, Science and Research (DIISR), the Department of Defence through the Defence Science and Technology Organisation (DSTO), and the National Health and Medical Research Council (NHMER). In this Section the favourable Australian taxation regime for R&D expenditure is also briefly presented.

From Section 4 onwards the report concentrates on South Australia. Section 4 examines the data on Gross Expenditure on Research and Development (GERD). After presenting the general figures, each component of the GERD is analysed separately: Commonwealth Government, State/Territory Government, Business, and Higher Education. Finally, South Australia is compared to other OECD Countries.

In Section 5, the main institutions that form the South Australia's R&D system are described. Firstly, the three local universities of the State (the University of Adelaide, the Flinders University, and the University of South Australia) are presented. An analysis of the data on students (with a focus on international, postgraduate, and research students) is reported, as well as data on the research income of each university. Secondly, the two foreign universities which, in the last five years, made a decision to open offshore campuses in Adelaide are introduced: Carnegie Mellon University, Heinz College, Australia and University College London (UCL), School of Energy and Resources Australia. Finally, the Federal Research Centres based in South Australia are described: the South Australia's Cooperative Research Centres (CRCs), the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Centres in South Australia, the DSTO presence in the State, and the South Australia Research and Development Institute (SARDI), which is the State Government's principal research institute.

After the description of the key actors of the R&D system in South Australia and the investigation of data on higher education institutions' students and research income, Sections 6 and 7 analyse the outcomes of research and development activity: publications and patents. The purpose of this research is to identify the key strengths of the South Australia's R&D system, which

may assist in further developing the State's involvement in international cooperation activities.

Section 6 explains in detail the methodology used to collect and elaborate the data in publications and patents, the data coverage, and the indicators used to evaluate the obtained results. In particular, in order to allow a clearer and more comprehensive elaboration of this data, the universities' Schools are categorised into three macro-areas according to their competence field (Health Sciences; Humanities & Social Sciences; and Engineering, Science & Related).

Section 7 of the report presents and analyses the outcomes of the data on R&D activities' results. Both in the case of publications and patents, the aggregate data is displayed first, followed by the data on single local universities and Federal Research Centres. The report aims to assess the research centres within each university, their key strengths, and their trend and evolvement between 2005 and 2009.

Finally, Section 8 draws the conclusive remarks of this research project and focuses on Australian on the potential for Australia in the area of international cooperation in the research and development field.

## **2. RESEARCH AND DEVELOPMENT: THEORETICAL NOTIONS**

### **2.1. Definition of Research and Development (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. R&D activities include: (a) basic research – any experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view; (b) applied research – any original investigation undertaken in order to acquire new knowledge; it is, however, directed primarily towards a specific practical aim or objective; (c) experimental development – any systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.<sup>2</sup>

### **2.2. Economic Reasons to Undertake R&D Activities**

In today's globalised world and markets, more than ever firms need to strive to acquire, accumulate and exploit new knowledge, apply it to their business, and place innovative products on the market.

R&D activities and innovation are twofold beneficial. On the one hand, innovation is essential for firms. In fact, R&D capital accumulation is necessary to create new knowledge related to new production techniques and innovative outcomes. This process of technical development is evolutionary and cumulative in character. Innovation activities and the consequent technological change widen production opportunities for the economy as they

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<sup>2</sup> Definitions by UNESCO: [www.uis.unesco.org](http://www.uis.unesco.org).

make it possible to obtain greater outputs with given inputs or to substitute some inputs with cheaper, more innovative ones.<sup>3</sup>

On the other hand, innovative technological process is also crucial to the long-run performance of the economy as a whole. Innovation can be considered an endogenous variable which contributes to explaining the differences in national growth rates and why economies, even with different rates, do not converge to long-run steady state equilibrium. The identified reason is that capital accumulation through technological improvements of both natural and human capital avoids the long-run productivity decrease.<sup>4</sup> Therefore, R&D and innovation activities are decisive to economic growth, development and welfare. They stimulate investments that introduce new commodities and processes, which improve the living standards of the society. Moreover, they lead to new developments, which increase the comparative advantage of an economy and affect positively the trade performance and competitiveness of a country worldwide. These effects result in a greater level of economic growth.<sup>5</sup>

### **2.3. Specific Features of R&D Investments and Related Issues**

The innovation process is characterised by peculiar aspects that may discourage firms from investing in R&D activities.<sup>6</sup> First of all, a particular feature of R&D capital is the imperfect appropriability of returns due to intra- and inter-industry capital spillovers. Spillovers spread knowledge by channels such as patents, licensing agreements, R&D experts' mobility and input purchase. This characteristic has a disincentive effect on R&D investments undertaken by firms because the expected profitability associated to the economic efforts is reduced. Therefore, the presence of these spillovers may boost a free riding problem<sup>7</sup>, as the research and investment activity can be

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<sup>3</sup> Saha, A. (1994), p. 64

<sup>4</sup> Romer, P. (1986).

<sup>5</sup> Kokkinou, A. (2010), p. 112.

<sup>6</sup> Shah, A. (1994).

<sup>7</sup> For a definition of the free riding problem, see: Coleman, J. S. (1966). Foundations for a theory of Collective decision. *The American Journal of Sociology*. Vol. LXXI, No. 6, pp. 615-625. "[A] fundamental problem of collective action may be called the problem of "contingency". The action may be beneficial to all parties but only if other parties participate in it (and thus pay the cost of participation). That is, there may be complete consensus on the action, contingent on the participation of others. [...] But it is even more to the advantage of

assimilated to a public good. The optimal level of R&D investments implemented by firms is inferior to the desirable level from the social welfare optimisation perspective. Thus, R&D will be underprovided by private entities. This can be considered a case of market failure.

Another problem related to innovation actions rises from the information asymmetry between an R&D performer and the potential financial backers. Research and development investment is different from traditional risky ventures. In fact, in this case it is in the interest of the firm involved in the R&D activity to keep crucial project information secret. But without a detailed description of the project itself, it may be difficult to find an investor disposed to fund the innovative venture. This could hamper the start-up of potentially innovative and successful project.

Finally, another feature of R&D activities is that success propagates success. This is to say that, since innovative investments and knowledge accumulation involve costs, successful firms can boast an advantage over their rivals in enjoying greater chances to success in the future projects. In fact, past positive results from R&D investments imply greater current R&D efforts by successful firms, which thus tend to develop further innovations and widen the gap between themselves and their competitors. As a consequence, R&D intensive industries show a tendency towards a concentrated market structure.

#### **2.4. Justifications for Government Support of R&D**

These specific features of research and development investments and activities suggest a market failure. Firms do not have enough incentive to undertake the innovation effort that would be optimal from the social welfare point of view, because of the intra- and inter-industry spillovers. Furthermore, the problem of asymmetric information between the R&D performer and the project financial baker could limit potentially innovative and profitable investments. In addition, firms that succeed in their R&D activities have

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*each not to participate, if all others do. This problem [...] is known as "free-rider" problem". The problem was extensively treated from the economic perspective by Professor M. Olson. See: Olson, M. (1965). *The Logic of Collective Action: Public goods and the Theory of Groups*. Cambridge, MA: Harvard University Press.*

higher chances to breed successful investments, and this implies a rather concentrated market structure.

In a free market condition, private enterprises are unable to properly face the challenges of R&D activities due to this series of issues. In this context, the governmental intervention is justified. In particular, most industrial nations see the need to intervene through the tax code to encourage corporate R&D investments.<sup>8</sup> The public authorities increase the incentives to undertake innovation actions by applying a favourable taxation regime or granting a subsidy to firms engaged in research and development activity. Another common governmental policy to increase the R&D efforts toward the socially desirable level is the financing of university research programmes and public centres of research. In this way, the government supports additional innovation activities in those fields that are not judged enough profitable by private entities.

In this framework, the state interference is therefore crucial in order to encourage research and development activities and it gives a substantial support to the innovation development of the country as whole. In fact, as underlined before, R&D and innovation activities are decisive to economic growth, development and welfare.

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<sup>8</sup> Shah, A. (1994).

### **3. GOVERNMENT SUPPORT OF R&D IN AUSTRALIA**

Given the theoretical framework discussed above, the Australian public system of support to research and development activities is analysed. In particular, the Australian Government contributes directly to the financing and supporting of R&D projects in various fields and through a great number of programmes and services addressed to universities and public centres as well as private subjects. Furthermore, Australia has developed a favourable taxation regime for R&D expenditure in order to facilitate and stimulate corporate investments in innovation and research activities.

#### **3.1. Federal Government Funding of R&D activities**

The Australian Government contributes to the financing and supporting of R&D projects through the Department of Innovation, Industry, Science and Research (DIISR), the Department of Defence, and the National Health and Medical Research Council (NHMER). Each of these government organisations manages annually considerable resources to finance strategic research projects and programmes, undertaken by both public and private actors.

##### *3.1.1. Department of Innovation, Industry, Science and Research (DIISR)<sup>9</sup>*

The Department of Innovation, Industry, Science and Research (DIISR) strives as a key priority to encourage the sustainable growth of Australian industries by developing a national innovation system that drives knowledge creation, cutting-edge science and research, international competitiveness and greater productivity. The department is committed to developing policies and delivering programs, in partnership with stakeholders, to provide lasting economic benefits ensuring Australia's competitive future. The department also works to boost innovation by Australian industry and improve social and economic benefits for the Australian community.

The Department is structured into a number of Divisions.

- *AusIndustry*<sup>10</sup> is the Australian Government's principal business program delivery division in the Department of Innovation, Industry, Science and

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<sup>9</sup> See: [www.innovation.gov.au](http://www.innovation.gov.au).



Research. It delivers a range of more than 35 business programs – including innovation grants, tax and duty concessions, small business development, industry support and venture capital – worth \$2 billion a year.

- The *Industry and Small Business Policy Division* provides policy advice and analysis to portfolio Ministers on industry and small business policy issues to facilitate increased competitiveness and sustained growth for Australian businesses.
- The *Innovation Division* aims to contribute to the department’s vision to create an environment where new ideas are nurtured and innovation drives productivity, economic growth and social well being, by strengthening the links between science, research and industry.
- *Enterprise Connect*<sup>11</sup> is a division within the department, charged with the carriage of implementing and managing the Australian Government’s \$251 million Enterprise Connect initiative. It helps position Australian SMEs to be more competitive in an increasingly global market place through increased productivity, and profitability, and innovation. It also strengthens links between industry and sources of knowledge, including the research sector, by providing access to the latest information and technology.
- *Manufacturing Division* provides analysis and advice on policies to improve the competitive position of Australia's manufacturing, engineering, construction and space industries.
- The *Science and Infrastructure Division* advises the Minister for Innovation, Industry, Science and Research on policy and programs in areas of science and research infrastructure. It administers Government science and research infrastructure funding programs and develops policy to help Australia achieve a strong science and research capacity and to be engaged internationally on science and research issues.
- *Research Division* advises the Minister for Innovation, Industry, Science and Research on policy and programs relating to higher education research. It administers the Government’s Cooperative Research Centre

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<sup>10</sup> See: [www.ausindustry.gov.au](http://www.ausindustry.gov.au).

<sup>11</sup> See: [www.enterpriseconnect.gov.au](http://www.enterpriseconnect.gov.au).

(CRC) program and research block grants. In addition, the division develops policy to help Australia achieve a strong research capacity and also provides advice on major strategic research policy issues including research training, quality, funding and accountability.

- *eBusiness Division* is responsible for a range of whole-of-government and business service delivery initiatives directed at helping business interaction with government.
- *Corporate Division* provides a range of essential services and facilities to the department and its Ministers.
- The *National Measurement Institute (NMI)*<sup>12</sup> provides world-class measurement standards and services to facilitate trade and assist industry innovation.
- The *Australian Astronomical Observatory (AAO)*<sup>13</sup> is a world leader in astronomical research and in the development of innovative telescope instrumentation. *Questacon*<sup>14</sup> is Australia's National Science and Technology Centre. Since opening in 1988, it has become the national leader in developing and presenting world class creative, interactive science exhibitions and programs.
- *IP Australia*<sup>15</sup> is the Australian Government agency responsible for granting patent, trademark, industrial design and plant breeders' rights. It also manages programs to educate and promote awareness of the benefit of effective protection and use of intellectual property (IP); provides policy advice to government; develops legislation to support Australia's IP system; and contributes to bilateral and multilateral negotiations to improve IP protection internationally.
- Finally, the *business.gov.au*<sup>16</sup> website is an online government resource for the Australian business community. It provides a wide range of services and information about start-up, taxation, licensing and legislation, as well as significant transactions.

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<sup>12</sup> See: [www.measurement.gov.au](http://www.measurement.gov.au).

<sup>13</sup> See: [www.aao.gov.au](http://www.aao.gov.au).

<sup>14</sup> See: [www.questacon.edu.au](http://www.questacon.edu.au).

<sup>15</sup> See: [www.ipaustralia.gov.au](http://www.ipaustralia.gov.au).

<sup>16</sup> See: [www.business.gov.au](http://www.business.gov.au).

The Innovation, Industry, Science and Research portfolio is accountable to the Australian Parliament through the Minister for Innovation, Industry, Science and Research and the Minister for Small Business, Minister assisting on Deregulation, Minister assisting on Tourism. The DIISR Portfolio comprises the Department of Innovation, Industry, Science and Research, the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), the Australian Institute of Marine Science (AIMS), the Australian Nuclear Science and Technology Organisation (ANSTO), the Australian Research Council (ARC), the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and the Office of the Chief Scientist.

In particular, the mission of the *Australian Research Council*<sup>17</sup> is to advance Australia's research excellence to be globally competitive and deliver benefits to the community. The ARC advises the Government on research funding and policy and promotes the conduct of research and research training that is of the highest quality for the benefit of the Australian community. In seeking to achieve its mission, the ARC manages the National Competitive Grants Program (NCGP), a significant component of Australia's investment in research and development. Through the NCGP, the ARC supports the highest-quality fundamental and applied research and research training through national competition across all disciplines, with the exception of clinical medicine and dentistry. The ARC is also responsible for administering the Excellence in Research for Australia (ERA) initiative. The purpose of the ERA initiative is to assess research quality within Australia's higher education institutions and to give government, industry, business and the wider community assurance of the excellence of research conducted. It also provides a national stocktake, by research discipline areas, of research strength against international benchmarks. The ARC Discovery Programmes fund individual researchers and projects. The ARC Linkage programmes help to broker partnerships between researchers and industry, government and community organisations as well as the international community. The ARC Centres Programmes build research scale and focus and strengthen major research partnerships and networks.

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<sup>17</sup> See: [www.arc.gov.au](http://www.arc.gov.au).

The *Commonwealth Scientific and Industrial Research Organisation*<sup>18</sup> carries out scientific research to assist Australian industry and to further the interests of the Australian community; and to contribute to national and international objectives and responsibilities of the Australian Government. CSIRO also encourages or facilitates the application and use of the results of its own or any other scientific research. Secondary functions include international scientific liaison, training of research workers, publication of research results, and dissemination of science and technology.

The DIIRS is in charge of an exceptionally high number of programmes and services<sup>19</sup>. Some programmes delivered by the Department are focused on a specific field, such as the automotive sector<sup>20</sup> and the textile, clothing and footwear sector<sup>21</sup>. Moreover, the Department support many programmes aimed at sustaining the research and development activities in green and environment-friendly technologies<sup>22</sup>. The DIISR also offers a range of services to Small and Medium Enterprises (SMEs) in order to facilitate their access to innovative technologies and to help them become more innovative, efficient and competitive<sup>23</sup>. Some programmes support venture capital initiatives and highly innovative start-up companies<sup>24</sup>. The DIISR encourage companies undertaking R&D investments also through favourable financial measures<sup>25</sup>. Furthermore, through a variety of financed programmes and services, the

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<sup>18</sup> See: [www.csiro.au](http://www.csiro.au).

<sup>19</sup> For a more extensive description of the various programmes and services delivered by the DIISR, see: [www.innovation.gov.au/AboutUs/OurOrganisation/Pages/WhatWeDo.aspx](http://www.innovation.gov.au/AboutUs/OurOrganisation/Pages/WhatWeDo.aspx).

<sup>20</sup> Among the others: *A New Car Plan for a Greener Future*; *Automotive Competitiveness and Investment Scheme*; *Automotive Industry Structural Adjustment Programme*; *Automotive Transformation Scheme*; *LPG Vehicle Scheme*.

<sup>21</sup> Among the others: *TCF Innovation Package*; *Textile, Clothing and Footwear Corporatewear Register*; *Textile, Clothing and Footwear Expanded Overseas Assembly Provisions Scheme*; *Textile, Clothing and Footwear Product Diversification Scheme*; *Textile, Clothing and Footwear Small Business Programme*.

<sup>22</sup> Among the others: *Climate Ready Programme*; *Green Building Fund*; *Green Car Innovation Fund*; *Re-Tooling for Climate Change*.

<sup>23</sup> Among the others: *Business Enterprise Centres*; *Enterprise Connect*; *Small Business Online*; *Small Business Support Line*; *Small Business Tax Break*.

<sup>24</sup> Among the others: *Early Stage Venture Capital Limited Partnership*; *Innovation Investment Follow-on Fund*; *Innovation Investment Fund*; *Pre-Seed Fund*; *Venture Capital Limited Partnership Programme*.

<sup>25</sup> Among the others: *R&D Tax Concession*; *R&D Tax Credit*; *Tradex Scheme*; *Enhanced Project By-Law Scheme*. For a more extensive discussion of this topic refer to Paragraph 3.2.

Department of Innovation, Industry, Science and Research strongly supports research and development activity<sup>26</sup>.

One of the most important initiatives funded by the DIISR is the *Cooperative Research Centres (CRCs) Programme*<sup>27</sup>. A CRC is an incorporated or unincorporated organisation, formed through collaborative partnerships between publicly funded researchers and end users. Since 1991, the Commonwealth government has established well over 100 Cooperative Research Centres ranging from a wide variety of technical areas which include manufacturing, medical, information technology, environment, mining and agricultural technologies. CRCs draw industry and small to medium businesses with researchers to develop solutions for business and industry needs. However, while businesses and industry are the first to benefit from the Centres, the benefits go well beyond building a stronger economy, enhancing our health and safe guarding the environment for future generations. Every Cooperative Research Centre broadly serves the objectives of the federal Cooperative Research Centres program. These are to enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development; transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia; value of Australia of graduates researchers; and collaboration among researchers and between researchers and industry or other users, and to improve the efficiency in the use of intellectual and other research resources. Most CRCs are also characterised by a strong drive from industry and high levels of participant contribution (in the form of in-kind support and cash) relative to the grant from the Commonwealth government. The performance of a Cooperative Research Centre is closely managed by the Commonwealth government (currently the Department of Innovation, Industry, Science and Research) and by independent assessors.

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<sup>26</sup> Among the others: *Excellence in Research for Australia; International Science Linkages Programme; Joint Research Engagement; National Collaborative Research Infrastructure Strategy; Sustainable Research Excellence in Universities.*

<sup>27</sup> See: [www.crc.gov.au/Information/default.aspx](http://www.crc.gov.au/Information/default.aspx).

The Department also manages seven programmes to support research and research training in Australian Higher Education Providers (HEPs): Australian Postgraduate Awards; International Postgraduate Research Scholarships; Research Training Scheme; Commercialisation Training Scheme; Joint Research Engagement; Sustainable Research Excellence; Research Infrastructure Block Grants. In 2011, \$1.51 billion is being provided to eligible Australian Higher Education Providers (HEP) as block grants for research and research training, through a number of performance-based schemes. *Research Block Grants (RBG)*<sup>28</sup> are allocated according to performance based formula and are independent of funding for specific research projects, programs, or fellowships. HEPs have considerable autonomy in deciding what research projects, personnel, equipment and infrastructure this funding should support.

The Department of Innovation, Industry, Science and Research also encourages business-to-business cooperation on innovation projects<sup>29</sup> and assists less research-intensive universities adapt to a research system driven more strongly by performance outcomes by teaming up with other institutions to increase their research capabilities<sup>30</sup>.

The DIIRS facilitates the commercialisation of innovative ideas and products. In particular, *Commercialisation Australia*<sup>31</sup> represents a radical new initiative that assists researchers, entrepreneurs and innovative companies to convert intellectual property into successful commercial ventures. It provides multi-tiered assistance to talented researchers, entrepreneurs, and innovative firms take their ideas to market. It will give successful applicants access to specialist advice and services; funding of up to \$250,000 for proof of concept activities; and funding up to \$2 million for early stage commercialisation activities.

Finally, the DIIRS sustains a programme uniquely and specifically addressed to South Australia. The \$30 million *South Australia Innovation and Investment*

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<sup>28</sup> See: [www.innovation.gov.au/Research/ResearchBlockGrants/Pages/default.aspx](http://www.innovation.gov.au/Research/ResearchBlockGrants/Pages/default.aspx).

<sup>29</sup> *Industry Cooperative Innovation Programme*.

<sup>30</sup> *Collaborative Research Networks*.

<sup>31</sup> See: [www.commercialisationaustralia.gov.au](http://www.commercialisationaustralia.gov.au).

*Fund (SAIIF)*<sup>32</sup> was established by the Australian and South Australian Governments to assist industry development in South Australia by providing grants to innovate job creation projects to strengthen South Australia's manufacturing and technology base.

### *3.1.2. Department of Defence – Defence Science and Technology Organisation (DSTO)*<sup>33</sup>

The Defence Science and Technology Organisation (DSTO) is part of Australia's Department of Defence. DSTO is the Australian Government's lead agency charged with applying science and technology to protect and defend Australia and its national interests. DSTO delivers expert, impartial advice and innovative solutions for Defence and other elements of national security. DSTO supports Australia's defence by investigating future technologies for defence applications; ensuring Australia is a smart buyer of defence equipment; developing new defence capabilities; and enhancing existing capabilities by increasing operational effectiveness, improving safety, maximising availability and reducing the cost of ownership.

DSTO has an annual budget of approximately \$400 million and employs more than 2,300 staff, predominantly scientists, engineers, IT specialists and technicians. DSTO has a presence in nearly every state and territory in Australia. It has its national headquarters in Canberra with research facilities in Melbourne, Edinburgh (near Adelaide), Canberra, Brisbane, Sydney, HMAS Stirling at Rockingham (near Perth), Scottsdale in Tasmania, and Innisfail in northern Queensland.

At all times, DSTO works closely with the industry, science and technology community to enhance its ability to support Australia's defence and national security capabilities and to contribute to national wealth. The Defence Science and Technology Organisation is in charge of plentiful research projects in the

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<sup>32</sup> See: [www.ausindustry.gov.au/CommunityAssistance/saiif/Pages/saiif.aspx](http://www.ausindustry.gov.au/CommunityAssistance/saiif/Pages/saiif.aspx).

<sup>33</sup> See: [www.dsto.defence.gov.au](http://www.dsto.defence.gov.au).

field of defence, ranging from aircraft design and engineering to informatics and telecommunication innovations<sup>34</sup>.

### 3.1.3. *National Health and Medical Research Council (NHMRC)*<sup>35</sup>

The National Health and Medical Research Council (NHMRC) is an independent statutory agency within the portfolio of the Australian Government Minister for Health and Ageing. NHMRC brings together within a single national organisation the functions of research funding and development of advice. In fact, it is Australia's peak body for supporting health and medical research; for developing health advice for the Australian community, health professionals and governments; and for providing advice on ethical behaviour in health care and in the conduct of health and medical research. One of its strengths is that it draws upon the resources of all components of the health system, including governments, medical practitioners, nurses and allied health professionals, researchers, teaching and research institutions, public and private program managers, service administrators, community health organisations, social health researchers and consumers.

Among its primary responsibilities, NHMRC provides advice to the Australian Government on health and medical research, and manages research support and funding through a variety of mechanisms, including grants for individuals specific research projects and broad programs of research. NHMRC is committed to supporting the translation of research into improved health policy and practice. NHMRC also wishes to encourage collaboration between universities, medical research institutes and the health system (including hospitals) to facilitate research translation.

Moreover, the Council directly funds numerous research projects. NHMRC relies on peer review to judge the relative quality of research proposals competing for funding and this can only occur with the assistance of the researchers who participate on the peer review panels. Good peer review relies on the fact and the perception that it is fair, informed, expert, able to

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<sup>34</sup> For a more extensive overview of the research projects undertaken by DSTO, see: [www.dsto.defence.gov.au/research/archive.php?category](http://www.dsto.defence.gov.au/research/archive.php?category).

<sup>35</sup> See: [www.nhmrc.gov.au](http://www.nhmrc.gov.au).



identify quality and generally able to undertake the task without fear or favour. To maintain a high level of independence and increase the transparency of the peer review process, the NHMRC Academy has been established to assist with these processes. In particular, the role of the Academy will be to assist in identifying the most suitable experts to undertake the peer review tasks. Academy members are individuals with considerable knowledge of relevant Australian and International health and medical research fields. They have established reputations for high integrity, fairness and a willingness to contribute to the health and medical research sector.

In the period 2004-09, NHMRC expended over \$3.05 billion on health and medical research, funding 20,356 new and ongoing awards. Furthermore, between 2004 and 2009, the annual NHMRC expenditure on health and medical research increased by 98.98%, from \$342.3 million to \$681.1 million<sup>36</sup>.

### **3.2. Australian Taxation Regime for R&D expenditure<sup>37</sup>**

Australian legislation offers a favourable environment to R&D expenditure in order to increase the amount of R&D conducted within the Australian territory. The R&D Tax Concession is the Federal Government's principal incentive to companies undertaking research and development within Australia. It is broad-based, not industry specific, and market-driven. The applicant decides on the scope and timing of its research and development activity. However, activities under the R&D Tax Concession are required to be subjected of a research and development plan. Thus, the tax relief is addressed only to companies that think strategically about their R&D as a critical and continuous part of their business.

Under the R&D Tax Concession, companies are allowed to claim a tax deduction in their income tax return of up to 125% of their eligible expenditure on research and development activities based in Australia. A deduction of

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<sup>36</sup> For more extensive information about NHMRC research highlights, see: [www.nhmrc.gov.au/research/hss/index.htm](http://www.nhmrc.gov.au/research/hss/index.htm).

<sup>37</sup> See: "Guide to R&D Tax Concession": [www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Pages/GuidetotheRDTaxConcession.aspx](http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Pages/GuidetotheRDTaxConcession.aspx); and PricewaterhouseCoopers Australia – Taxation: Research and Development: [www.pwc.com.au/tax/research-development/index.htm](http://www.pwc.com.au/tax/research-development/index.htm).

175% is scheduled for companies whose level of R&D expenditure exceeds their average R&D expenditure over the previous three years.

Moreover, a firm can choose an R&D tax offset instead of a deduction. In order to do that, a company must have an annual turnover of less than \$5 million and an aggregated R&D amount that is more than \$20,000 and less than \$2 million per year. Eligible companies can choose to receive the offset of 30 cents for each dollar of R&D expenditure.

On 30 September 2010, the Tax Laws Amendment (Research and Development) Bill 2010 was reintroduced into the House of Representatives. The Bill was originally introduced into Parliament in June, but it did not pass the Senate when the Federal Election was called (July 2010). It proposes the introduction of a new R&D Tax Credit programme. In particular, the programme contains the following measures (as contained in the Bill released on 30 September 2010):

- A 45% refundable R&D tax offset for companies with a grouped turnover of less than \$20 million;
- A 40% non-refundable R&D tax offset for companies with a grouped turnover of more than \$20 million.

Tax incentives are designed so that they will ultimately have a beneficial effect on the whole economy through spillovers sparked off by the incentives themselves. Thus, only core R&D expenses are eligible for incentives, as they can potentially generate the coveted widespread benefits. According to the proposed Bill, in order to be eligible for the tax relief, core R&D activities must be “experimental activities whose outcome cannot be known or determined in advance” and are to be determined by “applying a systematic progression of work that is based on principles of established science”.

## 4. SOUTH AUSTRALIA: DATA ON GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT (GERD)

As suggested by the theoretical framework discussed above, innovation development is crucial for the long-term economic growth of a Country. Moreover, it has been underlined the need of governmental intervention in order to achieve the socially optimal level of research and development activity.

The Gross Expenditure on Research and Development (GERD) measures the Country's effort devoted to R&D activities. This consists of the total expenditure (current and capital) on R&D by all resident companies, research institutes, university and government laboratories, etc. It excludes R&D expenditures financed by domestic firms but performed abroad.

The relevant data was collected from the Australian Bureau of Statistics (ABS)<sup>38</sup>. The release presents summary statistics on Research and Experimental Development (R&D) undertaken by Australian organisations within the Business, Government (Commonwealth and State/Territory), Higher Education and private non-profit sectors, divided by State. The reference time period ranges from 2002-2003 to 2008-2009.<sup>39</sup>

In the reference period, South Australian total Gross Expenditure on R&D increased by 67.05%, from 1,126,143 thousand dollar to 1,881,213 thousand dollars (*Table 1* and *Graph 1*).

*Graph 2* represents the composition of South Australian GERD at the end of the reference time period (2008-09).

**Table 1: South Australian GERD 2002-2009 (\$'000)**

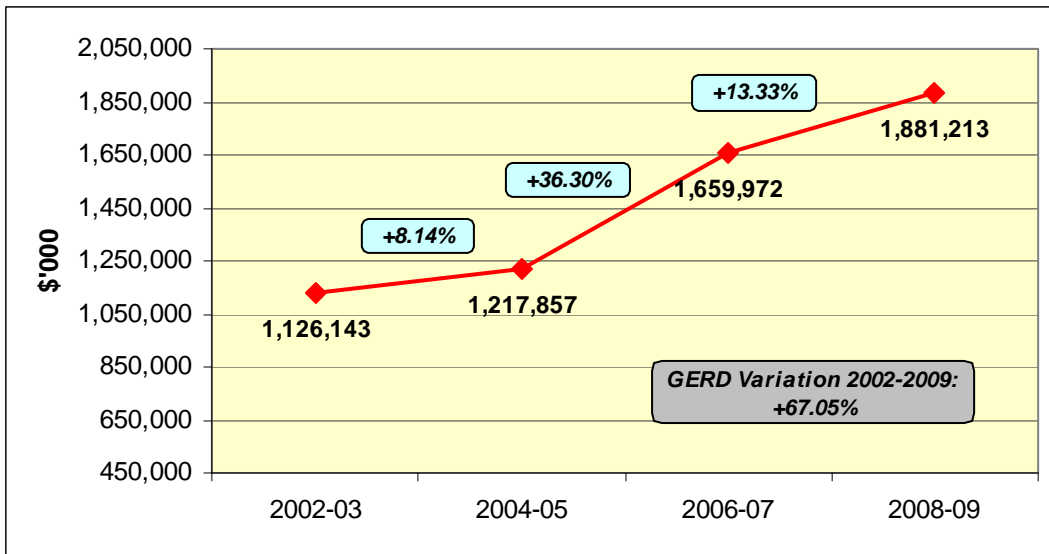
	2002-03	2004-05	2006-07	2008-09
<b>BUSINESS</b>	539,969	542,508	844,573	932,488
<b>GOVERNMENT</b>	322,083	347,821	417,183	440,758
<b>HIGHER EDUCATION</b>	257,957	325,383	395,085	505,080
<b>PRIVATE NON-PROFIT</b>	6,135	2,146	3,131	2,887
<b>TOTAL</b>	1,126,143	1,217,857	1,659,972	1,881,213

*Source: Australian Bureau of Statistics*

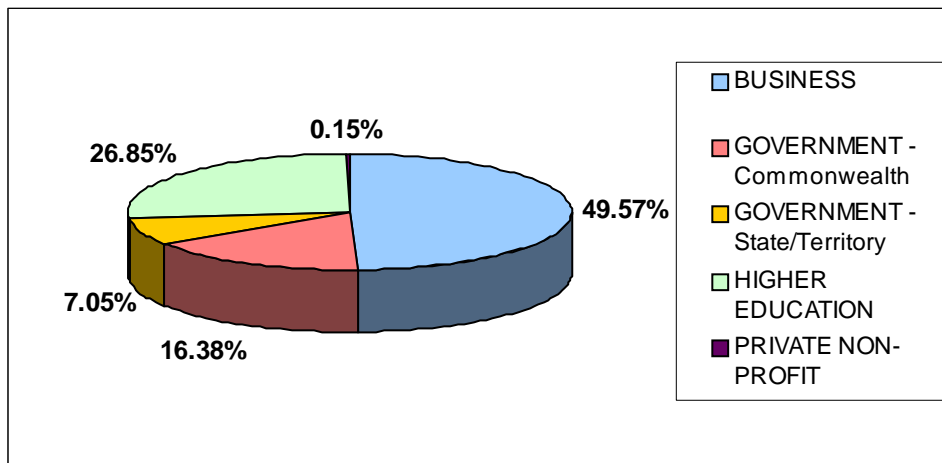
<sup>38</sup> [www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8112.02008-09?OpenDocument](http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8112.02008-09?OpenDocument).

<sup>39</sup> Annex: Table 1

**Graph 1: South Australian GERD 2002-2009**



**Graph 2: South Australian GERD composition (2008-09)**



The most common indicator of R&D levels is the ratio of Gross Expenditure on R&D to Gross Domestic Product (GDP), which denotes the degree of R&D intensity or innovation of a country. This measure makes it possible to compare the level of research and development of different countries as it is normalised for the GDP. In this analysis, the Australian States were considered and therefore the ratio of GERD to Gross State Product (GSP) was used as an indicator of research and development level (*Table 2*).

**Table 2: Ratio of Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

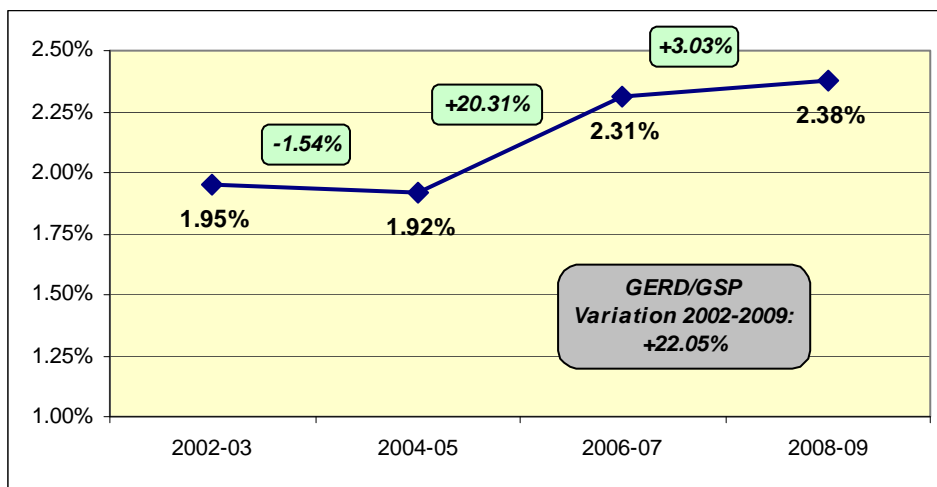
	2002-03	2004-05	2006-07	2008-09
WA	1.27%	1.71%	2.08%	2.70%
VIC	1.77%	1.86%	2.28%	2.44%
SA	1.95%	1.92%	2.31%	2.38%
TAS	1.59%	1.54%	2.13%	2.22%
NSW	1.56%	1.65%	1.88%	2.12%
QLD	1.28%	1.28%	1.48%	1.59%
NT	1.28%	1.26%	1.69%	1.43%

Source: Australian Bureau of Statistics (Authors' elaboration)

The South Australian GERD to GSP ratio increased by 22.05% between 2002 and 2009, from 1.95% to 2.38% (Graph 3).

The following graph<sup>40</sup> (Graph 4) shows the evolution of the GERD/GSP ratio between 2002 and 2009 for each State.<sup>41</sup> In 2008-09, South Australian GERD on GSP ratio was the highest after Western Australia and Victoria.

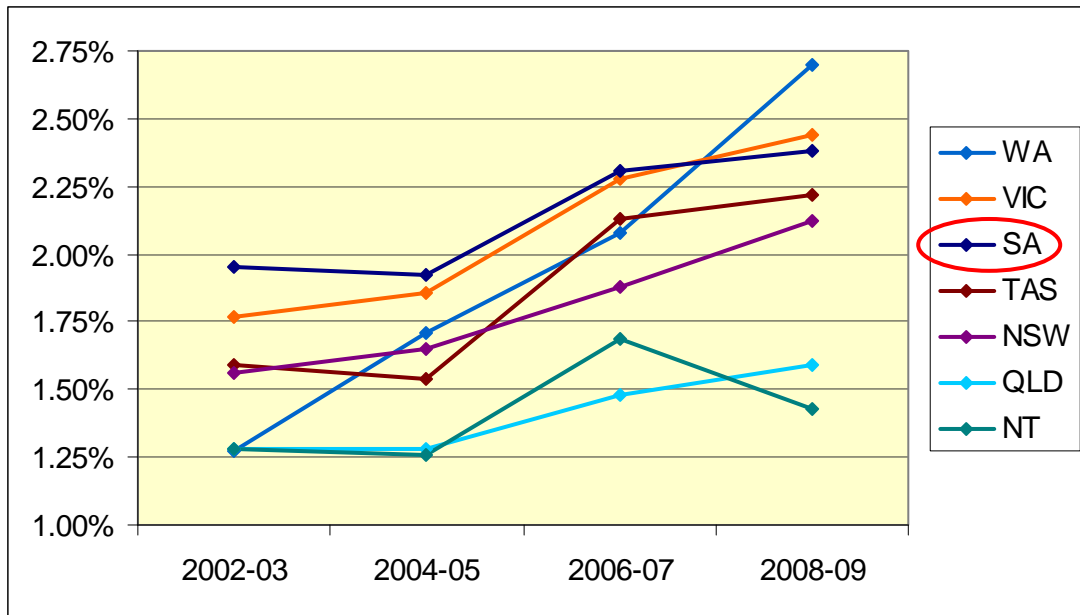
**Graph 3: South Australian ratio of Gross Expenditure on R&D on GSP**



<sup>40</sup> This and the following graphs do not contain Australian Capital Territory (ACT). This choice is due to its extreme and distorting data on GERD. In fact, ACT presents exceptionally high levels of expenditure on R&D compared to its Gross State Product (from 5.75% in 2002-03 to 4.11% in 2008-09). Moreover, most of this expenditure is financed by the Commonwealth and Higher Education institutions. In the Annex, you can find all the complete tables containing the statistics relative to the Australian Capital Territory as well.

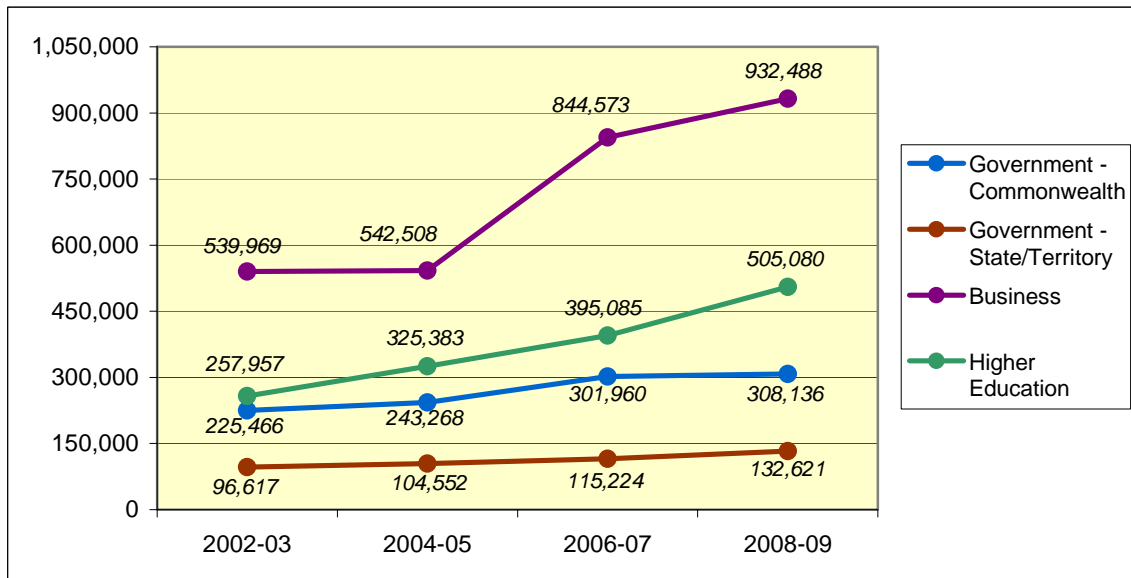
<sup>41</sup> South Australia (SA); New South Wales (NSW); Victoria (VIC); Queensland (QLS); Western Australia (WA); Tasmania (TAS); Northern Territory (NT).

**Graph 4: Gross Expenditure on R&D on GSP – Australian States/Territories**

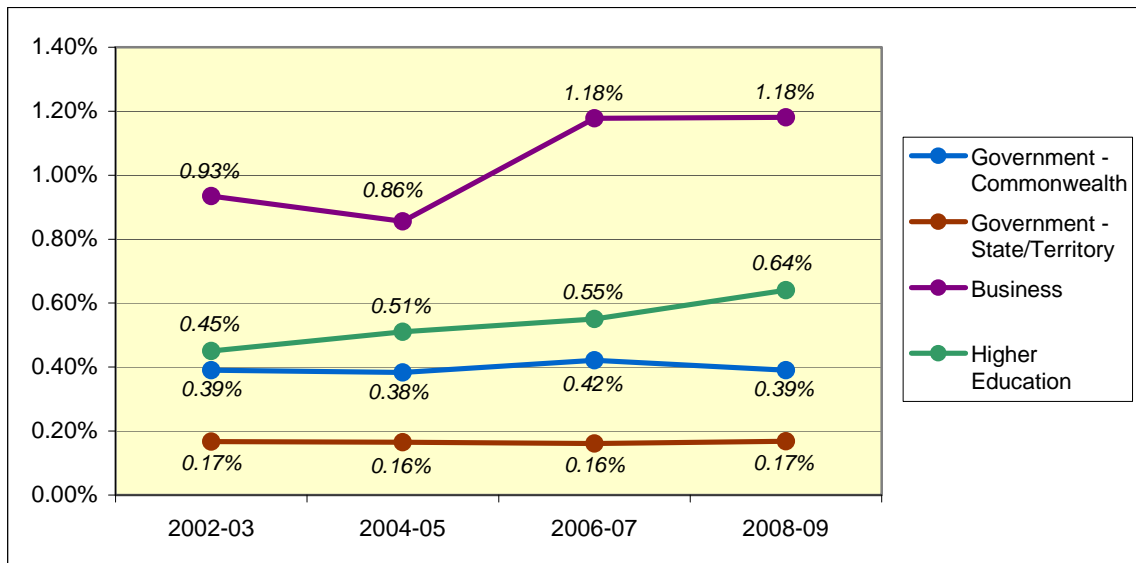


Throughout the reference time period, South Australia experienced an increase in all components of the Gross Expenditure on R&D, both in absolute terms (*Graph 5*) and in percentage of the GSP (*Graph 6*).

**Graph 5: Components of GERD (\$'000) – South Australia (2002-2009)**

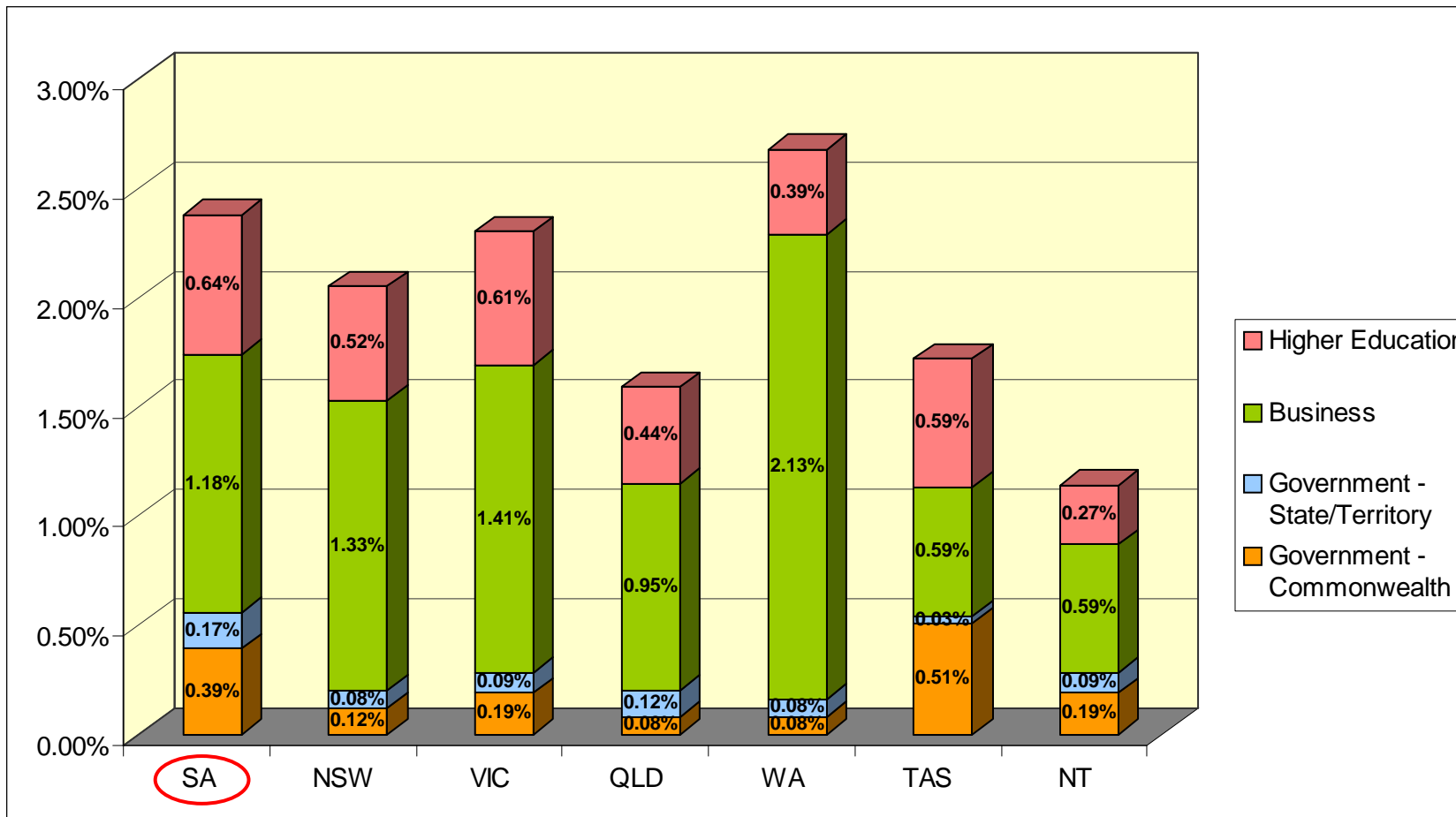


**Graph 6: Components of GERD as Percentage of GSP – South Australia (2002-2009)**



Graph 7 represents the composition of GERD for every Australian State/Territory in 2008-09. At the end of the reference period, South Australia had the highest Higher Education GERD and State Government GERD as percentage of GSP, as well as the second highest Commonwealth Government GERD as percentage of GSP.

**Graph 7: Composition of GERD as percentage of GSP (2008-2009)**





## 4.1. Composition of Gross Expenditure on Research and Development

### 4.1.1. Government Gross Expenditure on Research and Development

Government Gross Expenditure on Research and Development is divided into Commonwealth expenditure and State/Territory expenditure. The former is the research and development activity funded by the Australian Federal Government, while the latter is the R&D expenditure related to State/Territory Government (*Table 3*).

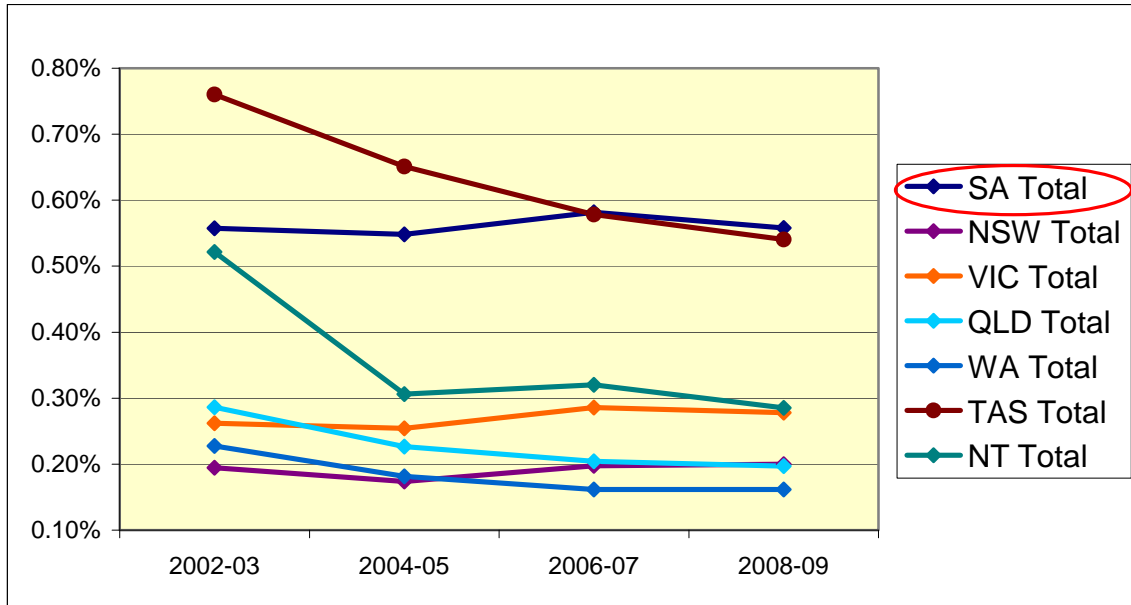
**Table 3: Government Gross Expenditure on R&D (GERD) on Gross State Product (GSP)  
– Australian States/Territories**

		2002-03	2004-05	2006-07	2008-09
SA	Commonwealth	0.39%	0.38%	0.42%	0.39%
SA	State/Territory	0.17%	0.16%	0.16%	0.17%
SA	<i>Total</i>	<i>0.56%</i>	<i>0.55%</i>	<i>0.58%</i>	<i>0.56%</i>
NSW	Commonwealth	0.10%	0.08%	0.11%	0.12%
NSW	State/Territory	0.10%	0.09%	0.09%	0.08%
NSW	<i>Total</i>	<i>0.19%</i>	<i>0.17%</i>	<i>0.20%</i>	<i>0.20%</i>
VIC	Commonwealth	0.18%	0.17%	0.20%	0.19%
VIC	State/Territory	0.08%	0.08%	0.08%	0.09%
VIC	<i>Total</i>	<i>0.26%</i>	<i>0.25%</i>	<i>0.29%</i>	<i>0.28%</i>
QLD	Commonwealth	0.10%	0.09%	0.09%	0.08%
QLD	State/Territory	0.18%	0.14%	0.11%	0.12%
QLD	<i>Total</i>	<i>0.29%</i>	<i>0.23%</i>	<i>0.20%</i>	<i>0.20%</i>
WA	Commonwealth	0.10%	0.08%	0.07%	0.08%
WA	State/Territory	0.12%	0.10%	0.09%	0.08%
WA	<i>Total</i>	<i>0.23%</i>	<i>0.18%</i>	<i>0.16%</i>	<i>0.16%</i>
TAS	Commonwealth	0.70%	0.63%	0.53%	0.51%
TAS	State/Territory	0.06%	0.02%	0.05%	0.03%
TAS	<i>Total</i>	<i>0.76%</i>	<i>0.65%</i>	<i>0.58%</i>	<i>0.54%</i>
NT	Commonwealth	0.21%	0.18%	0.13%	0.19%
NT	State/Territory	0.31%	0.13%	0.19%	0.09%
NT	<i>Total</i>	<i>0.52%</i>	<i>0.31%</i>	<i>0.32%</i>	<i>0.29%</i>

*Source: Australian Bureau of Statistics (Authors' elaboration)*

*Graph 8* shows the evolvement of the Government GERD on GSP ratio. At the end of the reference period (2008-09), South Australia boasted the highest ratio of total Government GERD on GSP.

**Graph 8: Government GERD on GSP – Australian States/Territories**

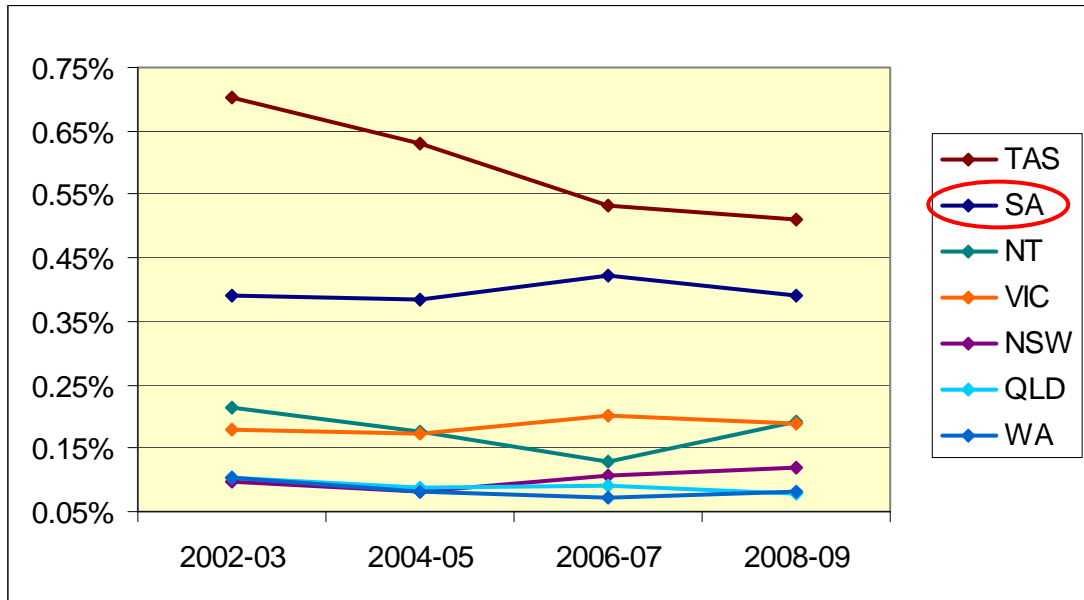


Graph 9 represents the Commonwealth GERD on GSP ratio for each State, while Graph 10 shows the ratio of State/Territory GERD on GSP. Regarding South Australia, the Commonwealth expenditure on R&D remained substantially unchanged throughout the reference period. Compared to the other States, South Australia had the highest ratio of Commonwealth GERD on GSP after Tasmania (which, however, has experienced a considerable decline in its ratio during the considered time period). Also the ratio of South Australia's State GERD did not change noticeably from 2002-03 to 2008-09. However, while in 2002-03 the State with the highest ratio of State GERD on GSP was the Northern Territory (followed by Queensland and South Australia), at the end of the reference period South Australia enjoyed the highest ratio, with a five-percentage point ahead of Queensland, which follows.

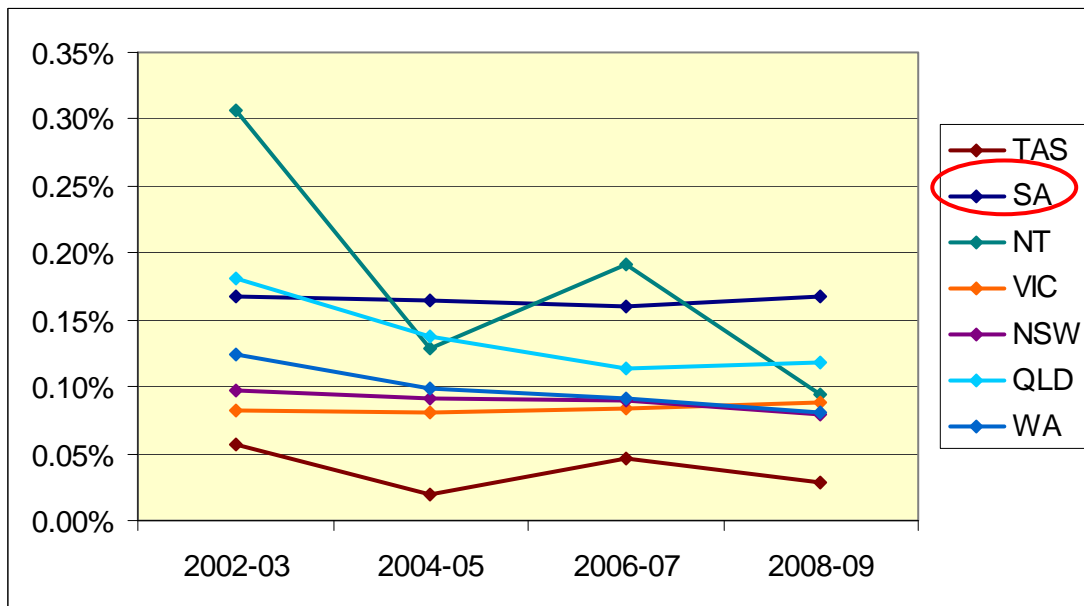
The data on Government Gross Expenditure on R&D suggests that South Australia was able to attract Federal resources and, during the reference period, maintained its level of Commonwealth expenditure on research and development, unlike most States/Territories. Moreover, the State Government had the ability to sustain its R&D and in 2008-09 exhibited the highest ratio of State/Territory GERD on GSP. It is possible to conclude that in South Australia the Government well supported the research and development

activity, which is fundamental in order to reach the socially desirable level of R&D investments.

**Graph 9: Commonwealth GERD on GSP – Australian States/Territories**



**Graph 10: State/Territory GERD on GSP – Australian States/Territories**



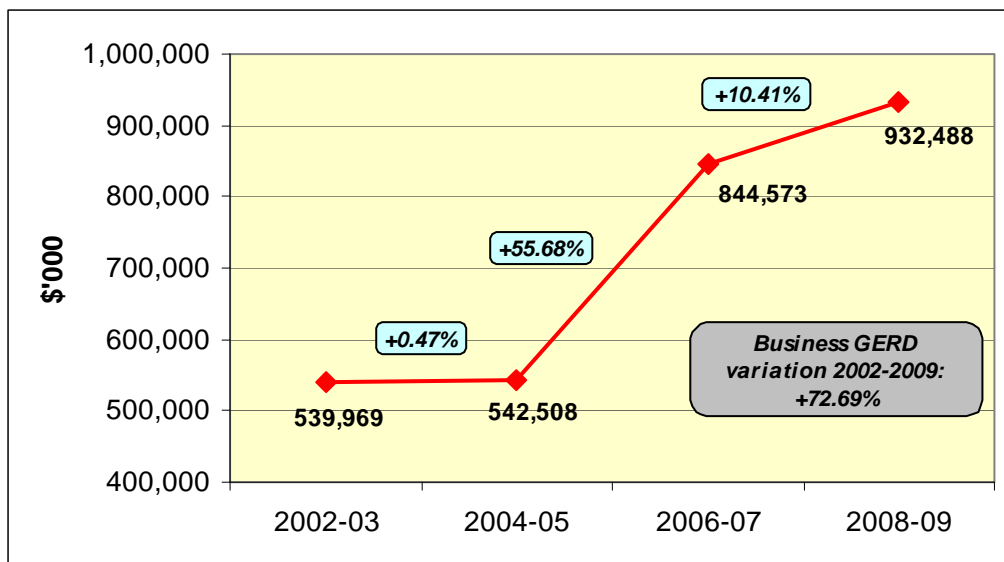
#### 4.1.2. Business Gross Expenditure on Research and Development

Obviously, parallel to R&D activity supported by the Government, it is necessary that also private firms make an effort investing in research and

development. As suggested by the theoretical framework discussed above, R&D activities contribute to the successful results of the company involved, but also to the growth of the economy as a whole. Public institutions need to boost private investments in research and innovative fields and provide themselves R&D investments that would not be otherwise privately undertaken. However, they cannot totally replace the private engagement in research and development activities.

The South Australian Business component of Gross Expenditure on R&D increased by 72.69% throughout the reference period (*Graph 11*).

**Graph 11: South Australian Business GERD (2002-2009)**



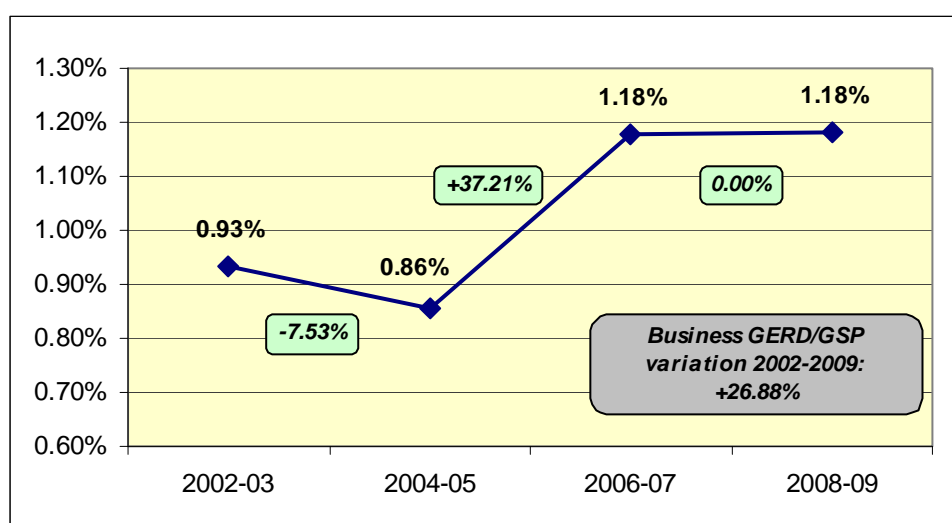
The ratio of Business GERD on GSP augmented by 26.27% from 2002-03 to 2008-09 (*Table 4* and *Graph 12*). These data underlines the considerable R&D effort undertaken by private firms in South Australia.

**Table 4: Business Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

	2002-03	2004-05	2006-07	2008-09
WA	0.68%	1.07%	1.50%	2.13%
VIC	0.98%	1.03%	1.32%	1.41%
NSW	0.98%	1.04%	1.17%	1.33%
SA	0.93%	0.86%	1.18%	1.18%
QLD	0.58%	0.63%	0.82%	0.95%
TAS	0.39%	0.43%	0.49%	0.59%
NT	na	0.36%	0.76%	0.59%

Source: Australian Bureau of Statistics (Authors' elaboration)

**Graph 12: South Australian Business GERD as percentage of GSP (2002-2009)**

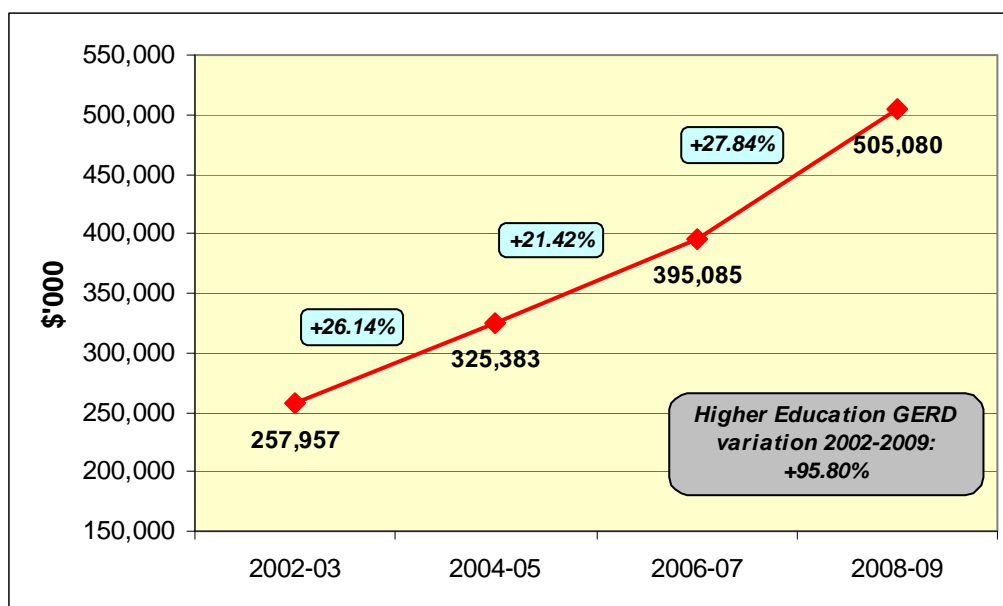


#### 4.1.3. Higher Education Gross Expenditure on Research and Development

Finally, a crucial component of the Gross Expenditure on Research and Development is represented by Higher Education investments in R&D. Universities and Research Centres are essential institutions where research and development activities are carried out and they contribute in a fundamental way to the innovative and scientific development of a Country. Higher education expenditure on R&D is financed by both government funds and private grants.

South Australian data on Higher Education GERD is very positive. Between 2002-03 and 2008-09 the State Higher Education expenditure on R&D increased by 95.80%, from 257,957 thousand dollars to 505,080 thousand dollar (Graph 13).

**Graph 13: Higher Education Gross Expenditure on R&D – South Australia**



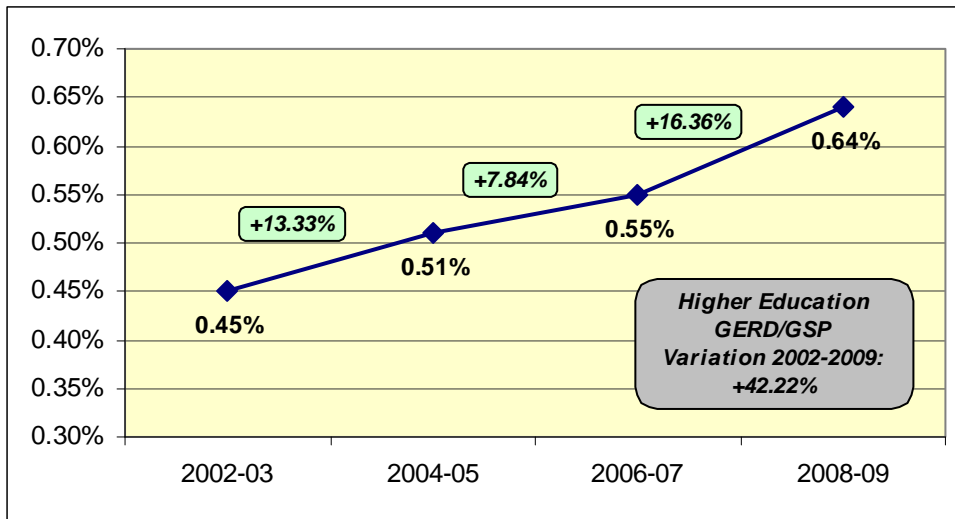
Moreover, South Australia enjoyed the highest ratio of Higher Education GERD on GSP throughout the whole considered period among the Australian States/Territories. It augmented by 42.22% (from 0.45% in 2002-03 to 0.64% in 2008-09). The South Australian ratio was also higher than the Australian National one (*Table 5; Graph 14 and Graph 15*).

**Table 5: Higher Education Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

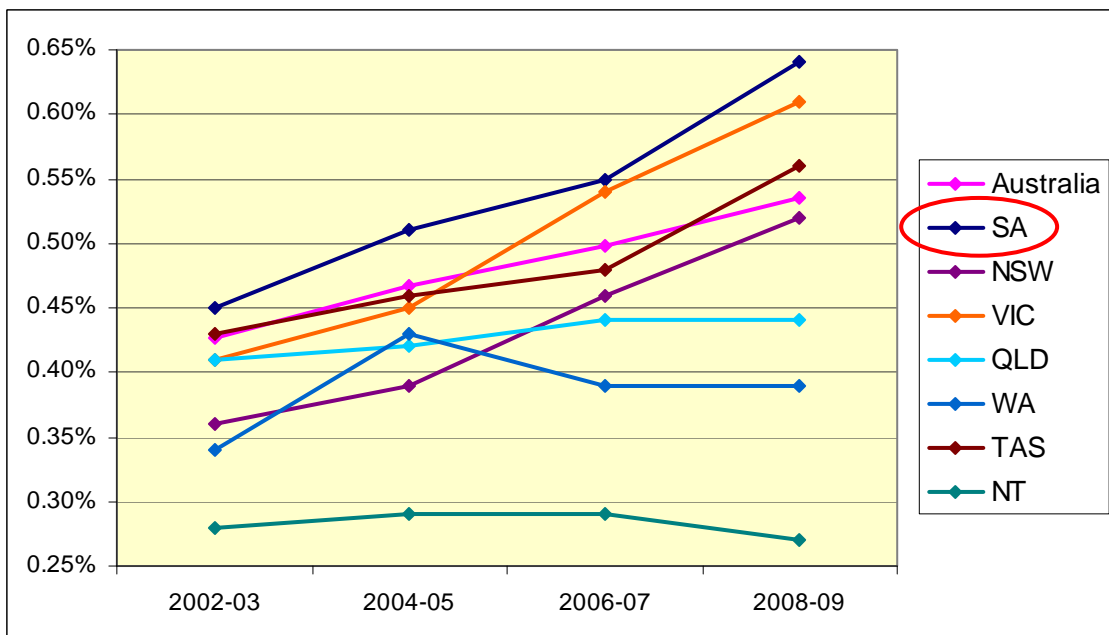
	2002-03	2004-05	2006-07	2008-09
<i>Australia</i>	0.43%	0.47%	0.50%	0.54%
SA	0.45%	0.51%	0.55%	0.64%
NSW	0.36%	0.39%	0.46%	0.52%
VIC	0.41%	0.45%	0.54%	0.61%
QLD	0.41%	0.42%	0.44%	0.44%
WA	0.34%	0.43%	0.39%	0.39%
TAS	0.43%	0.46%	0.48%	0.56%
NT	0.28%	0.29%	0.29%	0.27%

Source: Australian Bureau of Statistics (Authors' elaboration)

**Graph 14: Higher Education GERD on GSP – South Australia**



**Graph 15: Higher Education GERD on GSP – Australian States/Territories**



The results of South Australian Higher Education expenditure on R&D reflect the high quality of South Australian research undertaken by University Departments: these institutions were engaged in exceptionally consistent and considerable levels of research and development investments.

## 4.2. South Australia's Data on GERD: International Comparison

South Australia's data concerning Gross Expenditure on Research and Development reveal the State's efforts into investing in innovation activities and improving its R&D system. Indeed, among Australian States and Territories, South Australia presented the third highest ratio of GERD on GSP at the end of the reference time period (2008-09), as well as the highest Government GERD on GSP ratio, the highest State GERD on GSP ratio, and the highest Higher Education GERD on GSP ratio.

The South Australia's excellent results in R&D activity are further highlighted when it is compared to other industrialised Countries. In particular, the previous data is analysed in comparison to Australia, the European Union (27 Member Countries), the Euro Area Countries (16 European Countries), and five highly industrialised countries (France, Germany, Japan, United Kingdom, and United States). The considered years are 2003, 2005, 2007, and 2009. Data on Japanese and US GERD are not available for the year 2009, thus these two countries are excluded from the graphs showing 2009 data.

The tables and graphs in the following pages present this data. *Table 6* and *Graph 16* display the data<sup>42</sup> on total Gross Expenditure on R&D as percentage of Gross Domestic Product<sup>43</sup> (2003-2009); *Graph 17* represents 2007 data, while *Graph 18* represents 2009 data. *Table 7* and *Graph 19* present the Government funded GERD as percentage of GDP; *Graph 20* is the representation of 2007 data, while *Graph 22* is the one of 2009 data. *Table 8* and *Graph 23* show the Business GERD as percentage of GDP; *Graph 24* and *Graph 25* display 2007 data and 2009 data respectively. Finally, *Table 9* and *Graph 25* display the data regarding Higher Education GERD on GDP ratio; *Graphs 26* and *Graph 27* illustrate these data in 2007 and in 2009. The tables also include the percentage variations. South Australia data, as well as the highest values for each year, are highlighted.

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<sup>42</sup> Data on Australia and South Australia are provided by the *Australian Bureau of Statistics* ([www.abs.gov.au](http://www.abs.gov.au)). Data on EU-27, Euro Area, France, Germany, Japan, UK and USA are provided by *Eurostat* ([www.epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/](http://www.epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/)).

<sup>43</sup> GERD on GSP for South Australia and GERD on GDP for the considered countries.

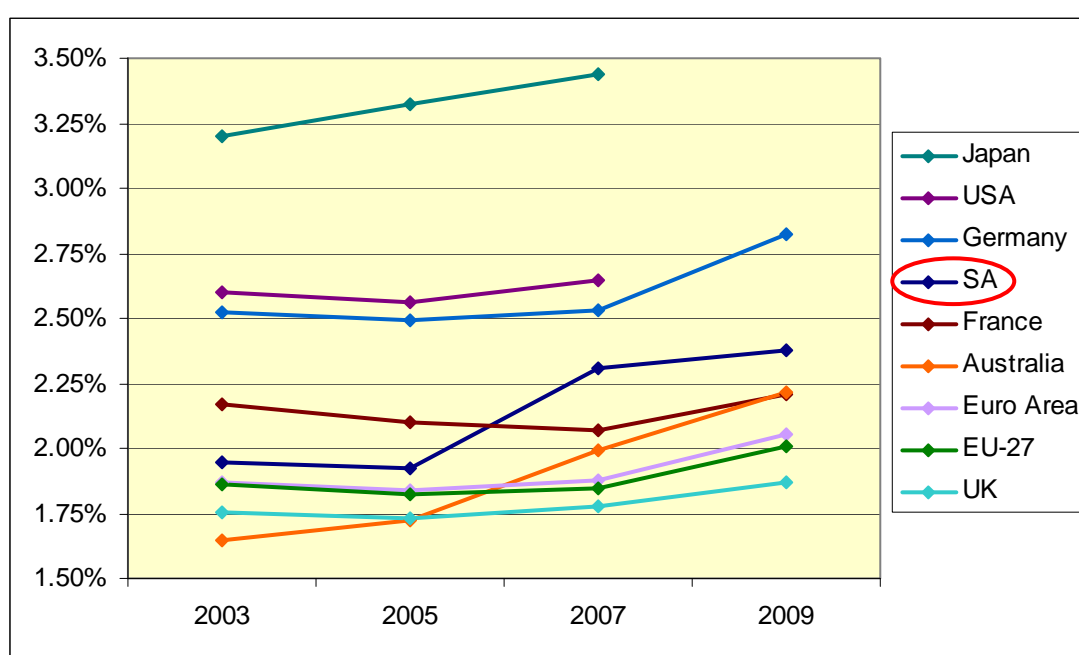


**Table 6: Gross Expenditure on R&D (Total) – 2003-2009**

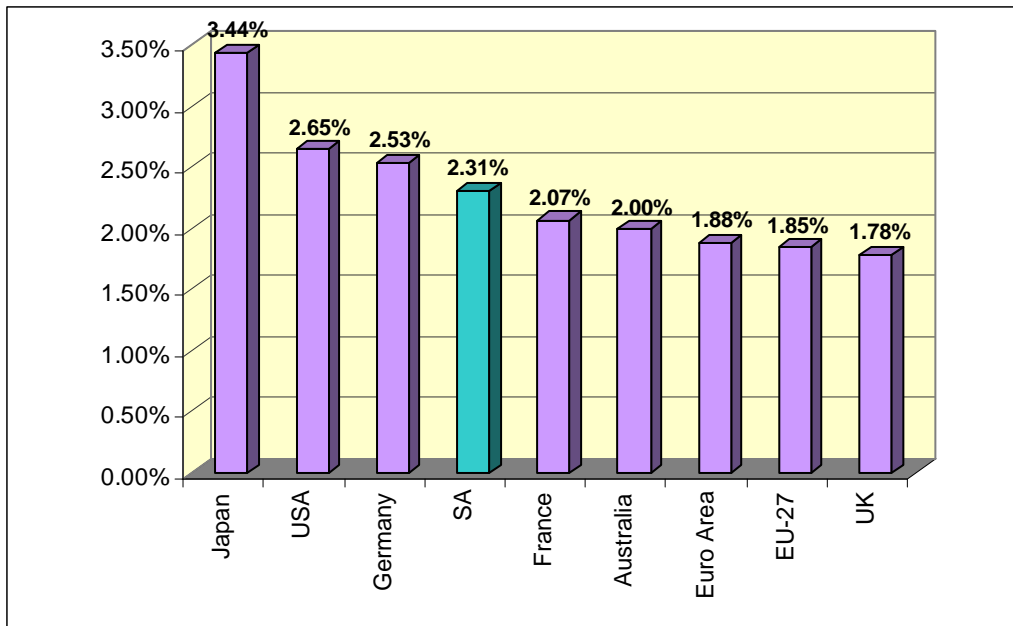
	2003	2005	2007	2009	Variation 2003-2007	Variation 2003-2009
Japan	3.20%	3.32%	3.44%	na	7.50%	na
USA	2.60%	2.56%	2.65%	na	1.92%	na
Germany	2.52%	2.49%	2.53%	2.82%	0.40%	11.90%
SA	1.95%	1.92%	2.31%	2.38%	18.46%	22.14%
France	2.17%	2.10%	2.07%	2.21%	-4.61%	1.84%
Australia	1.64%	1.72%	2.00%	2.21%	21.49%	34.77%
Euro Area	1.87%	1.84%	1.88%	2.05%	0.53%	9.63%
EU-27	1.86%	1.82%	1.85%	2.01%	-0.54%	8.06%
UK	1.75%	1.73%	1.78%	1.87%	1.71%	6.86%

Source: Australian Bureau of Statistics (Authors' elaboration) and Eurostat

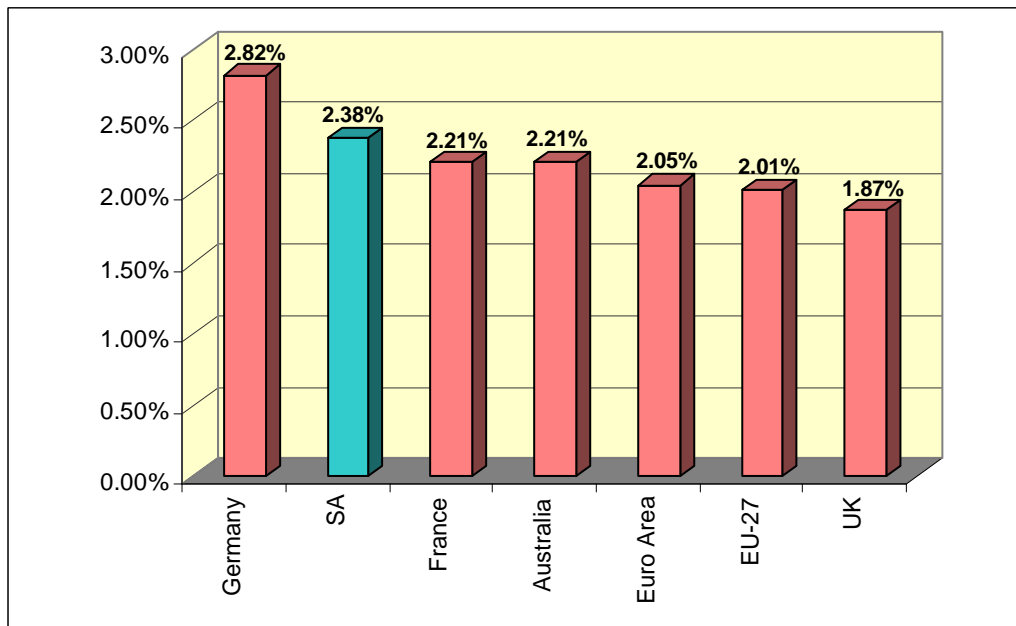
**Graph 16: Gross Expenditure on R&D (Total) – 2003-2009**



**Graph 17: Gross Expenditure on R&D (Total) - 2007**



**Graph 18: Gross Expenditure on R&D (Total) – 2009 (\*)**



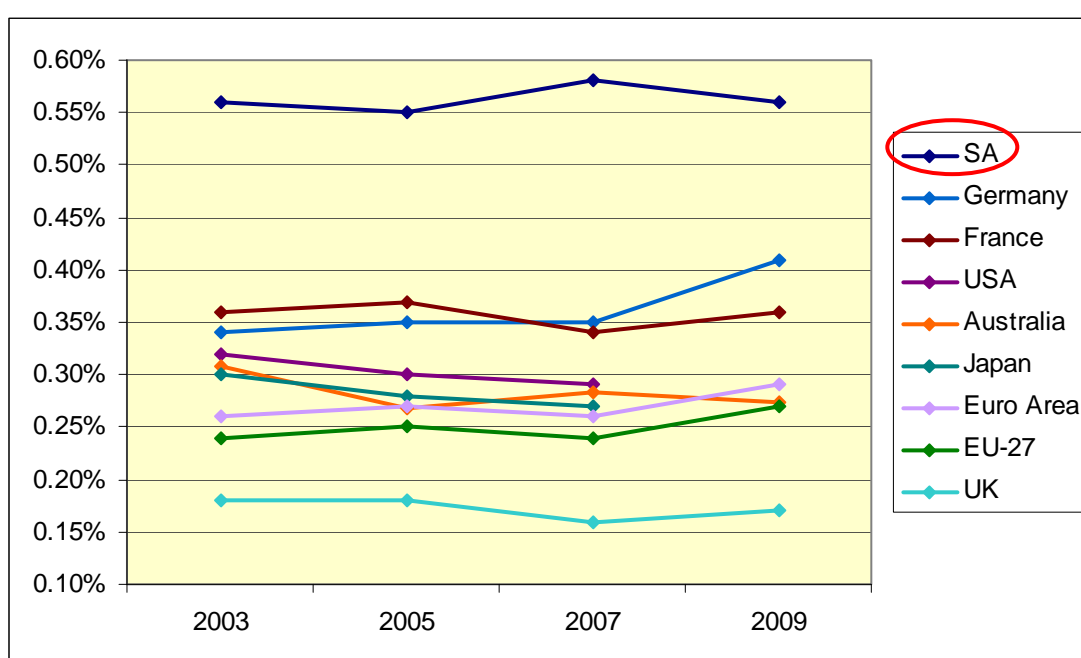
(\*) Japanese and US data on GERD are not available for 2009.

**Table 7: Government Gross Expenditure on R&D – 2003-2009**

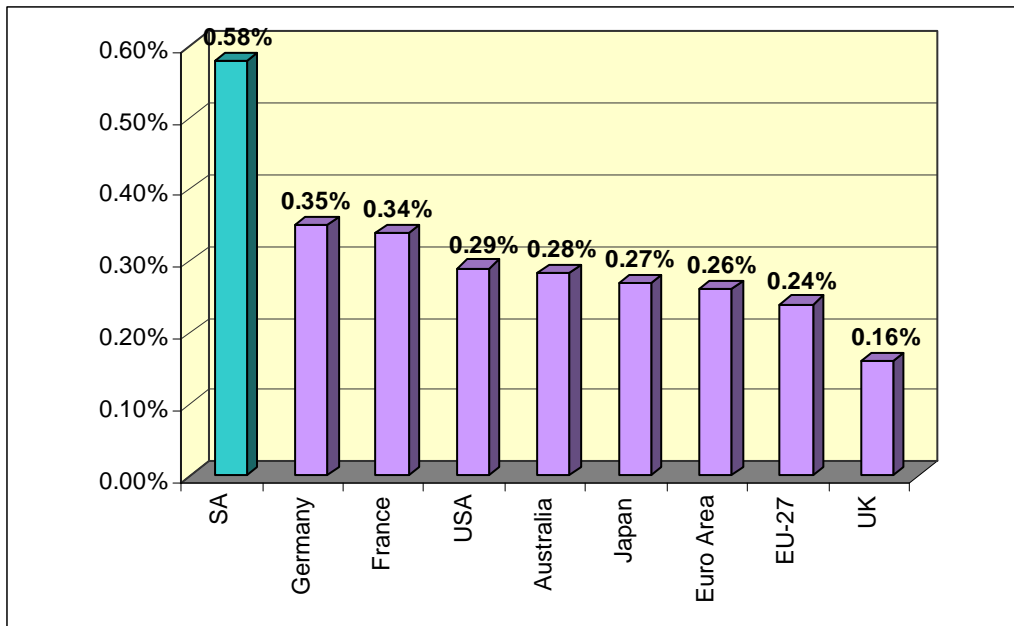
	2003	2005	2007	2009	Variation 2003-2007	Variation 2003-2009
SA	0.56%	0.55%	0.58%	0.56%	3.57%	0.00%
Germany	0.34%	0.35%	0.35%	0.41%	2.94%	20.59%
France	0.36%	0.37%	0.34%	0.36%	-5.56%	0.00%
USA	0.32%	0.30%	0.29%	na	-9.38%	na
Australia	0.31%	0.27%	0.28%	0.27%	-8.08%	-11.55%
Japan	0.30%	0.28%	0.27%	na	-10.00%	na
Euro Area	0.26%	0.27%	0.26%	0.29%	0.00%	11.54%
EU-27	0.24%	0.25%	0.24%	0.27%	0.00%	12.50%
UK	0.18%	0.18%	0.16%	0.17%	-11.11%	-5.56%

Source: Australian Bureau of Statistics (Authors' elaboration) and Eurostat

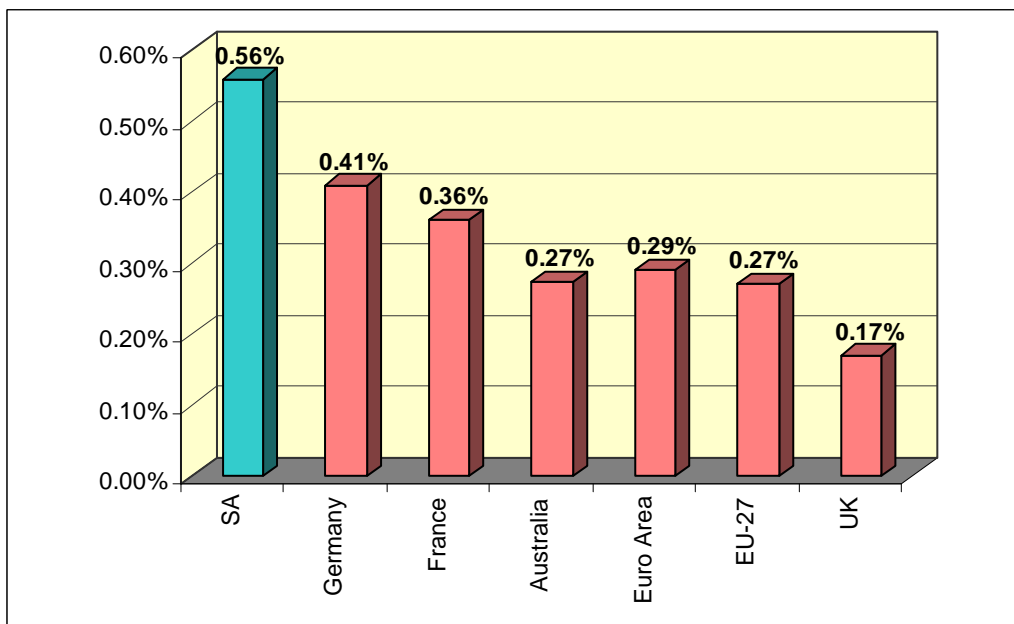
**Graph 19: Government Gross Expenditure on R&D – 2003-2009**



**Graph 20: Government Gross Expenditure on R&D – 2007**



**Graph 21: Government Gross Expenditure on R&D – 2009 (\*)**



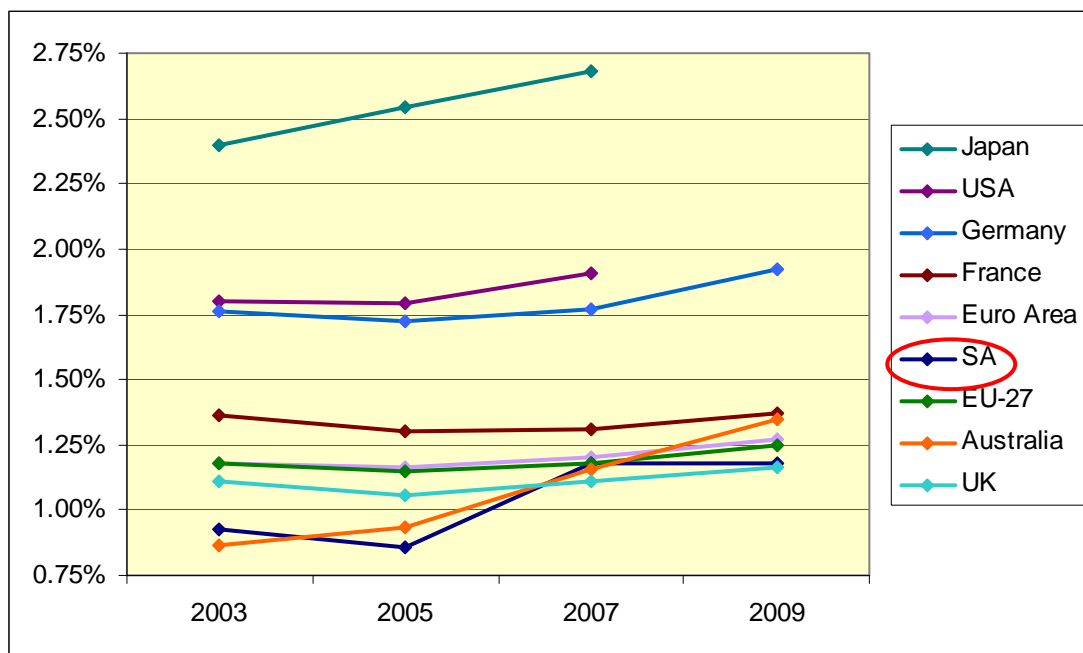
*(\*) Japanese and US data on GERD are not available for 2009.*

**Table 8: Business Gross Expenditure on R&D – 2003-2009**

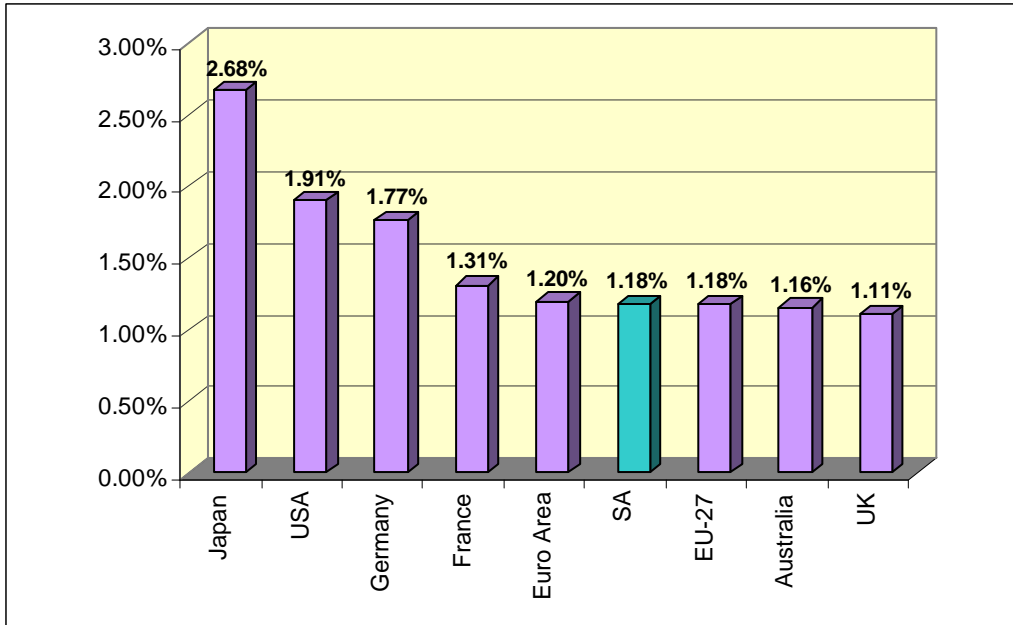
	2003	2005	2007	2009	Variation 2003-2007	Variation 2003-2009
Japan	2.40%	2.54%	2.68%	na	11.67%	na
USA	1.80%	1.79%	1.91%	na	6.11%	na
Germany	1.76%	1.72%	1.77%	1.92%	0.57%	9.09%
France	1.36%	1.30%	1.31%	1.37%	-3.68%	0.74%
Euro Area	1.18%	1.16%	1.20%	1.27%	1.69%	7.63%
SA	0.93%	0.86%	1.18%	1.18%	26.88%	26.88%
EU-27	1.18%	1.15%	1.18%	1.25%	0.00%	5.93%
Australia	0.86%	0.94%	1.16%	1.35%	34.23%	55.92%
UK	1.11%	1.06%	1.11%	1.16%	0.00%	4.50%

Source: Australian Bureau of Statistics (Authors' elaboration) and Eurostat

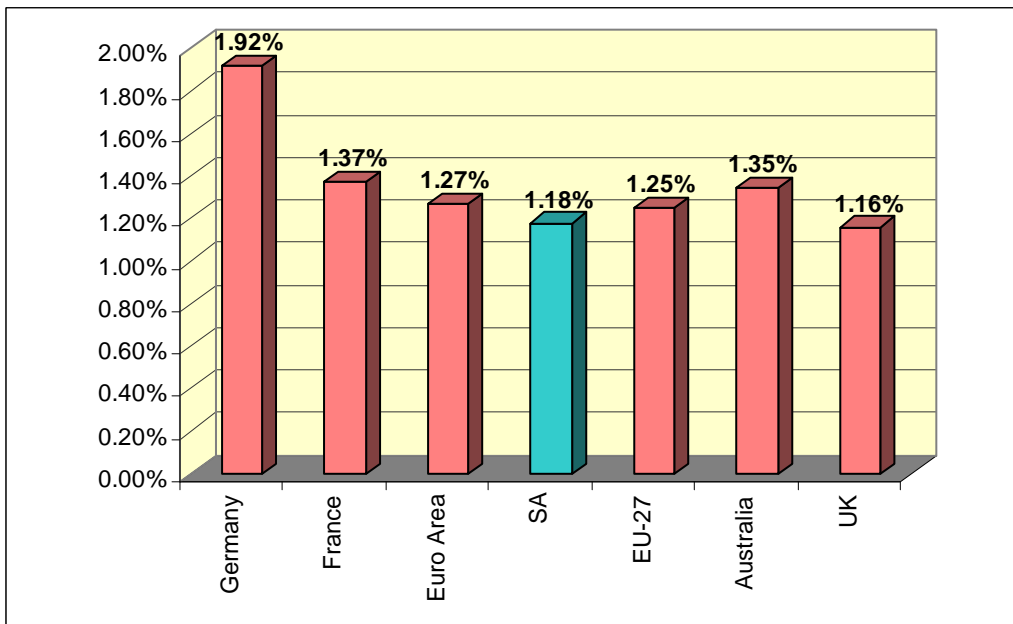
**Graph 22: Business Gross Expenditure on R&D – 2003-2009**



**Graph 23: Business Gross Expenditure on R&D – 2007**



**Graph 24: Business Gross Expenditure on R&D – 2009 (\*)**



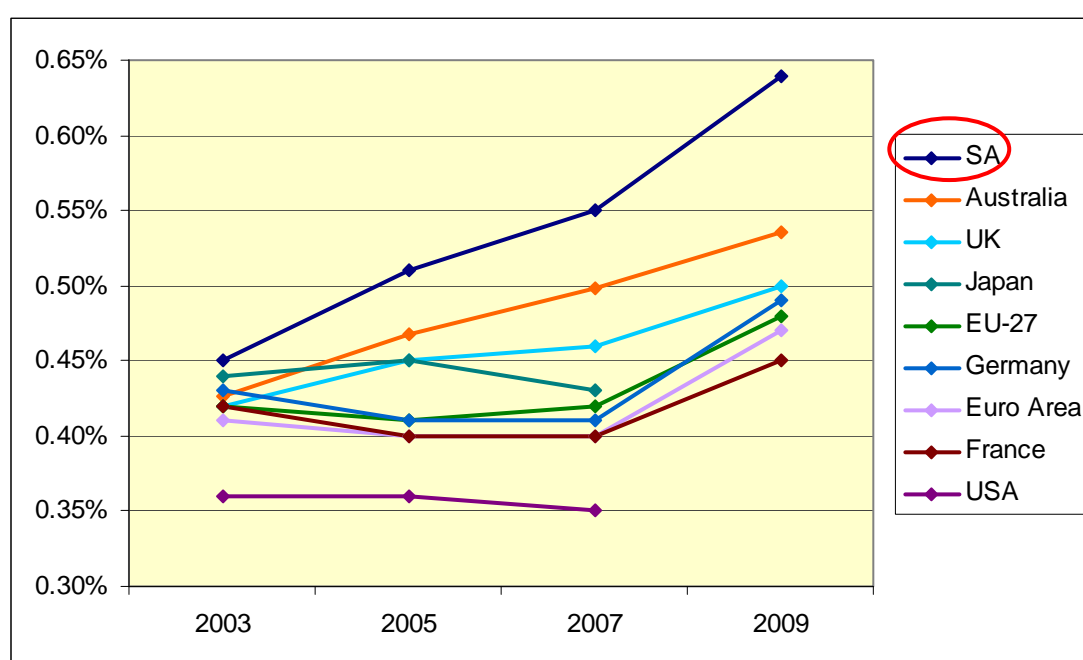
(\*) Japanese and US data on GERD are not available for 2009.

**Table 9: Higher Education Gross Expenditure on R&D – 2003-2009**

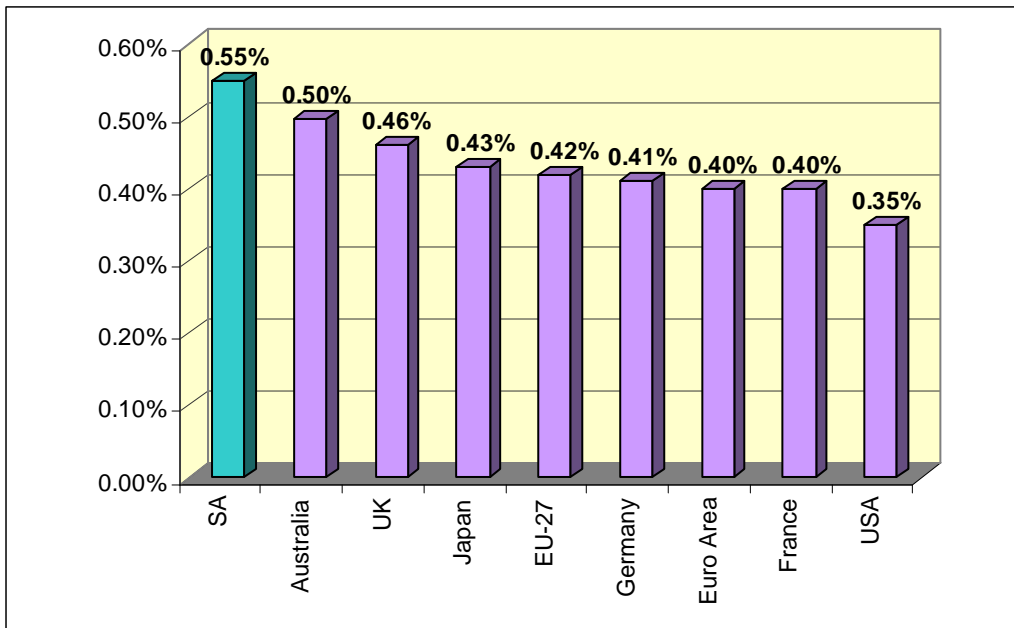
	2003	2005	2007	2009	Variation 2003-2007	Variation 2003-2009
SA	0.45%	0.51%	0.55%	0.64%	22.22%	43.17%
Australia	0.43%	0.47%	0.50%	0.54%	16.77%	25.72%
UK	0.42%	0.45%	0.46%	0.50%	9.52%	19.05%
Japan	0.44%	0.45%	0.43%	na	-2.27%	na
EU-27	0.42%	0.41%	0.42%	0.48%	0.00%	14.29%
Germany	0.43%	0.41%	0.41%	0.49%	-4.65%	13.95%
Euro Area	0.41%	0.40%	0.40%	0.47%	-2.44%	14.63%
France	0.42%	0.40%	0.40%	0.45%	-4.76%	7.14%
USA	0.36%	0.36%	0.35%	na	-2.78%	na

Source: Australian Bureau of Statistics (Authors' elaboration) and Eurostat

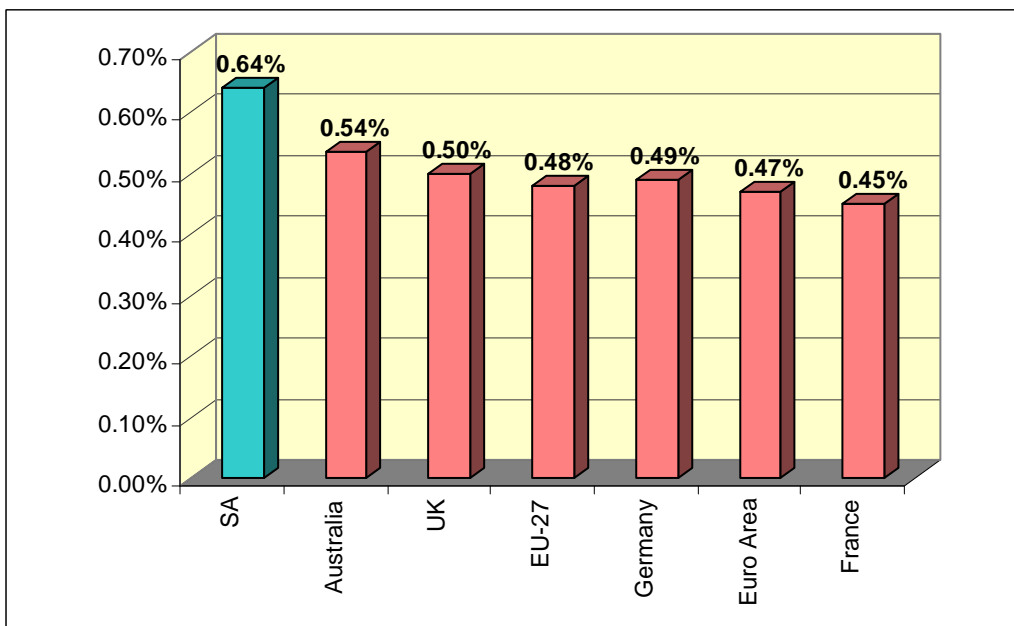
**Graph 25: Higher Education Gross Expenditure on R&D – 2003-2009**



**Graph 26: Higher Education Gross Expenditure on R&D – 2007**



**Graph 27: Higher Education Gross Expenditure on R&D – 2009 (\*)**



(\*) Japanese and US data on GERD are not available for 2009.



Regarding the ratio of Gross Expenditure on R&D on GDP, in 2007 South Australia was placed just after Japan, the United States and Germany, and before France, the European Union and the United Kingdom. The State also experienced a high rate of growth of the GERD on GSP ratio (+18.46%) compared to the other considered countries.

As stated above, the Government commitment to sustain the research and development activity is fundamental. Throughout the reference time period, South Australia boasted the highest ratio of Gross Expenditure on R&D on GDP among the considered countries. This suggests the high consideration that the South Australia's public sector (both from the Commonwealth and the State Government) addressed to innovation and research investments.

With reference to the share of Gross Expenditure on Research and Development financed by the business sector, South Australia did not stand out. In fact, at the end of the reference period, only the United Kingdom registered a worse result in this field. However, between 2003 and 2009, South Australia experienced the second highest percentage increase in the Business GERD (+26.88%), which suggests the increasing effort undertaken by private companies to sustain the State R&D activity throughout the years. As it is theoretically accepted that a strong Government investment in R&D supports and encourages the private engagement in innovative activities, it is possible to conclude that the high level and stability of the South Australia's public founding of R&D throughout the reference time period had positively stimulate the State business contribution to research and development, resulting in its considerable growth. In fact, in 2003 South Australia's Business GERD on GDP ratio was the lowest (together with Australian one), while at the end of the reference period its ratio is average.

Finally, South Australia emerges in particular for its Higher Education Gross Expenditure on Research and Development as percentage of Gross Domestic Product. Even though at the beginning of the period this ratio was aligned with those of the other considered countries, between 2003 and 2009 the State Higher Education investment in research activities grew markedly (+43.17%) and ended up with an extremely high and satisfying result (0.64% of GDP). This figure highlights the effort undertaken by South Australia's universities in the R&D field.

## **5. R&D IN SOUTH AUSTRALIA: UNIVERSITIES AND RESEARCH CENTRES**

As stated above, South Australian Higher Education expenditure on research and development activities is very high. South Australia boasts three high profile and internationally recognised universities based in its capital city: University of South Australia, University of Adelaide, and Flinders University. Moreover, two foreign universities have opened offshore campuses in Adelaide including Carnegie Mellon University (USA) and University College London (UK). These are extremely outstanding and renowned universities, which are offering niche degrees in the field of technology, energy and public policy. Furthermore, a number of Federal Research Centres are based in South Australia: four Cooperative Research Centres (CRCs) have their headquarters in the State; many divisions of the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) are represented; and the Defence Science and Technology Organisation (DSTO) has an office in the State. Finally, the South Australian Research and Development Institute (SARDI) is the State Government's principal research institute.

Parallel to these major Research Centres, South Australia hosts a number of other excellent institutions engaged in R&D activities. For instance, the Australian Wine Research Institute and the Australian Centre for Plant Functional Genomics are internationally well known and recognised.

### **5.1. South Australia's Universities**

#### *5.1.1. University of Adelaide<sup>44</sup>*

The University of Adelaide was founded in 1874 (it is the oldest of the State's universities) and is one of Australia's leading universities. In fact, it is one of Australia's Group of Eight (Go8).<sup>45</sup> The Go8 is a coalition of leading Australian

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<sup>44</sup> See: [www.adelaide.edu.au](http://www.adelaide.edu.au).

<sup>45</sup> See: [www.go8.edu.au](http://www.go8.edu.au).

universities<sup>46</sup>, intensive in research and comprehensive in general and professional education.

The University of Adelaide has major strengths in wine and food, health sciences, biological sciences, physical sciences, information technology and telecommunications, environmental sciences and social sciences. There are five faculties: Engineering, Computer and Mathematical Sciences; Health Sciences; Humanities and Social Sciences; Professions; and Sciences. The University of Adelaide offers courses at both undergraduate and postgraduate degree and diploma level across a wide range of disciplines.

The University has produced 102 Rhodes Scholars<sup>47</sup> (at December 2009) and five Nobel Laureates are among its alumni: Sir William Bragg (1862–1942) and Sir Lawrence Bragg (1890–1971) for the discovery of X-ray crystallography (Nobel Prize for Physics, 1915); Sir Howard Walter Florey (1898–1968) for his role in the extraction of penicillin (Nobel Prize for Physiology or Medicine, 1945); John M Coetzee (1940–) for his novels about the effects of colonization (Nobel Prize for Literature, 2003); and Professor Barry Marshall (1951–) for his discovery of the bacterium *Helicobacter pylori* and its role in gastritis and peptic ulcer disease (Nobel Prize for Physiology or Medicine, 2005).

The University has four onshore campuses. North Terrace, in the cultural heart of the city of Adelaide, is the main campus and site of most teaching and research facilities. Thebarton campus in the inner western suburbs is one of the premier University-owned technology/research parks in Australia. Waite campus in suburban Urrbrae encompasses the largest agricultural research complex in the Southern hemisphere, with many co-located government and industry partners. Roseworthy campus, 50km north of Adelaide, is an internationally renowned centre for excellence in agriculture and animal science.

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<sup>46</sup> Go8 Members: University of Western Australia; University of New South Wales; Monash University; University of Queensland; University of Melbourne; University of Adelaide; University of Sydney; and Australian National University.

<sup>47</sup> *Established in the will of Cecil Rhodes in 1902, the Rhodes is the oldest and perhaps the most prestigious international graduate scholarship program in the world. Intellectual excellence is required of Rhodes Scholars, but it is not enough to earn this outstanding educational opportunity. Rhodes' vision in founding the Scholarship was to develop outstanding leaders who would be motivated to "esteem the performance of public duties as their highest aim"* ([www.adelaide.edu.au/graduatecentre/scholarships/postgrad/rhodes.html](http://www.adelaide.edu.au/graduatecentre/scholarships/postgrad/rhodes.html)).

Moreover, the University also offers a growing range of programs in Singapore through the Ngee Ann-Adelaide Education Centre, a partnership with the Ngee Ann Kongsi.

### *5.1.2. Flinders University<sup>48</sup>*

The Flinders University was established in 1966. Flinders has built a strong reputation for quality and innovation in its courses and in its teaching. It was the first university in the world to have a bachelor course in nanotechnology, and the first in Australia to offer a graduate entry medical course.

Flinders University has four faculties: Education, Humanities, Law and Theology; Science and Engineering; Social and Behavioral Sciences; Health Sciences. A wide range of courses are offered, from undergraduate degrees to PhDs.

Flinders University's Bedford Park campus is situated within the foothills of the Southern Mt Lofty Ranges, few kilometers from Adelaide. It also has a presence in Victoria Square, the heart of Adelaide, where they provide information and advice to students, teach a selection of courses and topics, and engage with major business, community and political stakeholders.

A range of courses are delivered offshore by academic staff from Flinders in association with a foreign partner institution. Some courses also can be taken offshore through distance education. Flinders University's partner institutions are: Xianda College (Shanghai), Nankai University (Tianjin), and Capital Normal University (Beijing) in China; The Chinese University of Hong Kong in Hong Kong; HELP College in Malaysia; Social Services Training Institute, ECON Healthcare, National Cancer Council, PostAllied Health Training Institute - Singapore General Hospital, and Parkway College of Nursing and Allied Health in Singapore.

### *5.1.3. University of South Australia<sup>49</sup>*

The University of South Australia was funded in 1991 through the amalgamation of the South Australian Institute of Technology and the Magill, Salisbury and Underdale campuses of the South Australian College of

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<sup>48</sup> See: [www.flinders.edu.au](http://www.flinders.edu.au).

<sup>49</sup> See: [www.unisa.edu.au](http://www.unisa.edu.au).

Advanced Education. Therefore, it was built on more than a century's experience in educating professionals and applied research and it is the largest university in South Australia. It is part of the Australian Technology Network of Universities (ATN).<sup>50</sup> The ATN is an influential alliance of five distinctive and prominent universities<sup>51</sup> from each Mainland State and its aim is to help enhance Australia's social and economic wealth by creating, disseminating and applying new knowledge.

The University of South Australia has four divisions: Business; Education, Arts and Social Sciences; Health Sciences; and Information Technology, Engineering and the Environment. It offers a wide range of undergraduate degrees, Masters of Science and PhDs across numerous disciplines.

The University has five campuses. City West campus is located amidst Adelaide's educational and cultural precinct and is characterised by innovative learning facilities and a range of research activities across the disciplines. City East campus is focused on the health, biomedical and nursing professions. Magill campus, set in spacious parklands eight kilometres from the city, can boast student-centred learning facilities for a range of humanities and social science disciplines. Mawson Lakes campus is located twenty minutes north of Adelaide and is the main campus for the Division of IT, Engineering and the Environment. Finally, Whyalla campus is four hundred kilometres from Adelaide and represents the major centre of tertiary education in rural South Australia. Whyalla's academic programs focus on business, social work, and nursing along with research opportunities in rural health and community. As part of the University of South Australia's regional engagement strategy, Mount Gambier Regional Centre was established in 2005, with undergraduate degree level studies in the program areas of: Nursing and Rural Health; Social Work and Rural Practice; and Business and Regional Enterprise. The University's Foundation Studies Regional Strand is also on offer at Mount Gambier.

Furthermore, the University of South Australia is among the largest providers of transnational education in Australia. Its transnational programs offer

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<sup>50</sup> See: [www.atn.edu.au](http://www.atn.edu.au).

<sup>51</sup> ATN Members: University of Technology, Sydney; RMIT University; Curtin University of Technology; Queensland University of Technology; University of South Australia.

students in four countries the opportunity to complete a University of South Australia degree in their home country (*Offshore Programs*<sup>52</sup>). Some programs include a period of study in Australia, while others can be completed outside Australia at one of the University's partner institutions. Its partner institutions are: Hong Kong Baptist University and Hopkins Training and Education Group in Hong Kong; Institute Jantung Negara, Taylor's University College, and Taylor's College in Malaysia; Beijing University of Civil Engineering and Architecture (BUCEA) (Beijing) and Jiangxi University of Finance and Economics (Jiangxi) in China; and Kaplan Higher Education in Singapore.

#### 5.1.4. South Australia's Universities: Data on Students<sup>53</sup>

This section presents some relevant data about the total number of students enrolled in South Australia's universities, the presence of international students, and the students involved in postgraduate research activities.

The University of South Australia had the largest number of total students, followed by University of Adelaide and Flinders University. However, in the reference period (2005-2009), Flinders experienced the higher increase in the number of enrolled students (+17.21%) (*Table 10* and *Graph 28*).

**Table 10: Total Number of Enrolled Students**

	2005	2006	2007	2008	2009	2005-2009 Variation
Uni South Australia	32266	33680	34603	36156	36850	14.21%
Uni Adelaide	19222	19646	20478	21311	22471	16.90%
Flinders Uni	16010	17051	17320	17681	18766	17.21%
<b>TOTAL</b>	<b>67498</b>	<b>70377</b>	<b>72401</b>	<b>75148</b>	<b>78087</b>	<b>15.69%</b>

Source: Universities' websites (see footnote 53)

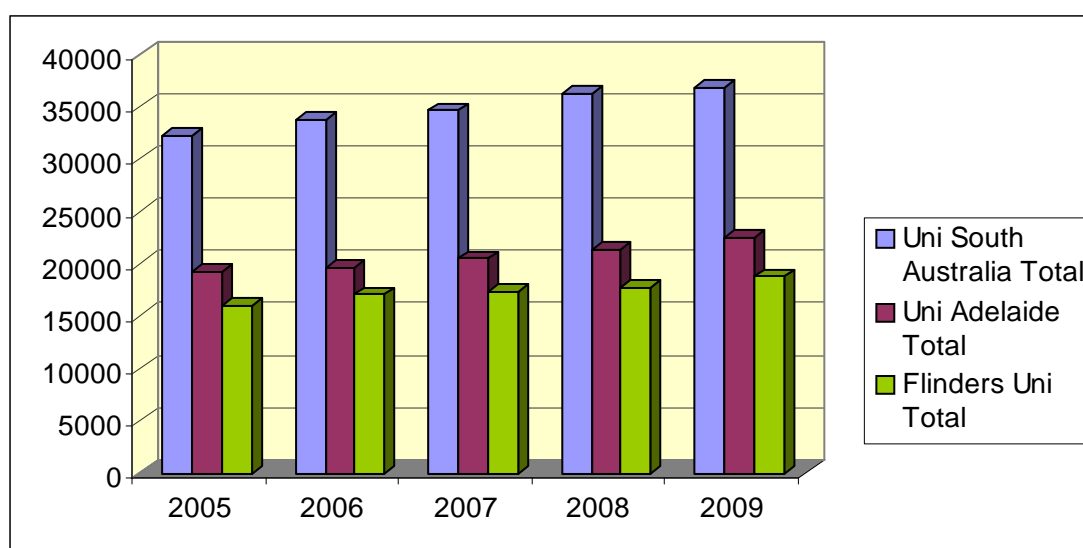
<sup>52</sup> See: [www.unisa.edu.au/partner/transnational/default.asp](http://www.unisa.edu.au/partner/transnational/default.asp).

<sup>53</sup> **University of South Australia:** data about students are taken from the report "University of South Australia: Key statistics 2004 to 2009" ([www.unisa.edu.au/pas/bai/keystatistics/keystatistics.asp](http://www.unisa.edu.au/pas/bai/keystatistics/keystatistics.asp)).

**University of Adelaide:** data about students are taken from the 2005-2009 "Pocket Statistics" reports ([www.adelaide.edu.au/sp/statistics](http://www.adelaide.edu.au/sp/statistics)).

**Flinders University:** data about students are taken from the 2005-2009 "Quick Stats" Brochures ([planning.flinders.edu.au/?content=quickstats](http://planning.flinders.edu.au/?content=quickstats)).

**Graph 28: Total Number of Students (2005-2009)**



Regarding international students, it is necessary to underline a distinction: international students are foreign students attending courses in South Australia, while transnational students are those attending courses offered by South Australia's universities offshore.

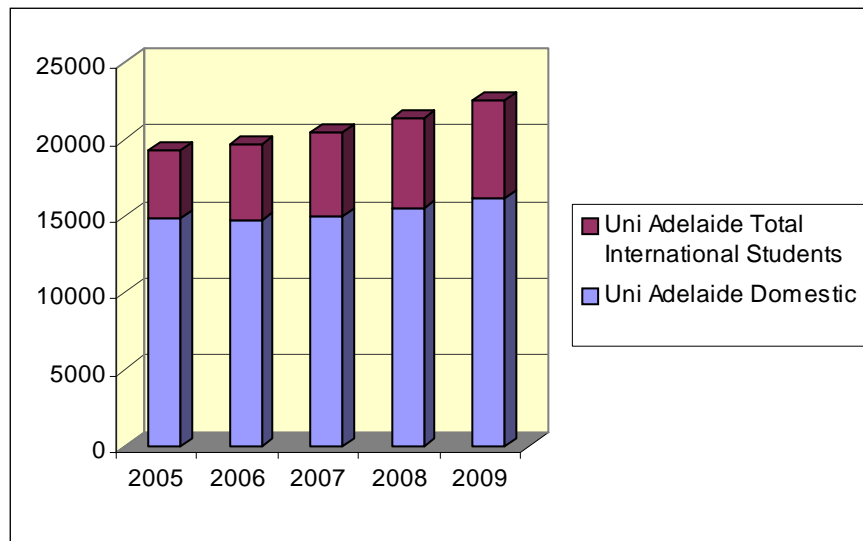
**Table 11: Enrolments: Domestic, International and Transnational students**

		2005	2006	2007	2008	2009
Uni South Australia	Domestic	22342	23193	23028	23077	23275
Uni South Australia	International	4177	4654	4875	5355	6137
Uni South Australia	Transnational	5747	5833	6700	7724	7438
<i>Uni South Australia</i>	<i>Total International Students</i>	<i>9924</i>	<i>10487</i>	<i>11575</i>	<i>13079</i>	<i>13575</i>
<b>Uni South Australia</b>	<b>Total</b>	<b>32266</b>	<b>33680</b>	<b>34603</b>	<b>36156</b>	<b>36850</b>
Uni Adelaide	Domestic	14796	14721	15008	15454	16181
Uni Adelaide	International	3637	4195	4739	5191	5664
Uni Adelaide	Transnational	789	730	731	666	626
<i>Uni Adelaide</i>	<i>Total International Students</i>	<i>4426</i>	<i>4925</i>	<i>5470</i>	<i>5857</i>	<i>6290</i>
<b>Uni Adelaide</b>	<b>Total</b>	<b>19222</b>	<b>19646</b>	<b>20478</b>	<b>21311</b>	<b>22471</b>
Flinders Uni	Domestic	12966	13672	14038	14483	15470
Flinders Uni	International	1855	2023	2231	2337	2447
Flinders Uni	Transnational	1189	1356	1051	861	849
<i>Flinders Uni</i>	<i>Total International Students</i>	<i>3044</i>	<i>3379</i>	<i>3282</i>	<i>3198</i>	<i>3296</i>
<b>Flinders Uni</b>	<b>Total</b>	<b>16010</b>	<b>17051</b>	<b>17320</b>	<b>17681</b>	<b>18766</b>

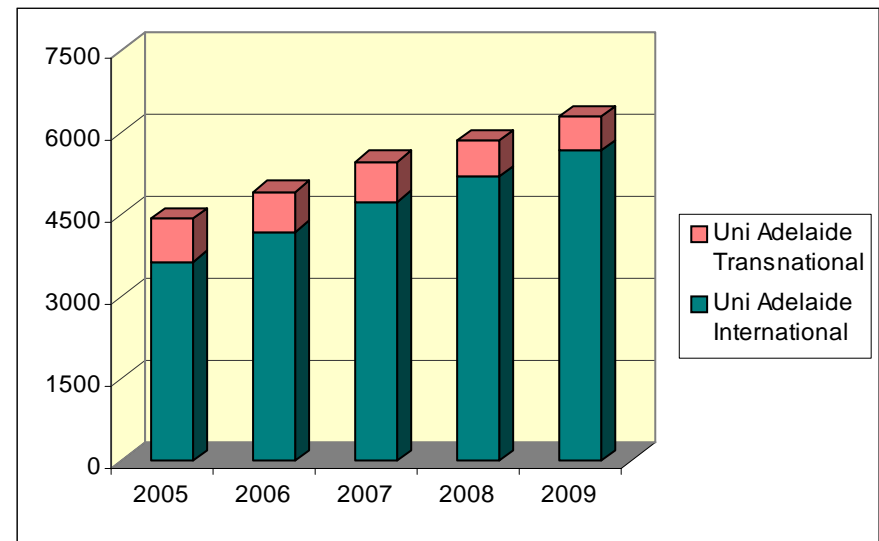
Source: Universities' websites (see footnote 53)

The following graphs (Graphs 29-34) show how students split between domestic and foreign and, within the foreign students, the division between international and transnational, throughout the reference time period.

**Graph 29: Domestic and Total International Students – University of Adelaide**

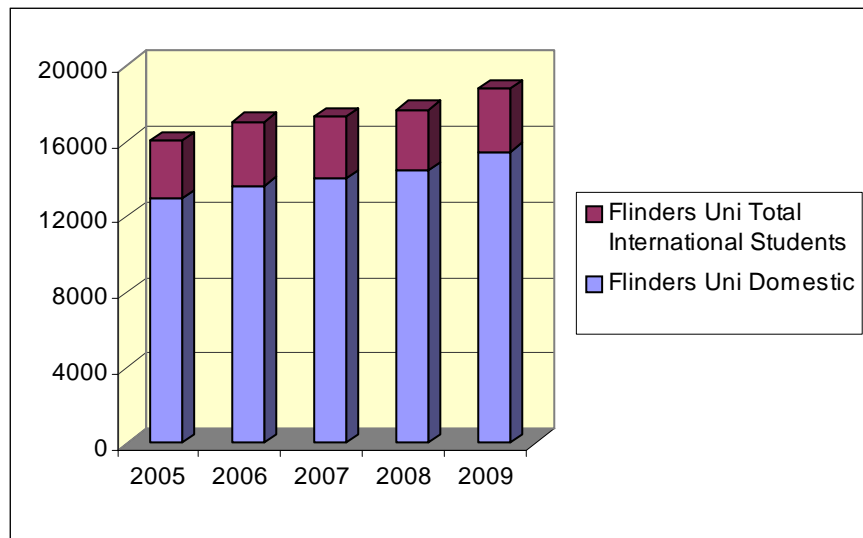


**Graph 30: International and Transnational Students – University of Adelaide**

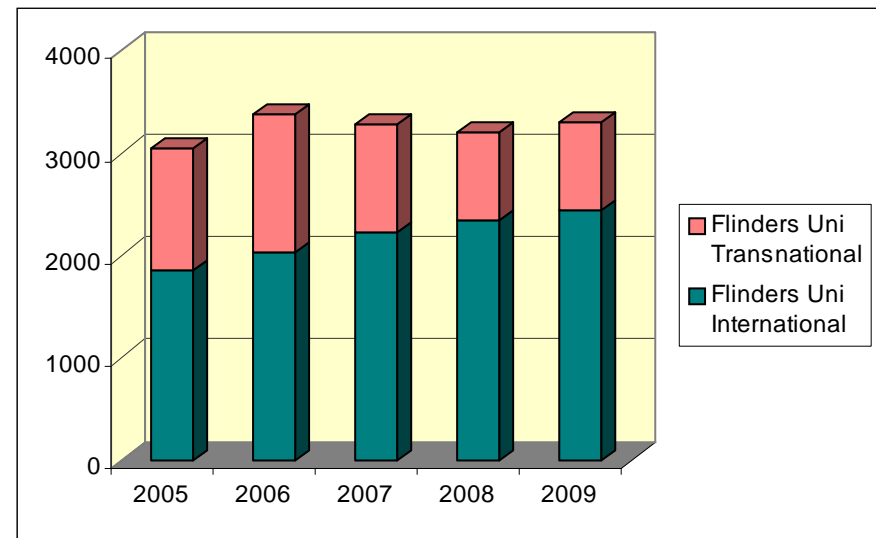




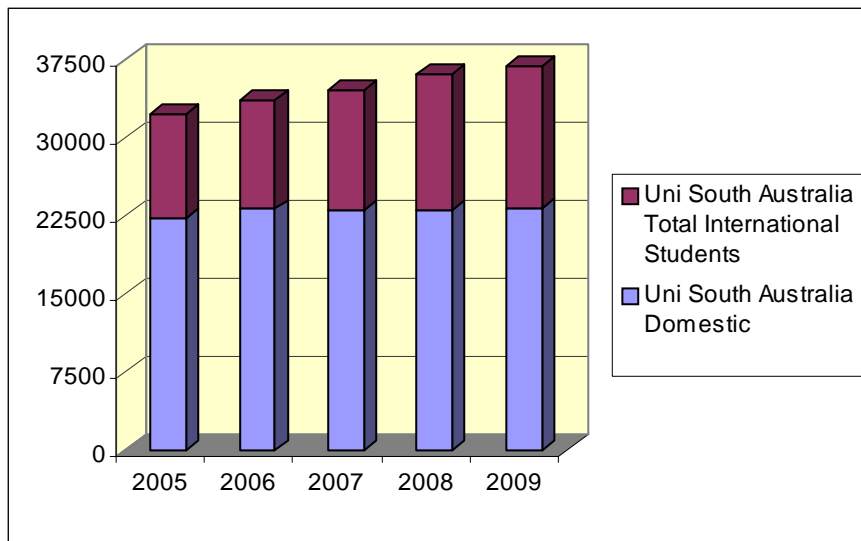
**Graph 31: Domestic and Total International Students – Flinders University**



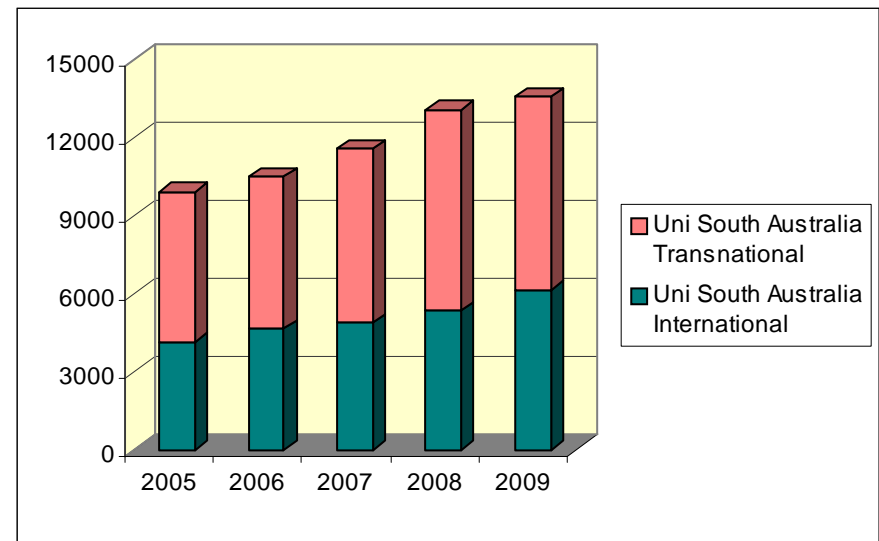
**Graph 32: International and Transnational Students – Flinders University**



**Graph 33: Domestic and Total International Students – University of South Australia**

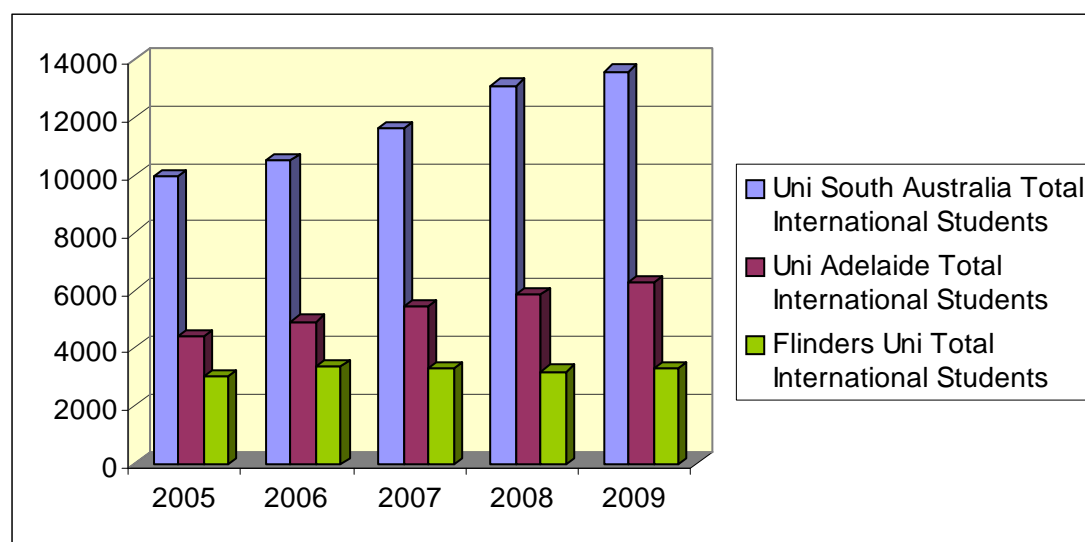


**Graph 34: International and Transnational Students – University of South Australia**



The University of South Australia boasted the higher number of international students, both in its Australian campuses and offshore (*Graphs 33-34 and Graph 35*). However, the University of Adelaide experienced the highest rate of growth of the percentage of total foreign students throughout the reference time period (*Table 12 and Graph 36*).

**Graph 35: Total Number of Foreign Students (2005-2009)**

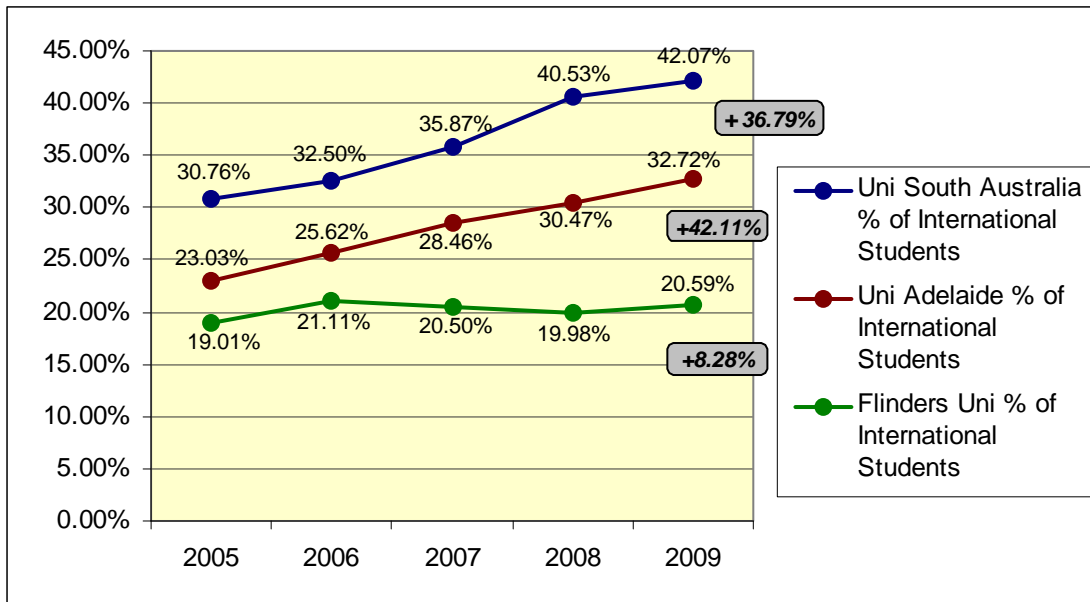


**Table 12: Percentage of Foreign Students**

		2005	2006	2007	2008	2009
Uni South Australia	Total International Students	9924	10487	11575	13079	13575
Uni South Australia	Total	32266	33680	34603	36156	36850
<i>Uni South Australia</i>	<i>% of International Students</i>	30.76%	32.50%	35.87%	40.53%	42.07%
Uni Adelaide	Total International Students	4426	4925	5470	5857	6290
Uni Adelaide	Total	19222	19646	20478	21311	22471
<i>Uni Adelaide</i>	<i>% of International Students</i>	23.03%	25.62%	28.46%	30.47%	32.72%
Flinders Uni	Total International Students	3044	3379	3282	3198	3296
Flinders Uni	Total	16010	17051	17320	17681	18766
<i>Flinders Uni</i>	<i>% of International Students</i>	19.01%	21.11%	20.50%	19.98%	20.59%

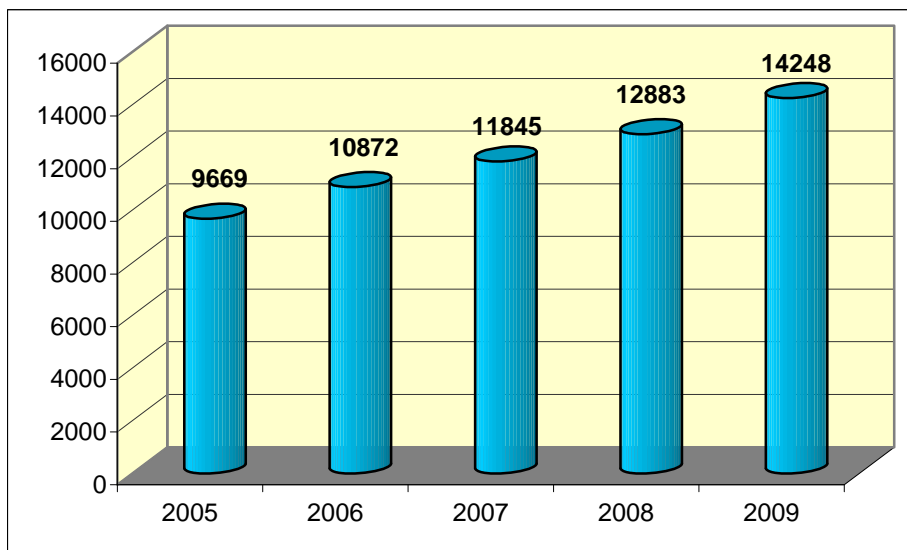
Source: Universities' websites (see footnote 53)

**Graph 36: Percentage of Foreign Students (2005-2009)**

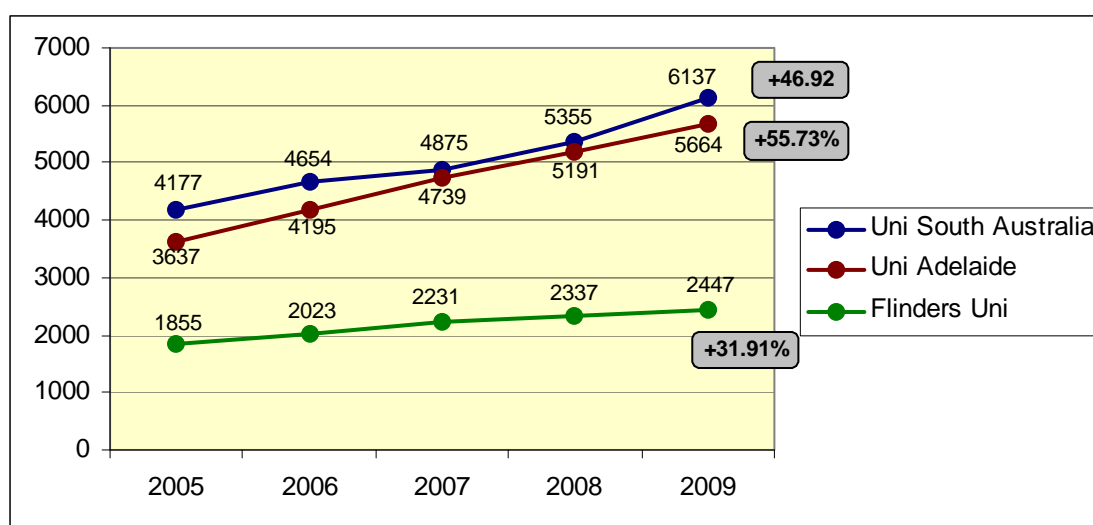


Considering only the international students (foreign students attending higher education courses in South Australia), the State hosted 14,248 foreign students in 2009. The number increased by 47.36% from 2005 to 2009 (*Graph 37*). *Graph 38* shows how international students were divided among the three universities. This data underlines the increasing appeal of South Australia as a place where to carry out higher education degrees and courses.

**Graph 37: Total Number of International Students – South Australia’s Universities (2005-2009)**



**Graph 38: International Students (2005-2009)**



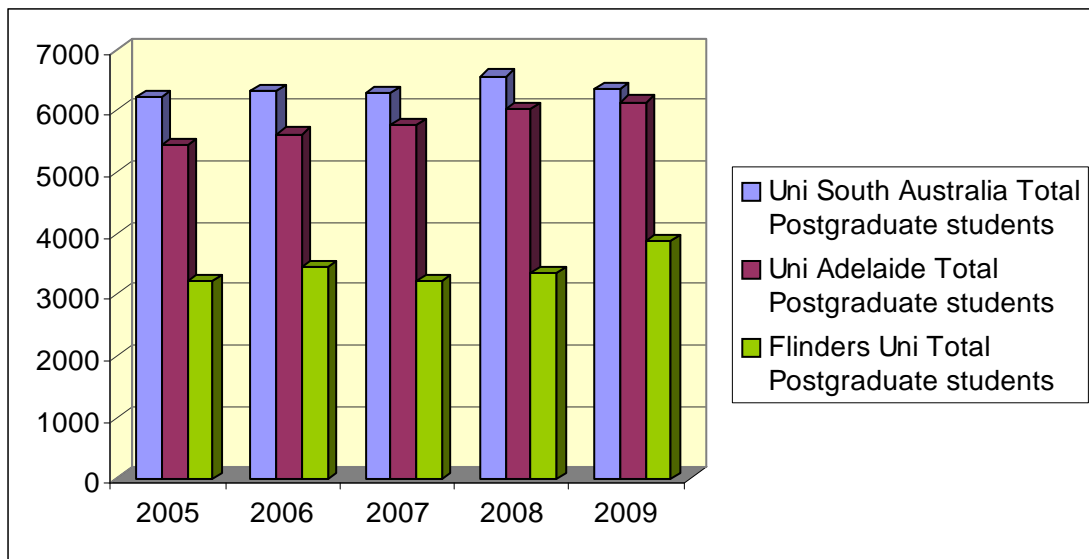
Postgraduate courses can be either research (Doctorate by research and Masters by research programs) or coursework (Doctorate by coursework and Masters by coursework programs) oriented. *Table 13* and *Graph 39* present the data regarding higher degree students.

**Table 13: Postgraduate students**

		2005	2006	2007	2008	2009	Variation 2005-2009
Uni South Australia	Higher degree research	1021	993	1084	1088	1144	12.05%
Uni South Australia	Higher degree coursework	5193	5325	5213	5475	5216	0.44%
<i>Uni South Australia</i>	<i>Total Postgraduate students</i>	<i>6214</i>	<i>6318</i>	<i>6297</i>	<i>6563</i>	<i>6360</i>	<i>2.35%</i>
Uni Adelaide	Higher degree research	1777	1842	1853	1814	1851	4.16%
Uni Adelaide	Higher degree coursework	3672	3773	3913	4218	4292	16.88%
<i>Uni Adelaide</i>	<i>Total Postgraduate students</i>	<i>5449</i>	<i>5615</i>	<i>5766</i>	<i>6032</i>	<i>6143</i>	<i>12.74%</i>
Flinders Uni	Higher degree research	914	908	876	913	898	-1.75%
Flinders Uni	Higher degree coursework	2306	2536	2357	2433	2970	28.79%
<i>Flinders Uni</i>	<i>Total Postgraduate students</i>	<i>3220</i>	<i>3444</i>	<i>3233</i>	<i>3346</i>	<i>3868</i>	<i>20.12%</i>

Source: Universities' websites (see footnote 53)

**Graph 39: Postgraduate students (2005-2009)**



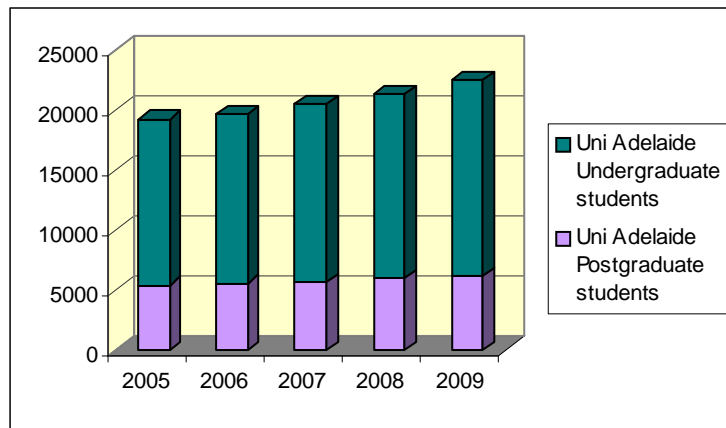
The University of South Australia enjoyed the highest number of postgraduate students, followed by the University of Adelaide and Flinders University. This data does not show a huge increment of the number of postgraduate students throughout the considered time period. *Table 14* and *Graphs 40-42*, which compare the number of postgraduate students with the number of undergraduate ones, underline this. Only the Flinders University experienced a slight increase in the number of students enrolled in higher education programmes, while both the University of South Australia and the University of Adelaide registered a decrease.

**Table 14: Postgraduate and Undergraduate Students (2005-2009)**

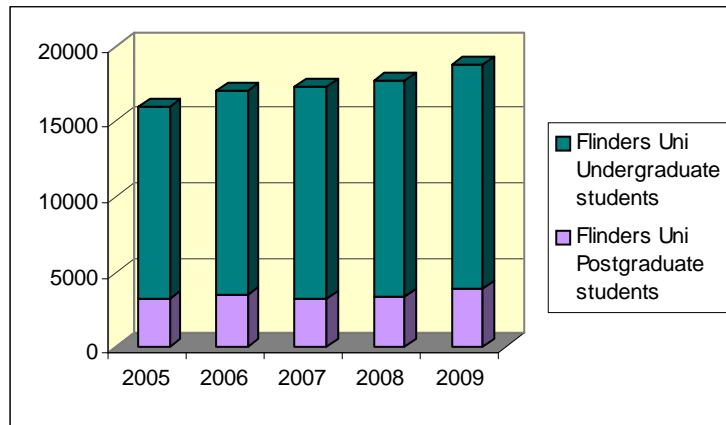
		<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Uni South Australia	Total	32266	33680	34603	36156	36850
Uni South Australia	Postgraduate students	6214	6318	6297	6563	6360
<i>Uni South Australia</i>	<i>% Postgraduate</i>	<i>19.26%</i>	<i>18.76%</i>	<i>18.20%</i>	<i>18.15%</i>	<i>17.26%</i>
Uni South Australia	Undergraduate students	26052	27362	28306	29593	30490
<i>Uni South Australia</i>	<i>% Undergraduate</i>	<i>80.74%</i>	<i>81.24%</i>	<i>81.80%</i>	<i>81.85%</i>	<i>82.74%</i>
Uni Adelaide	Total	19222	19646	20478	21311	22471
Uni Adelaide	Postgraduate students	5449	5615	5766	6032	6143
<i>Uni Adelaide</i>	<i>% Postgraduate</i>	<i>28.35%</i>	<i>28.58%</i>	<i>28.16%</i>	<i>28.30%</i>	<i>27.34%</i>
Uni Adelaide	Undergraduate students	13773	14031	14712	15279	16328
<i>Uni Adelaide</i>	<i>% Undergraduate</i>	<i>71.65%</i>	<i>71.42%</i>	<i>71.84%</i>	<i>71.70%</i>	<i>72.66%</i>
Flinders Uni	Total	16010	17051	17320	17681	18766
Flinders Uni	Postgraduate students	3220	3444	3233	3346	3868
<i>Flinders Uni</i>	<i>% Postgraduate</i>	<i>20.11%</i>	<i>20.20%</i>	<i>18.67%</i>	<i>18.92%</i>	<i>20.61%</i>
Flinders Uni	Undergraduate students	12790	13607	14087	14335	14898
<i>Flinders Uni</i>	<i>% Undergraduate</i>	<i>79.89%</i>	<i>79.80%</i>	<i>81.33%</i>	<i>81.08%</i>	<i>79.39%</i>

Source: Universities' websites (see footnote 53)

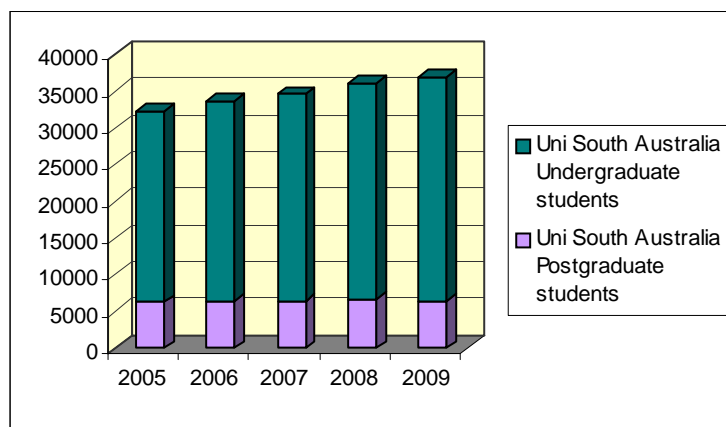
**Graph 40: Postgraduate and Undergraduate students (2005-2009) – University of Adelaide**



**Graph 41: Postgraduate and Undergraduate students (2005-2009) – Flinders University**



**Graph 42: Postgraduate and Undergraduate students (2005-2009) – University of South Australia**

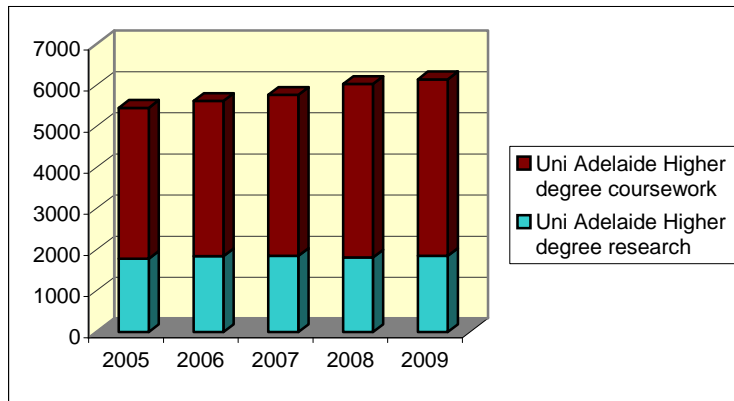




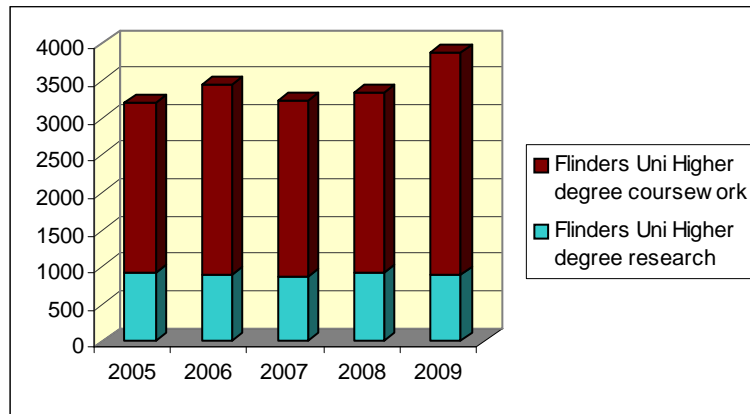
The following graphs (*Graphs 43-45*) show how postgraduate students split between research and coursework degrees between 2005 and 2009. Most students were enrolled in coursework programmes. The University of Adelaide had the highest number of research students throughout the reference period. The University of South Australia, which experienced an increase of 12.05% in this number throughout the considered five years, and the Flinders University followed it.

The *Table 15* and *Graph 46*, instead, present the data regarding the percentage of research students on total postgraduate students. The University of Adelaide exhibited the highest number of research students compared to the total postgraduate ones, with 33.97% in 2009. The Flinders University followed with 27.89% of research postgraduate students in 2009. Regarding the University of South Australia, 18.41% of its postgraduate students were enrolled in research programmes.

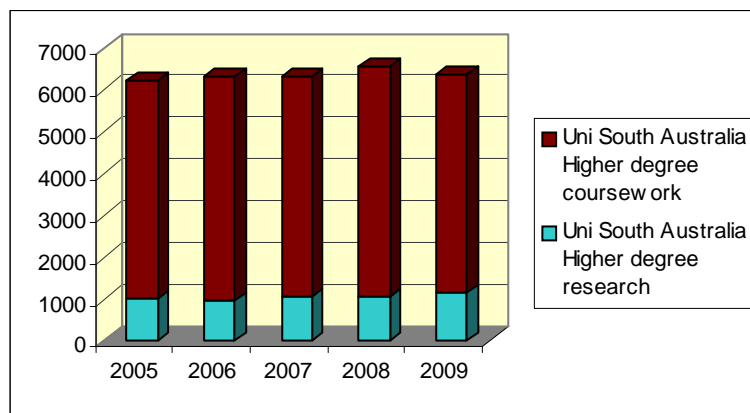
**Graph 43: Higher Degree Coursework and Research Students (2005-2009) – University of Adelaide**



**Graph 44: Higher Degree Coursework and Research Students (2005-2009) – Flinders University**



**Graph 45: Higher Degree Coursework and Research Students (2005-2009) – University of South Australia**

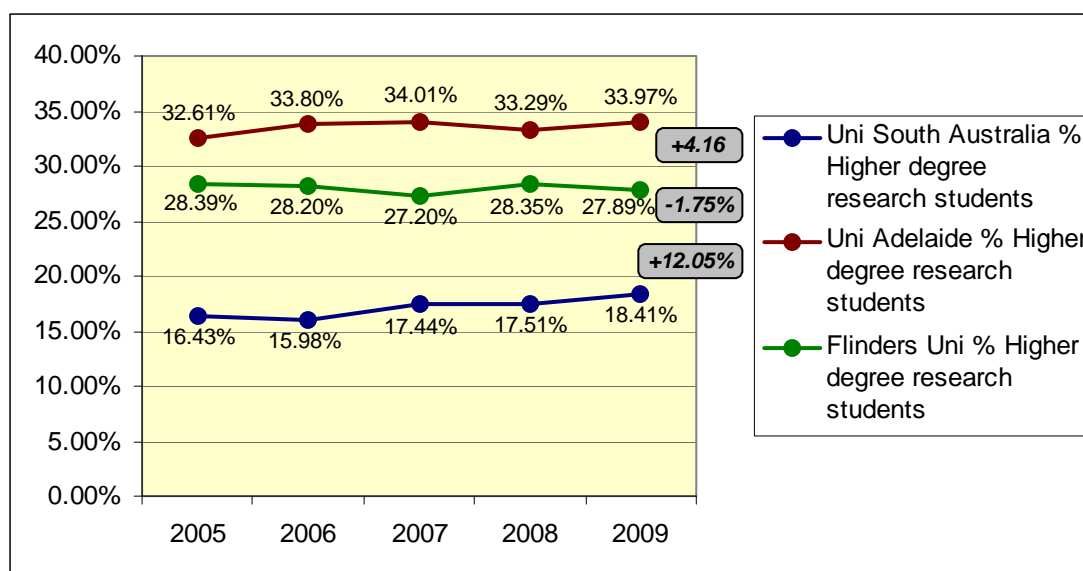


**Table 15: Percentage of Higher Degree Research students on Postgraduate Students**

		2005	2006	2007	2008	2009
Uni South Australia	Higher degree research	1021	993	1084	1088	1144
Uni South Australia	Total Postgraduate students	6214	6318	6297	6563	6360
<i>Uni South Australia</i>	<i>% Higher degree research students</i>	<i>16.43%</i>	<i>15.98%</i>	<i>17.44%</i>	<i>17.51%</i>	<i>18.41%</i>
Uni Adelaide	Higher degree research	1777	1842	1853	1814	1851
Uni Adelaide	Total Postgraduate students	5449	5615	5766	6032	6143
<i>Uni Adelaide</i>	<i>% Higher degree research students</i>	<i>32.61%</i>	<i>33.80%</i>	<i>34.01%</i>	<i>33.29%</i>	<i>33.97%</i>
Flinders Uni	Higher degree research	914	908	876	913	898
Flinders Uni	Total Postgraduate students	3220	3444	3233	3346	3868
<i>Flinders Uni</i>	<i>% Higher degree research students</i>	<i>28.39%</i>	<i>28.20%</i>	<i>27.20%</i>	<i>28.35%</i>	<i>27.89%</i>

Source: Universities' websites (see footnote 53)

**Graph 46: Percentage of Higher Degree Research students on Postgraduate Students (2005-2009)**



All the three South Australia's universities presented a satisfying level of research students, but the University of Adelaide stood out in terms of both total postgraduate students (27.34% of total students in 2009) and higher degree research students (8.24% of total students in 2009). This fact is further highlighted by *Table 16* and *Graphs 47-48*, which compare the number of postgraduate and research students to the total number of enrolments. However, all the three South Australia's universities experienced a decrease in the percentage of higher degree research students on total enrolments. As already stated above, also the percentage of postgraduate students on total

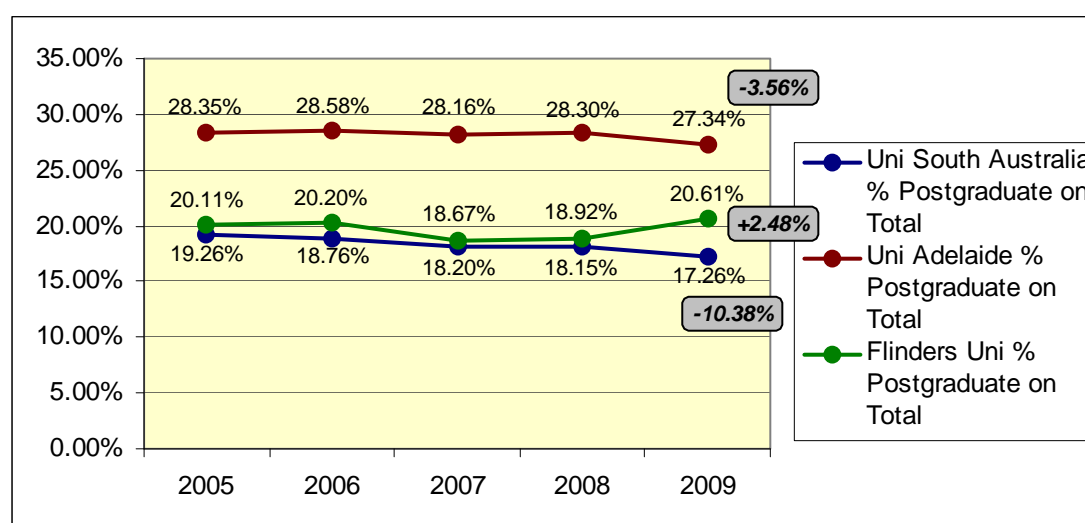
enrolments decreased between 2005 and 2009 (apart from a slight increase for Flinders University).

**Table 16: Percentage of Postgraduate and Research Students on Total Enrolments**

		2005	2006	2007	2008	2009
Uni South Australia	Higher degree research	1021	993	1084	1088	1144
Uni South Australia	% Higher degree research on Total	3.16%	2.95%	3.13%	3.01%	3.10%
Uni South Australia	Total Postgraduate	6214	6318	6297	6563	6360
Uni South Australia	% Postgraduate on Total	19.26%	18.76%	18.20%	18.15%	17.26%
Uni South Australia	Total	32266	33680	34603	36156	36850
Uni Adelaide	Higher degree research	1777	1842	1853	1814	1851
Uni Adelaide	% Higher degree research on Total	9.24%	9.38%	9.05%	8.51%	8.24%
Uni Adelaide	Total Postgraduate	5449	5615	5766	6032	6143
Uni Adelaide	% Postgraduate on Total	28.35%	28.58%	28.16%	28.30%	27.34%
Uni Adelaide	Total	19222	19646	20478	21311	22471
Flinders Uni	Higher degree research	914	908	876	913	898
Flinders Uni	% Higher degree research on Total	5.71%	5.33%	5.06%	5.16%	4.79%
Flinders Uni	Total Postgraduate	3220	3444	3233	3346	3868
Flinders Uni	% Postgraduate on Total	20.11%	20.20%	18.67%	18.92%	20.61%
Flinders Uni	Total	16010	17051	17320	17681	18766

Source: Universities' websites (see footnote 53)

**Graph 47: Percentage of Postgraduate Students on Total Enrolments (2005-2009)**



**Graph 48: Percentage of Higher Degree Research Students on Total Enrolments  
(2005-2009)**

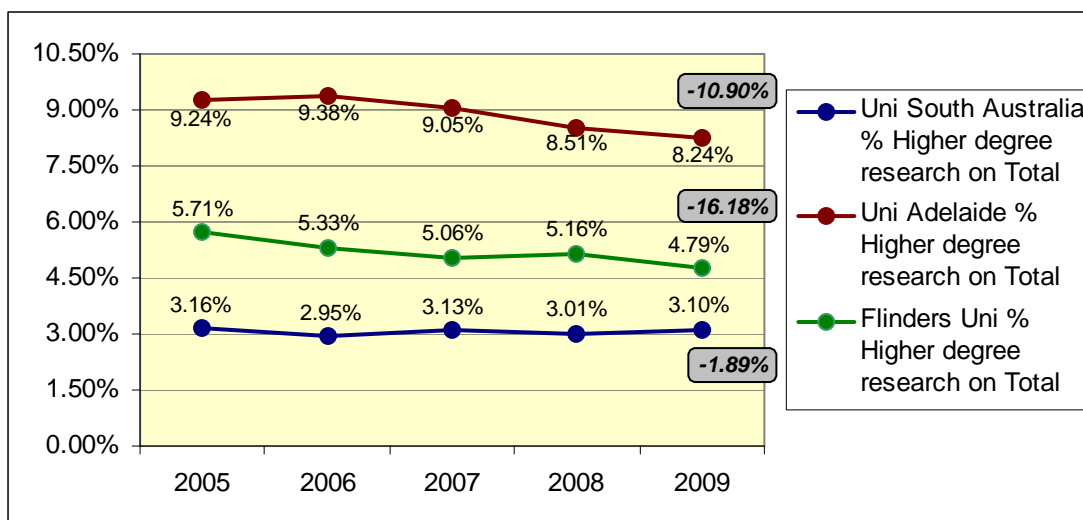


Table 17 shows the data on Research Student Load measured as Equivalent Full-Time Student Unit (EFTSL).<sup>54</sup> The data is divided between domestic and international students.

**Table 17: Research Student Load (EFTSL)**

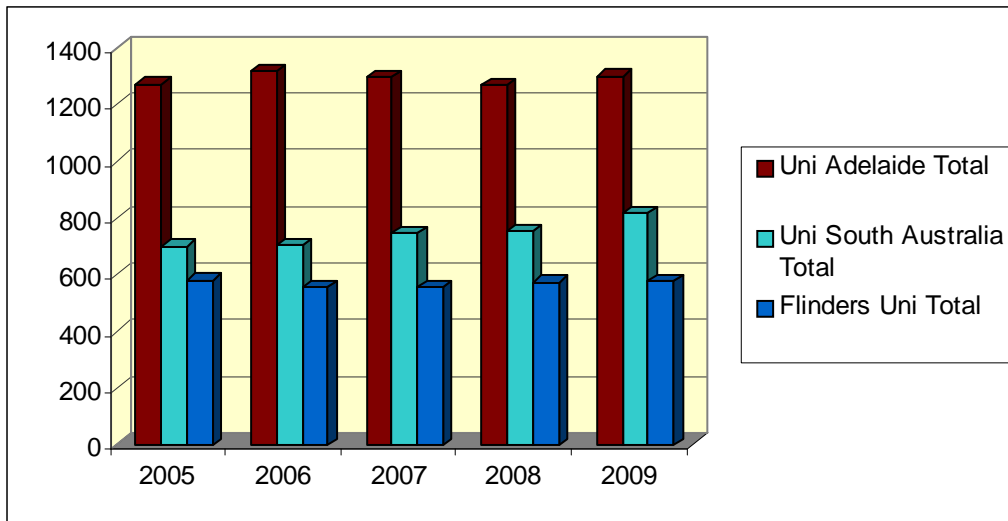
		2005	2006	2007	2008	2009
Uni Adelaide	Domestic	1057	1109	1080	1036	1008
Uni Adelaide	International	214	209	213	233	291
<i>Uni Adelaide</i>	<i>Total</i>	<i>1271</i>	<i>1318</i>	<i>1294</i>	<i>1269</i>	<i>1299</i>
Uni South Australia	Domestic	445	454	495	508	532
Uni South Australia	International	255	248	249	243	282
<i>Uni South Australia</i>	<i>Total</i>	<i>699</i>	<i>702</i>	<i>744</i>	<i>751</i>	<i>814</i>
Flinders Uni	Domestic	496	472	474	476	457
Flinders Uni	International	85	85	83	97	119
<i>Flinders Uni</i>	<i>Total</i>	<i>581</i>	<i>557</i>	<i>557</i>	<i>573</i>	<i>576</i>

Source: Universities' websites (see footnote 53)

The University of Adelaide had the highest total Research Student Load, followed by the University of South Australia and the Flinders University (Graph 49).

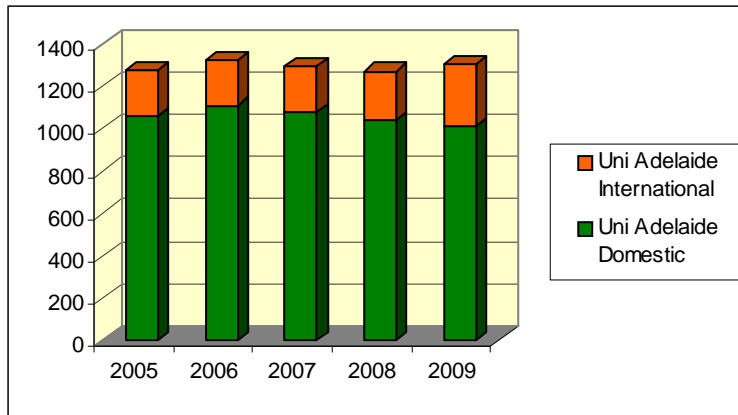
<sup>54</sup> The **Equivalent Full-Time Student Unit (EFTSL)** is a measure of the workload for students undertaking a full year of study in a particular year. A typical full-time student would have an EFTSL of 1.0 (or above 1.0 under certain accelerated pathways); a part-time student undertaking part of the full-time student load would incur an EFTSL less than 1.0 (see: <http://www.deewr.gov.au/Skills/Programs/Support/VetFeeHelp/FAQs/Pages/EFTSL.aspx>).

**Graph 49: Total Research Student Load (EFTSL)**

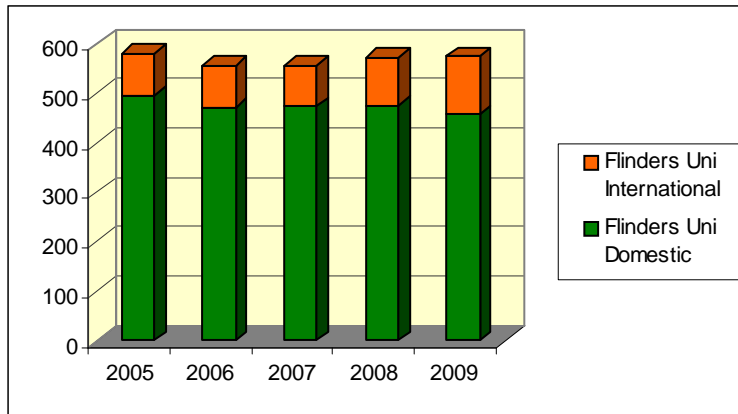


The University of South Australia, instead, had the highest research student load referable to international students (*Graphs 50-52*). However, it experienced a decrease in the percentage on international research student throughout our reference period (-5.04%). On the other hand, the Flinders University had the larger increase of percentage of international research student load compared to the total one (+41.22%) (*Table 18 and Graph 53*).

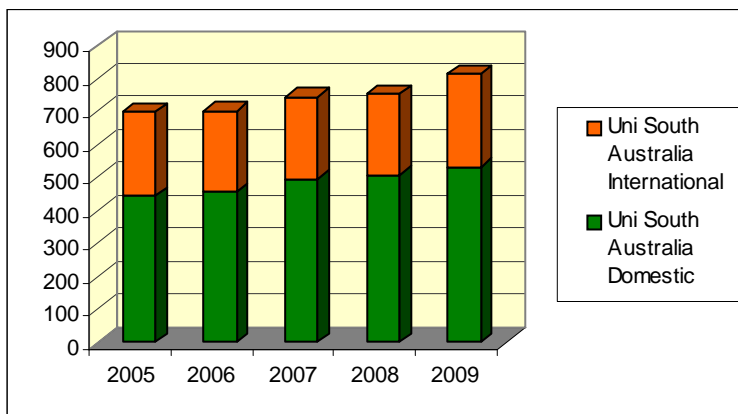
**Graph 50: Research Student Load (EFTSL) – University of Adelaide**



**Graph 51: Research Student Load (EFTSL) – Flinders University**



**Graph 52: Research Student Load (EFTSL) – University of South Australia**

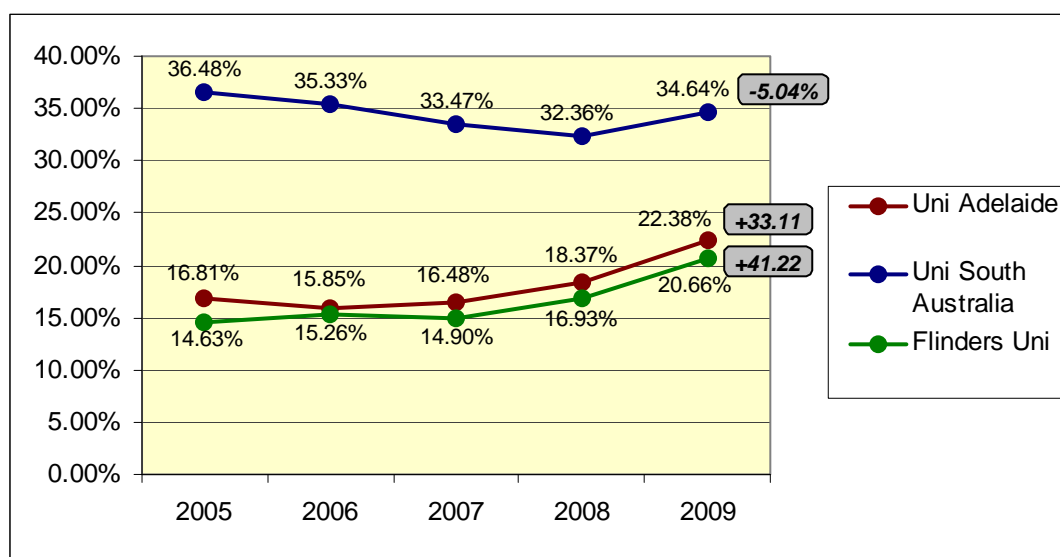


**Table 18: Percentage of International Research Student Load (EFTSL)**

		2005	2006	2007	2008	2009	Variation 2005-2009
Uni Adelaide	International	214	209	213	233	291	
Uni Adelaide	Total	1271	1318	1294	1269	1299	
<i>Uni Adelaide</i>	<i>% International</i>	16.81%	15.85%	16.48%	18.37%	22.38%	33.11%
Uni South Australia	International	255	248	249	243	282	
Uni South Australia	Total	699	702	744	751	814	
<i>Uni South Australia</i>	<i>% International</i>	36.48%	35.33%	33.47%	32.36%	34.64%	-5.04%
Flinders Uni	International	85	85	83	97	119	
Flinders Uni	Total	581	557	557	573	576	
<i>Flinders Uni</i>	<i>% International</i>	14.63%	15.26%	14.90%	16.93%	20.66%	41.22%

Source: Universities' websites (see footnote 53)

**Graph 53: Percentage of International Research Student Load (EFTSL)**



#### 5.1.5. South Australia's Universities: Data on Research Income<sup>55</sup>

In this section some significant data on the universities' research income and its composition are presented. The total research income is divided into four categories, according to the instructions given by the Department of Innovation, Industry, Science and Research (DIISR) Higher Education

<sup>55</sup> **University of South Australia:** data about research income are taken from the report "University of South Australia: Key statistics 2004 to 2009" ([www.unisa.edu.au/pas/bai/keystatistics/keystatistics.asp](http://www.unisa.edu.au/pas/bai/keystatistics/keystatistics.asp)).

**University of Adelaide:** data about students are taken from the 2005-2009 "Pocket Statistics" reports ([www.adelaide.edu.au/sp/statistics](http://www.adelaide.edu.au/sp/statistics)).

**Flinders University:** data about the research income have been kindly provided by the University's Research Services Office.



Research Data Collection (HERDC) with reference to the collection of performance data on research income.<sup>56</sup>

- Category 1 (*Australian Competitive Grants*) consists only of those research schemes/programs listed on the annual Australian Competitive Grants Register (ACGR).<sup>57</sup>
- Category 2 (*Other Government Grants*) includes: any other research income received from the Australian Government that is not eligible for inclusion as Category 1 research income; research income from Australian Government business enterprises; research income (including contract research) from both state and local governments; research income from state government business enterprises; research income from partly government owned or funded bodies; research income from CRCs in which the University was not a core participant or participant.
- Category 3 (*Industry/International Grants*) must be divided in the following subcategories: (1) *Australian*: contract research income provided by industry or other non-government agencies grants for research other than government provided grants (which should be reported in either Category 1 or Category 2); donations and bequests for research from Australian business, Australian non-profit organisations and Australian individuals; income received from syndicated research and development arrangements; (2) *International A - Competitive, Peer-Reviewed Research Grant Income*: competitive grants, peer reviewed grants for research from non-Australian industry or non-Australian Government agencies including non-Australian industry collaborative research grants; in order to qualify for inclusion in this category the granting schemes must comply with the following criteria: funds must be provided on a competitive basis and clearly be for research only; the funding scheme must have a well-defined mechanism for competition and selection by a well-qualified panel; grants in kind such as the use of facilities, equipment etc. or subsidised travel or accommodation are not eligible; funding schemes used exclusively to fund

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<sup>56</sup> See: [www.unisa.edu.au/res/data/definitionincomecategory.asp](http://www.unisa.edu.au/res/data/definitionincomecategory.asp) and [www.innovation.gov.au/Research/Pages/default.aspx](http://www.innovation.gov.au/Research/Pages/default.aspx).

<sup>57</sup> The ACGR lists qualifying, nationally competitive research schemes. The income that Higher Education Providers receive from schemes listed on the ACGR drives the allocation of over \$200 million of Research Infrastructure Block Grants (RIBG) annually.

student scholarships are not eligible; schemes that provide funding wholly or mainly for infrastructure purposes are not eligible; (3) *International B - Other Income*: contract research provided by non-Australian industry or non-Australian Government agencies including non-Australian industry collaborative research grants; non-competitive grants for research from non-Australian industry or non-Australian Government agencies including non-Australian industry collaborative research grants; donations and bequests for research from non-Australian business, non-Australian non-profit organisations, and non-Australian individuals.

- Finally, under Category 4 (*Cooperative Research Centres*), universities must report the research income received for the financial year from a CRC in which they were a 'core participant' or 'participant' (a university is regarded as a core participant or participant if it is a signatory to the CRC's Commonwealth Agreement).

Table 19 shows the data regarding the Research Income of the three South Australia's universities. Data is available for the period 2005-2008.

**Table 19: Research Income (\$'000) – 2005-2008**

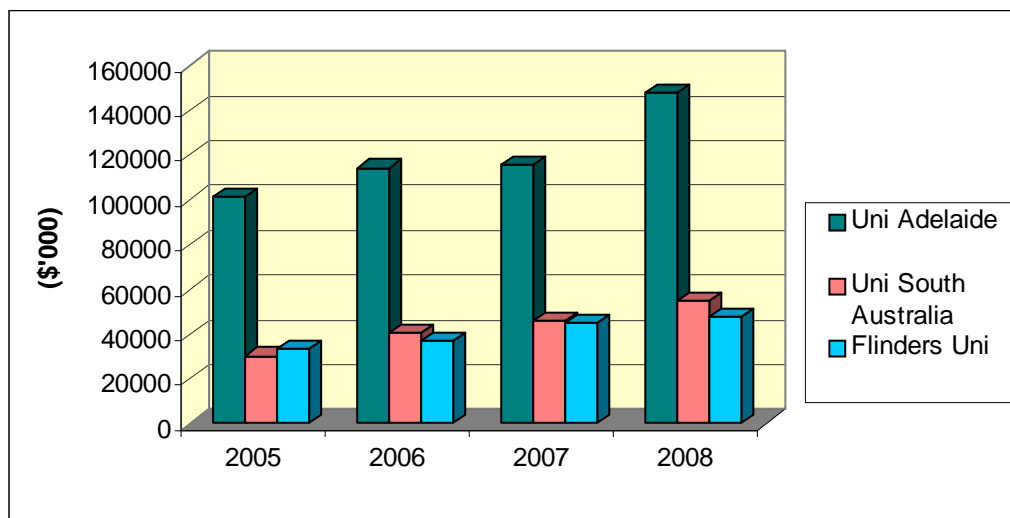
		2005	2006	2007	2008	Variation 2005-2008
Uni South Australia	Australian competitive grants	8436	10169	11564	12680	50.31%
Uni South Australia	Other government grants	10446	18273	16763	20981	100.85%
Uni South Australia	Industry/International grants	8926	9519	14007	15119	69.38%
Uni South Australia	Cooperative research centres	2481	2310	3317	5987	141.31%
<i>Uni South Australia</i>	<i>Total</i>	<i>30290</i>	<i>40272</i>	<i>45651</i>	<i>54767</i>	<i>80.81%</i>
Uni Adelaide	Australian competitive grants	56264	62038	60699	74062	31.63%
Uni Adelaide	Other government grants	25887	27462	28649	40004	54.53%
Uni Adelaide	Industry/International grants	13016	18169	20413	28907	122.09%
Uni Adelaide	Cooperative research centres	6684	6813	6011	4854	-27.38%
<i>Uni Adelaide</i>	<i>Total</i>	<i>101851</i>	<i>114482</i>	<i>115771</i>	<i>147827</i>	<i>45.14%</i>
Flinders Uni	Australian competitive grants	11796	13736	14888	16220	37.50%
Flinders Uni	Other government grants	12899	12580	19354	19453	50.81%
Flinders Uni	Industry/International grants	7766	9969	10440	11589	49.23%
Flinders Uni	Cooperative research centres	874	598	470	798	-8.70%
<i>Flinders Uni</i>	<i>Total</i>	<i>33335</i>	<i>36884</i>	<i>45153</i>	<i>48061</i>	<i>44.18%</i>

Source: Universities' websites (see footnote 55)

Graph 54 represents the evolution of the universities' total research income between 2005 and 2008. The University of Adelaide had the highest research

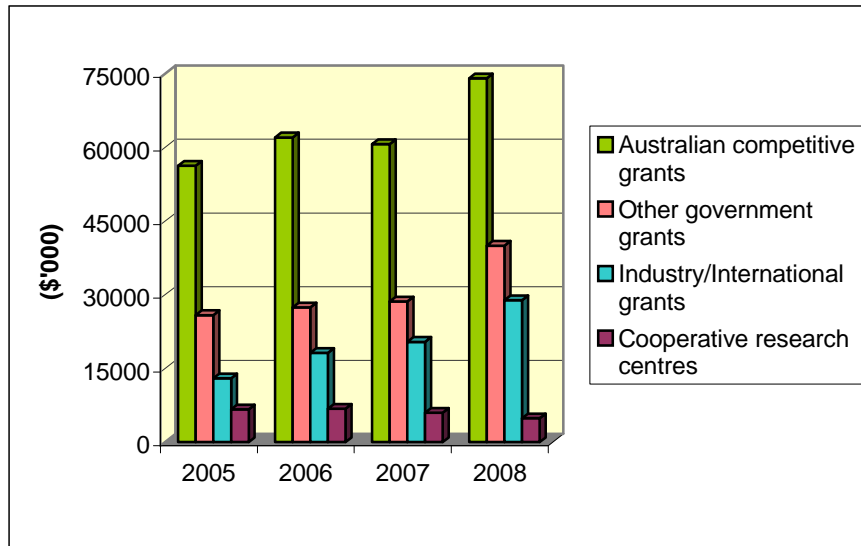
income, with an increase of 45.14% throughout the considered period. In 2005, the Flinders University had the second largest research income, after the University of Adelaide, but in 2008 it was overcome by the University of South Australia. Between 2005 and 2008, the total research income of the Flinders University increased by 44.17%, while the University of South Australia had the highest growth of research income, with an increase of 80.81%.

**Graph 54: Total Research Income (2005-2008)**

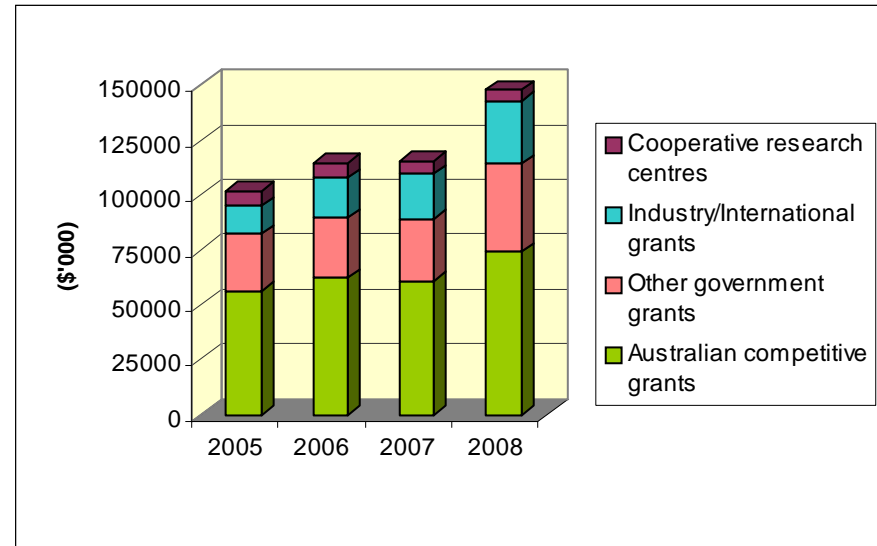


The following graphs (*Graphs 55-60*) show how the research income split into the four categories between 2005 and 2008. For the University of Adelaide, the first source of research income was represented by Australian competitive grants (Category 1), while for the other two universities other Government grants (Category2) constitute the majority of their research income. The less important source of research income corresponded to the Cooperative Research Centres (Category 4) for all three universities.

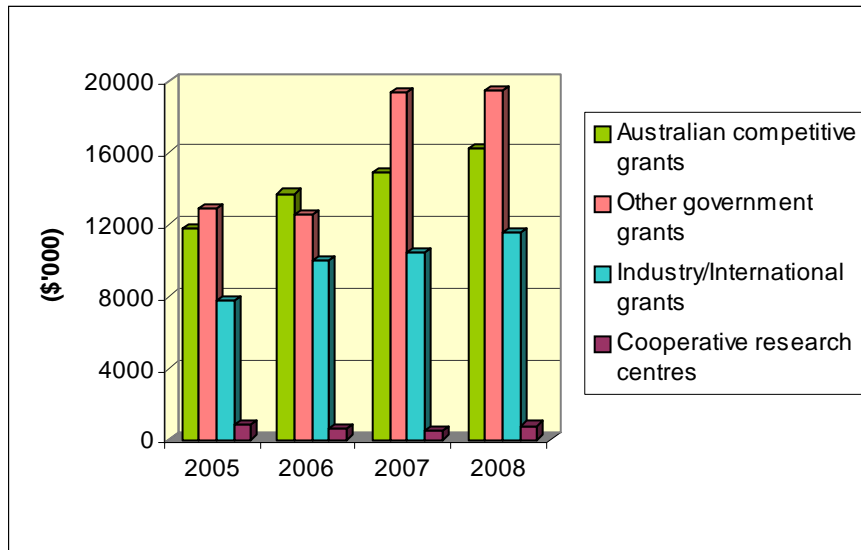
**Graph 55: Research Income Composition – University of Adelaide**



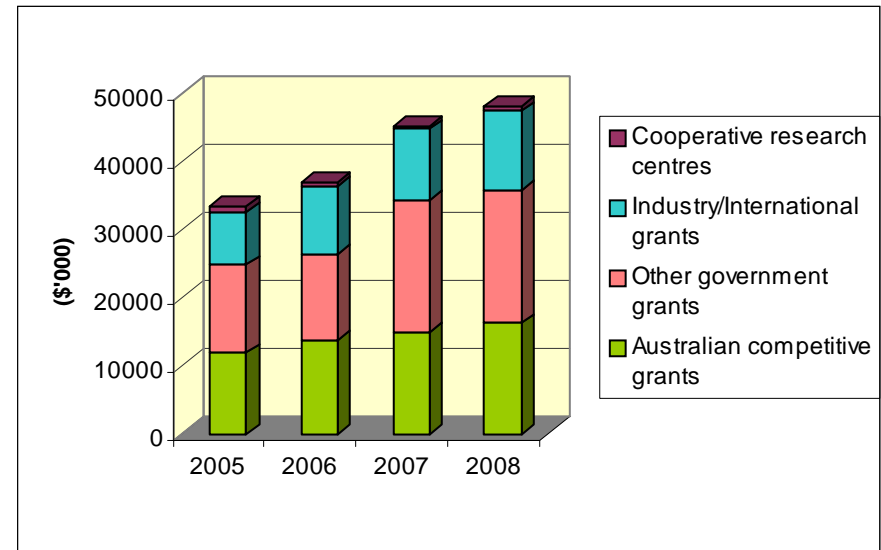
**Graph 56: Research Income Composition – University of Adelaide**



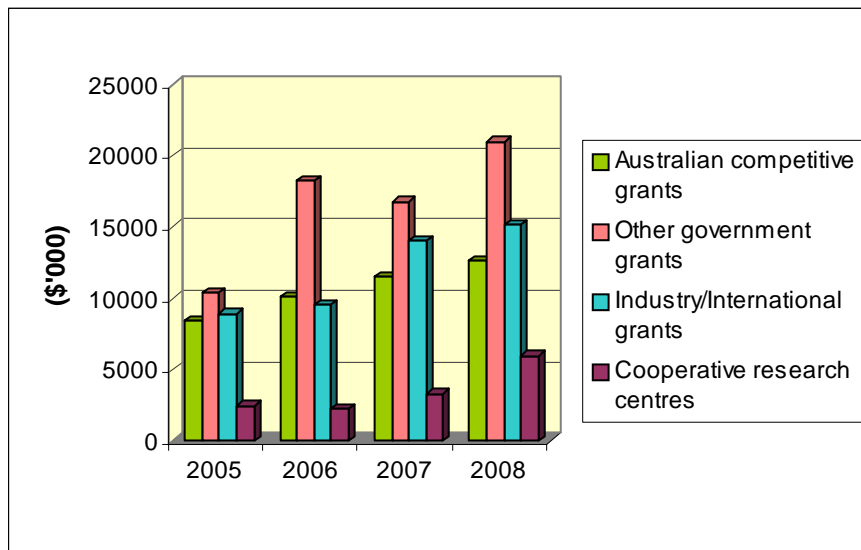
**Graph 57: Research Income Composition – Flinders University**



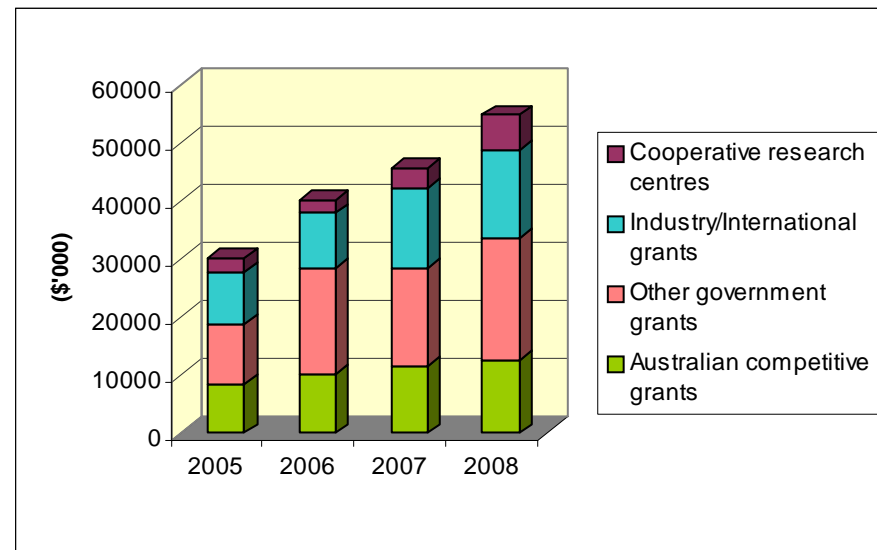
**Graph 58: Research Income Composition – Flinders University**



**Graph 59: Research Income Composition – University of South Australia**



**Graph 60: Research Income Composition – University of South Australia**



Tables 20(A) – 20(C) presents the data on Government grants to finance universities' research income. Total Government grants are the sum of Australian competitive grants (Category 1) and other Government grants (Category 2). This measure represents the overall government economic effort in order to support research activities undertaken by South Australia's universities. Data on Australian competitive grants and other Government grants is reported both in absolute values and as percentage of total Government grants. On the other hand, total Government grants are indicated as percentage of total research income.

**Table 20 (A): Research Income: Government Grants (\$'000) – University of Adelaide**

		2005	2006	2007	2008	Variation 2005-2008
Uni Adelaide	Australian competitive grants	56264	62038	60699	74062	31.63%
Uni Adelaide	% of Total Government grants	68.49%	69.32%	67.94%	64.93%	-5.20%
Uni Adelaide	Other government grants	25887	27462	28649	40004	54.53%
Uni Adelaide	% of Total Government grants	31.51%	30.68%	32.06%	35.07%	11.30%
Uni Adelaide	Total Government grants	82151	89500	89348	114066	38.85%
Uni Adelaide	% Government grants on total research income	80.66%	78.18%	77.18%	77.16%	-4.34%

**Table 20 (B): Research Income: Government Grants (\$'000) – Flinders University**

		2005	2006	2007	2008	Variation 2005-2008
Flinders Uni	Australian competitive grants	11796	13736	14888	16220	37.50%
Flinders Uni	% of Total Government grants	47.77%	52.20%	43.48%	45.47%	-4.81%
Flinders Uni	Other government grants	12899	12580	19354	19453	50.81%
Flinders Uni	% of Total Government grants	52.23%	47.80%	56.52%	54.53%	4.40%
Flinders Uni	Total Government grants	24695	26317	34242	35673	44.45%
Flinders Uni	% Government grants on total research income	74.08%	71.35%	75.84%	74.23%	0.20%

**Table 20 (C): Research Income: Government Grants (\$'000) – University of South Australia**

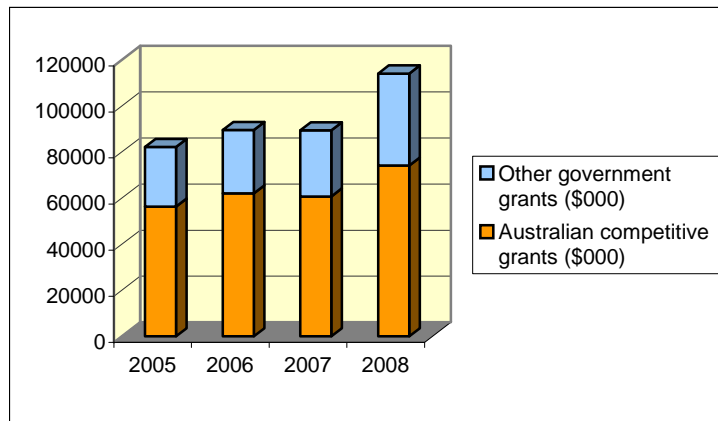
		2005	2006	2007	2008	Variation 2005-2008
Uni South Australia	Australian competitive grants	8436	10169	11564	12680	50.31%
Uni South Australia	% of Total Government grants	44.68%	35.75%	40.82%	37.67%	-15.69%
Uni South Australia	Other government grants	10446	18273	16763	20981	100.85%
Uni South Australia	% of Total Government grants	55.32%	64.25%	59.18%	62.33%	12.67%
Uni South Australia	Total Government grants	18882	28442	28327	33661	78.27%
Uni South Australia	% Government grants on total research income	62.34%	70.62%	62.05%	61.46%	-1.41%

Source: Universities' websites (see footnote 55)

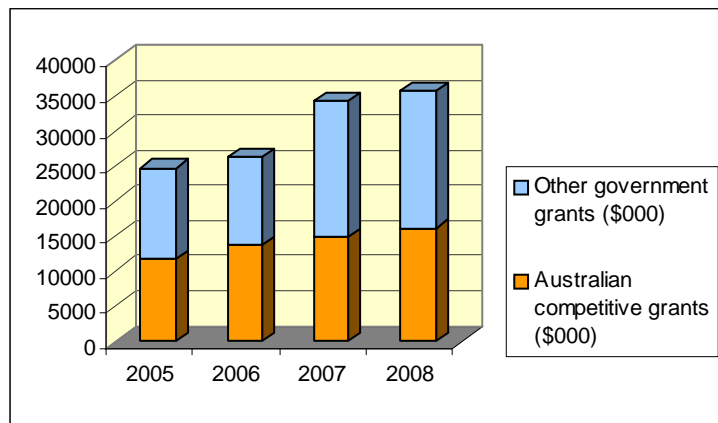
*Graphs 61-63* show how the Government grants split between the two categories throughout the reference period. It is further highlighted how Australian competitive grants represented the majority of Government grants for the University of Adelaide, while the University of South Australia and the Flinders University received more resources through other Government grants.



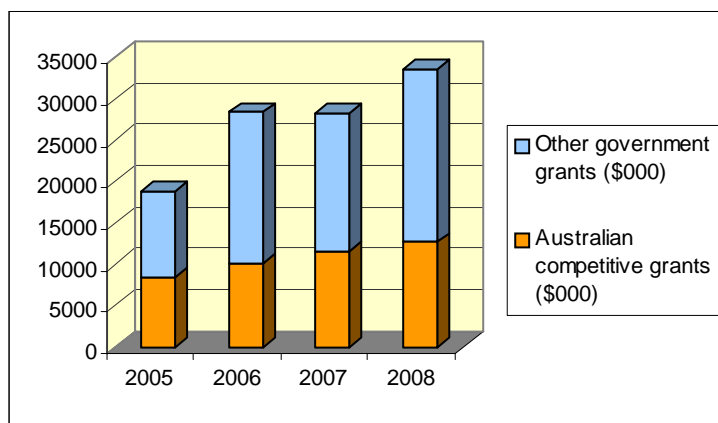
**Graph 61: Research Income: Government Grants (2005-2008) – University of Adelaide**



**Graph 62: Research Income: Government Grants (2005-2008) – Flinders University**

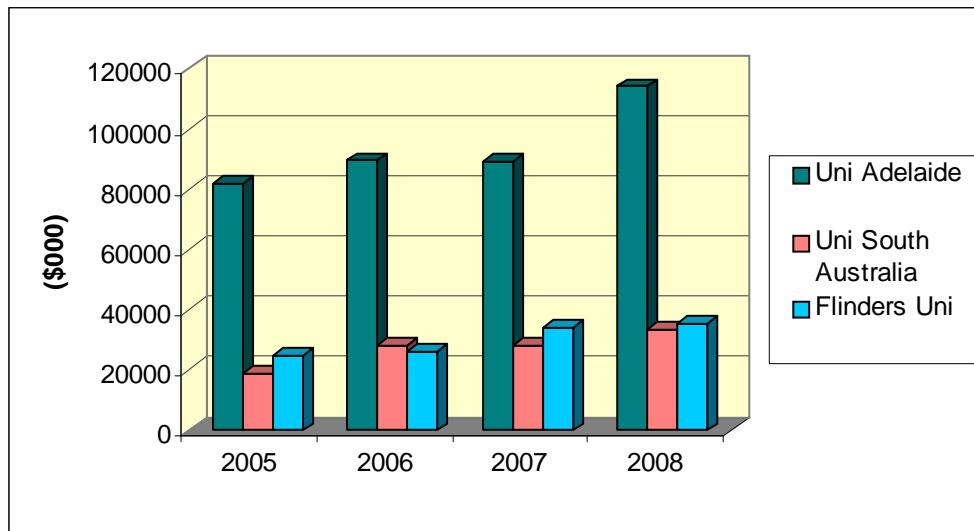


**Graph 63: Research Income: Government Grants (2005-2008) – University of South Australia**

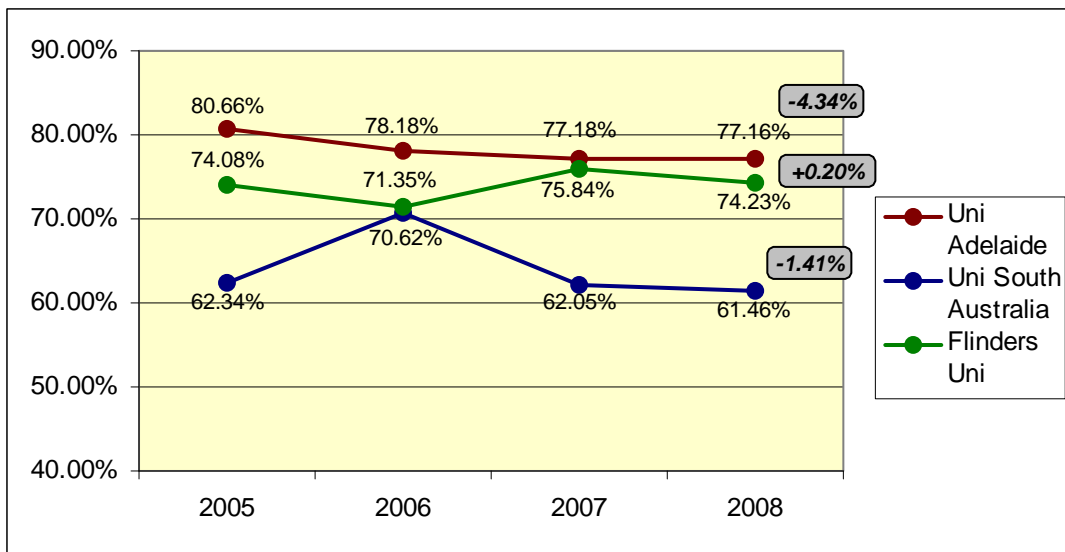


During the reference time period, all South Australia's universities received an increasing amount of Government grants, with the University of South Australia experiencing an increment of 78.27%. However, when considering the percentage of Government grants on total research income, you find that the University of Adelaide and the University of South Australia underwent a decrease, while the percentage remained substantially unchanged for the Flinders University (*Graph 64* and *Graph 65*). This means that overall the South Australian universities' dependence on public grants for their research activity decreased throughout the reference period, even though their total research income increased. This implies a growing ability of South Australia's university to attract private resources in order to finance their research projects.

**Graph 64: Research Income: Total Government Grants (2005-2008)**



**Graph 65: Research Income: Percentage of Government Grants on Total (2005-2009)**



## 5.2. Foreign Universities with an Offshore Campus in South Australia

In the last five years, two internationally well-known universities decided to open an offshore campus in Adelaide: Carnegie Mellon University (Pittsburgh, USA) and University College London (London, UK). Both consider the South Australia's campus as an Asian Pacific education base and are offering high-profile degrees in niche-specialised areas.

Their presence in Adelaide is a result of the 2003 *South Australia's Strategic Plan*, through which the Government declared its commitment to expand the international education of the State. The establishment of these two international universities improves the higher education profile of South Australia and highlights Adelaide's role as a bridge between Western institutions and the Southeast Asian countries.

### 5.2.1. Carnegie Mellon Heinz College Australia<sup>58</sup>

Carnegie Mellon University is a global US research university based in Pittsburgh. It is recognised for its world-class arts and technology programmes, collaboration across disciplines and innovative leadership in innovation. It was placed at the 20<sup>th</sup> place in the 2010 Times Higher Education - QS World University Ranking.

<sup>58</sup> See: [www.heinz.cmu.edu.au](http://www.heinz.cmu.edu.au).

The H. John Heinz III College at Carnegie Mellon is founded on the idea that the study of public policy and of information technology, independently or jointly, provides a uniquely powerful platform to influence the world of the 21<sup>st</sup> century. For this reason, the School of Information Systems and Management was added to the previous School of Public Policy and Management.

In May 2006 Heinz College began operations in Adelaide. This offshore campus serves as the school's Asia Pacific educational base and is characterised by a truly multicultural environment. Two post-graduate Carnegie Mellon degree programmes are offered the Heinz College in Adelaide: the Master of Science in Public Policy and Management and the Master of Science in Information Technology.

Carnegie Mellon University's global presence enables students of the Australia campus to reach a worldwide network of learning as well as study alongside students and staff from many different countries.

#### *5.2.2. University College London – School of Energy and Resources, Australia<sup>59</sup>*

The University College London (UCL) is one of the world's leading multidisciplinary universities and a modern, outward-looking institution, committed to engaging with the major issue of present times. It was founded in 1826 as a radically different university, opening up English education for the first time to people of all beliefs and social backgrounds. This spirit of radical liberalism has been at the heart of UCL throughout its development.

UCL is one of the world's prestigious, research-led universities. It operates in a global context and is committed to excellence, innovation, and the promotion of global understanding and cooperation. UCL was ranked 4<sup>th</sup> in the world in the 2010 Times Higher Education - QS World University Ranking. In 2010 the University College London established its School of Energy and Resources, Australia (SERAus) in Adelaide with the support of the Government of South Australia and the Australia energy company Santos Ltd. In this manner, UCL brings a unique internationally connected educational

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<sup>59</sup> See: [www.ucl.ac.uk/australia/](http://www.ucl.ac.uk/australia/).

experience to Australia with a specialist focus on education in the globally critical field of energy and resources.

UCL SERAus offers a Master of Science in Energy and Resources: Policy and Practice and a PhD programme. These are rigorous and challenging programmes which bind together industrial knowledge and expertise in the energy and resources sector.

### **5.3. Federal Research Centres based in South Australia**

Apart from universities, Federal Research Centres play a crucial role in the research and development activity. The main research institutions financed by the Australian Government are the Cooperative Research Centres (CRCs), the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO), and the Defence Science and Technology Organisation (DSTO). All these organisations have centres operating in South Australia. Furthermore, South Australia Government grants funds to a State research organisation: the South Australian Research and Development Institute (SARDI).

#### *5.3.1. CRCs based in South Australia<sup>60</sup>*

A Cooperative Research Centre is an incorporated or unincorporated organisation, formed through collaborative partnership between publicly funded researchers and end users. CRCs must comprise at least one Australian end-user (either from the private, public or community sector) and one Australian higher education institution (or research institute affiliated with a university). There are currently 42 CRCs operative, four of which are based in South Australia.

- The *Australian Seafood CRC<sup>61</sup>* is Australia's first entity to stimulate and provide comprehensive seafood related research and development and industry leadership on a national basis. One of its main competitive advantages is the fact that it has the support of the industry's major wild-harvest and aquaculture sectors, key companies and industry leaders throughout the value chain, and the nation's leading fisheries, aquaculture and seafood research institutes. The planned outcome for the Australian

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<sup>60</sup> See: [www.crc.gov.au](http://www.crc.gov.au).

<sup>61</sup> See: [www.seafoodcrc.com](http://www.seafoodcrc.com).

Seafood Cooperative Research Centre as a whole is to increase profitability and value of the Australian seafood industry as well as, assist end-users of its research to profitably deliver safe, high-quality, nutritious Australian seafood products to premium markets, domestically and overseas, and increase demand for Australian seafood. As a consequence of that, the main objectives of the research activity focus on production innovation (substantial increase in the production and profitability of selected wild-harvest and aquaculture species) and on product and market development (increased demand and access to premium markets for Australian seafood; fulfilment of consumer demands for safe, high-quality, nutritious seafood products; and increased profitability throughout the value chain). The goal of the Australian Seafood Cooperative Research Centre is to double the value of the Australian seafood industry to \$4 billion by 2017 to generate a significant number of new jobs in rural and regional areas.

- The *CRC for an Internationally Competitive Pork Industry*<sup>62</sup> is aimed at transforming the Australian pork industry while maintaining environmentally sustainable agricultural practice allowing the efficient production of innovative pork products from grain resources with improved conversion efficiency. The main sought outcomes of the research and development programmes of the Pork CRC are reduced production costs for high-quality pork through more reliable and consistent protein and energy supplies via innovative grain production, co-product utilisation and quality assessment; reduced production costs for high quality pork through improved herd feed conversion efficiency; increased demand for high-quality, niche Australian pork products as a result of enhanced capacity to deliver nutrients that promote the health and well-being of consumers via consumption of pork and pork products. These research outcomes will contribute to Australia 's industrial, commercial and economic growth through stabilised and sustained domestic and export pork market and improved confidence in the pork industry, leading to increased investment and industry growth.

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<sup>62</sup> See: [www.porkcrc.com.au](http://www.porkcrc.com.au).

- The *CRC for Contamination Assessment and Remediation of the Environment (CARE)*<sup>63</sup> is a research and development organisation providing cutting edge technologies and knowledge in assessing, preventing and remedying contamination of soil, water and air. CRC CARE's research is structured into four main programs to address industry and national needs. Risk assessment programme develops more reliable methods and technologies for assessing the risk associated with environmental contamination. Remediation technologies programme develops technologies for the low-cost, in-situ remediation of contamination that provide results acceptable to regulatory agencies and environmental auditors. Prevention technologies programme addresses the broad questions of reusing solid wastes, particularly investigating the innovative use of organic wastes in agriculture for their nutrient content, reuse of mineral solid wastes as soil replacements, and the use of metallic manufacturing wastes for their micronutrient value. Finally, the social, legal, policy and economic issues programme aims to understand the social, legal and economic drivers associated with environmental contamination and remediation, so that future solutions will be economically sound, socially acceptable and rapidly adoptable. It evaluates the legal and policy frameworks that govern the assessment and remediation of contaminated sites, using a comparative methodology, with the aim of identifying cost-effective solutions which also address community expectations and concerns, in Australia and the Asia-Pacific region. CRC CARE's approach brings together five Australian Universities, and State and Commonwealth agencies and regulatory authorities, mining, petroleum and agricultural industries, venture capitalists, environment consultants and suppliers to work collaboratively on vital contamination issues.
- Finally, *Deep Exploration Technologies CRC (DET)*<sup>64</sup> is aimed at developing more successful, cheaper and safer methods of deep exploration, which require research and development in the drilling, in the

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<sup>63</sup> See: [www.crccare.com](http://www.crccare.com).

<sup>64</sup> See: [www.detcrc.centric.com.au](http://www.detcrc.centric.com.au).

logging and in the targeting of exploration holes. The DET CRC is concerned with the technologies of exploration and its results will directly impact on the hardware and workflows of the mineral exploration business. The DET CRC runs three research programmes: drilling (next generation drilling technologies, drilling optimisation, etc.); logging & sensing (sensors for rapid down-hole rock characterisation, integration of geophysical and petrophysical data, etc.); and targeting (3D seismic exploration for hard rock environments, geochemical sampling deep cover, South Australian data integration, etc.). The research activities of the Deep Exploration Technologies CRC have been established to address the most significant challenges to the future of the minerals industry.

### 5.3.2. CSIRO Centres in South Australia

The Commonwealth Scientific and Industrial Research Organisation (CSIRO)<sup>65</sup> is Australian national science agency. CSIRO operations span seven sectors: agribusiness; energy and transport; health; information, communication and services; manufacturing; mineral resources; and environment and natural resources. Its research is largely performed by the Divisions, which are the business units of CSIRO. The relationship between Divisions enables CSIRO to tackle industrial and environmental problems with a multidisciplinary approach, assembling the best teams from across the Organisation.

CSIRO carries out its research activities in 56 sites throughout Australia and overseas. In particular, it operates in three centres in South Australia<sup>66</sup>.

- CSIRO at the *Waite Campus* (Adelaide)<sup>67</sup> undertakes a range of research in land and water management, plant science, sustainable farming systems, precision agriculture, and mathematics and statistics. Five CSIRO divisions are represented at the Waite Campus: CSIRO Land and Water; CSIRO Plant Industry; CSIRO Ecosystem Sciences; CSIRO Mathematics, Informatics and Statistics; and CSIRO Process Science and Engineering.

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<sup>65</sup> See: [www.csiro.au](http://www.csiro.au).

<sup>66</sup> See: [www.csiro.au/places/SA.html](http://www.csiro.au/places/SA.html).

<sup>67</sup> See: [www.csiro.au/places/Waite-Precinct.html](http://www.csiro.au/places/Waite-Precinct.html).



- Regarding land and water management, the major research areas based in Adelaide include: groundwater and surface water hydrology; soil and landscape science; contaminant chemistry and ecotoxicology; catchment biogeochemistry and aquatic ecology; water reuse and environmental process engineering; natural resource management policy and economics; and identification of opportunities and policy options for improving the use of land and water resources.
- CSIRO plant science on the Waite Campus aims to improve the performance of horticultural crops across the production, processing and marketing chain by developing improved genetic material from molecular and conventional breeding, and by generating better plant management techniques. An important focus is research for the Australian grape and wine industry.
- CSIRO farming systems research at Waite is focused on the biophysical performance of farming systems and agricultural land with the aim of identifying management solutions that improve production along with environmental and economic performance.
- CSIRO mathematicians and statisticians at Waite Campus are involved in: managing risk for the finance industry; designing ophthalmic lenses; discovering early biomarkers of diseases like colorectal cancer; protecting Australian agricultural industries from the impact of pests and diseases; identifying drivers of wine quality to support sustainable viticulture.
- The *CSIRO Science Education Centre (CSIROSEC)*<sup>68</sup> in Adelaide offers hands-on science programmes for students and teachers. It is the hub for CSIRO's science education programs in South Australia. The CSIROSEC is made possible by a dynamic partnership between CSIRO and the South Australian Department of Education and Children's Services.
- Finally, research at *CSIRO's Adelaide Laboratories*<sup>69</sup> (on the grounds of the University of Adelaide) covers a broad range of research and

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<sup>68</sup> See: [www.csiro.au/org/pscu.html](http://www.csiro.au/org/pscu.html).

<sup>69</sup> See: [www.csiro.au/places/Adelaide.html](http://www.csiro.au/places/Adelaide.html).

development including food, nutrition, diagnostics, biosensor research, and preventative health. The core skills of this scientific group include: genomics; food and nutrition; biochemistry; molecular biology; and cell signalling expertise.

### 5.3.3. DSTO in South Australia

The Defence Science and Technology Organisation (DSTO)<sup>70</sup> is the Australian government's lead agency charged with applying science and technology to protect and defend Australia and its national interests. DSTO delivers expert, impartial advice and innovative solutions for Defence and other elements of national security.

The South Australia's operational centre of DSTO is in Edinburgh. *DSTO Edinburgh*<sup>71</sup> is helping the Australian Defence Force (ADF) to achieve a capability edge through the exploitation of rapid advances in information technology, communications and intelligence gathering, and in the development of new equipment, electronic systems and war fighting concepts. It provides frontline war fighter support in the areas of weapons systems, electronic warfare, sensor systems and operational concepts. Its R&D programmes aim to provide commanders with knowledge superiority and platform ascendancy to coordinate forces to maximum operational effect.

DSTO Edinburgh's visionary and evolutionary business is carried out by the Systems Sciences Laboratory (SSL) and the Information Sciences Laboratory (ISL). On the one hand, the Systems Sciences Laboratory (SSL) conducts research into combat/mission systems, electronic warfare systems, weapons and sensor systems and associated technologies, including radar, sonar, electro-optic, radio frequency and avionics. It also leads research and experimentation into advanced concepts such as web-enabled military operations and tactical level network centric warfare. On the other hand, the Information Sciences Laboratory (ISL) supports Government policy and military decision-making through the protection of Australia's national critical infrastructure, development of intelligence and surveillance capabilities and

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<sup>70</sup> See: [www.dsto.defence.gov.au](http://www.dsto.defence.gov.au).

<sup>71</sup> See: [www.dsto.defence.gov.au/publications/3659/6271EdinSite%20brochure.pdf](http://www.dsto.defence.gov.au/publications/3659/6271EdinSite%20brochure.pdf).

input to Defence capability development. ISL also contributes to Defence campaign planning and execution through research in areas such as situation awareness, command and control, and information operations. ISL conducts research into the value of technologies such as intelligent pervasive computing, and distributed decision-making to the military.

#### *5.3.4. South Australia Research and Development Institute (SARDI)*

The South Australian Research and Development Institute (SARDI)<sup>72</sup> delivers robust scientific solutions for primary industries. SARDI is the State Government's principal research institute. SARDI addresses these priorities or barriers to growth throughout its science programs: value-chain linkages, food security, natural resource and climate adaptation, product, integrity requirements, innovation capability and enabling technologies, supplier competitiveness, and biosecurity.

SARDI multi-disciplinary research capability is organised into dedicated science programs within key research divisions.

- Aquatic Sciences division deals with algal production systems; aquaculture, inland waters and catchment ecology; marine environment and ecology; oceanography and wild fisheries.
- Innovative Food and Plants group works on food safety; food innovation value chain; gene function; new variety agronomy; oat and vetch; pulses and oilseeds; and wheat and barley.
- Livestock and Farming Systems division concerns to farming systems; intensive livestock production systems; integrated biosystems; livestock breeding and genetics; pasture improvement.
- Finally, Sustainable Systems programme is about climate applications; entomology; plant and soil health; viticulture; and water resources and irrigated crops.

SARDI carries out research for commercial clients and government and industry funded initiatives. The organisation is also a leading focus for business and industries to initiate collaborative research planning. Current collaborative projects include projects with universities, research

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<sup>72</sup> See: [www.sardi.sa.gov.au](http://www.sardi.sa.gov.au).

organisations, cooperative research centres and industry partnerships. SARDI has also a successful track record in commercialisation.

SARDI's scientific outcomes contribute to South Australia's Strategic Plan targets relating to the economy, the environment and science innovation. Science programs are also aligned to the State Government's Science Plan to meet specific industry priorities, increase productivity and economic performance, pursue innovation in environmental industries, attract investment and develop critical infrastructures.

SARDI pursues excellence through an extensive network of research centres, laboratories and field sites. State-of-the-art facilities support SARDI's highly skilled scientists in their work to create opportunities for market growth while increasing the productivity, sustainability and adaptability of South Australia's food and environmental industries. Moreover, regional sites provide significant opportunities for regional employment, community capacity building, technology transfer, and industry development<sup>73</sup>.

SARDI operates in four Metropolitan Centres.

- SARDI's corporate headquarters are located at the *Plant Research Centre*<sup>74</sup> on the agro-science precinct at the Waite Campus, Urrbrae (South Australia). The Plant Research Centre provides facilities for advanced research in crop and pasture breeding and evaluation, horticulture, sustainable resources research, entomology, plant nutrition, field crops pathology and associated disciplines.
- At the *Waite Agro-Science Precinct* SARDI scientists are collocated with research providers including CSIRO Plant Industries, University of Adelaide, Australian Wine Research Institute and SA Department of Water, Land and Biodiversity:
  - The *Plant Genomics Centre*<sup>75</sup> focuses on gene function research to use molecular genetic and genomics tools to further our understanding of key traits in species of importance to South Australian agriculture and horticulture.

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<sup>73</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities](http://www.sardi.sa.gov.au/about_us_2/facilities).

<sup>74</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/plant\\_research\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/plant_research_centre).

<sup>75</sup> See: [www.acpfg.com.au/](http://www.acpfg.com.au/).

- The *Field Crop Improvement Centre (FCIC)*<sup>76</sup> develops quality field crops to meet market demands (including cereal, pulse breeding, crop improvement, and national variety trials).
- The *Main Waite Building* is where entomology and pasture research is carried out.
- The *Diagnostic Centre* is a centre of excellence for field crop, pasture and horticultural diagnostics. A broad range of relevant, timely, innovative and impartial diagnostic services are offered including identification of nutritional disorders, quality, disease, pests and weeds.
- The *Genetic Resource Centre* directly supports the SARDI Lucerne Breeding and Australia Pasture Alliance programs, which develop improved cultivars for use across Australia and overseas. An additional recent initiative focuses on the development of viable options for the low rainfall livestock/cropping zone of southern Australia.
- The *South Australia Aquatic Sciences Centre*<sup>77</sup>, located at West Beach, is South Australia's leading focus for enhancing research in marine and inland fisheries, aquaculture, marine biotechnology, and environmental and ecosystem ecology.
- The *Glenside Laboratories*<sup>78</sup> provide the base for Human Health Food Safety research programs and livestock parasitology and biochemistry.

Besides, SARDI can also boast a number of Regional Centres:

- *Aquatic Sciences Mount Gambier, Lincoln Marine Sciences Centre (LMSC)*<sup>79</sup>, which is collocated with Flinders University and supports research in aquatic industries, aquaculture and the aquatic environment;
- *Clare Field Crops Unit*, which supports agronomy, tillage and seeding research;

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<sup>76</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/field\\_crop\\_improvement\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/field_crop_improvement_centre).

<sup>77</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/sa\\_aquatic\\_sciences\\_centre/sa\\_aquatic\\_sciences\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/sa_aquatic_sciences_centre/sa_aquatic_sciences_centre).

<sup>78</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/glenside\\_laboratories](http://www.sardi.sa.gov.au/about_us_2/facilities/glenside_laboratories).

<sup>79</sup> See: [www.flinders.edu.au/science\\_engineering/biology/home.cfm/lmsc/](http://www.flinders.edu.au/science_engineering/biology/home.cfm/lmsc/).

- *Kybybolite, Struan and Turretfield Agricultural Centres*<sup>80</sup>, which support livestock, pasture and crops research;
- *Lenswood Agricultural Centre*;
- *Loxton and Nuriootpa Agricultural Centres*, which support the viticulture, horticulture and irrigation industries;
- *Minnipa Agricultural Centre*<sup>81</sup>;
- *Pig and Poultry Production Institute (PPPI)*<sup>82</sup>, which is a joint venture between SARDI, Primary Industries South Australia, The University of Adelaide, the pig and poultry industries, located at Roseworthy Campus;
- *Regency TAFE*, which supports the innovative food industry;
- *The Australasian Experimental Stockfeed Extrusion Centre*<sup>83</sup>;
- and the *Waikerie Inland Saline Aquaculture Centre (WISAC)*<sup>84</sup>.

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<sup>80</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/struan\\_agricultural\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/struan_agricultural_centre) and [www.sardi.sa.gov.au/about\\_us\\_2/facilities/turretfield\\_research\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/turretfield_research_centre).

<sup>81</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/minnipa\\_agricultural\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/minnipa_agricultural_centre).

<sup>82</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/pig\\_and\\_poultry\\_institute](http://www.sardi.sa.gov.au/about_us_2/facilities/pig_and_poultry_institute).

<sup>83</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/stockfeed\\_extrusion\\_centre2](http://www.sardi.sa.gov.au/about_us_2/facilities/stockfeed_extrusion_centre2).

<sup>84</sup> See: [www.sardi.sa.gov.au/about\\_us\\_2/facilities/waikerie\\_inland\\_saline\\_aquaculture\\_centre](http://www.sardi.sa.gov.au/about_us_2/facilities/waikerie_inland_saline_aquaculture_centre).

## **6. PUBLICATIONS AND PATENTS: DATA AND METHODOLOGY**

In previous chapters, data was analysed on South Australia's Gross Expenditure on Research and Development including the description of South Australia's institutions and centres which carry out research activities. In the forthcoming chapters, results of the R&D in South Australia are presented through the analysis of data on publications and patents.

This first chapter describes how data was gathered. In order to give a complete and transparent idea of the methodology with which information was chosen and categorised, the collection process adopted is explained. This also clarifies the process used to develop relevant indicators, which are then employed as a method to classify and label research centres according to their importance and productivity.

### **6.1. Data coverage**

#### *6.1.1. Selected period*

Data taken into account cover the 2005 to 2009 time period. A time length of 5 years was chosen so as to fit into a period adequately long enough to contain a sufficient number of relevant information but, at the same time, relatively short to capture trends of the recent years, instead of an average of the last decade.

#### *6.1.2. Categorisation*

Both Federal Research Centres and research organisations which collaborate with universities' Divisions were taken into consideration.

During the process of gathering data on universities, an operational problem surfaced: some information was just attributed to sub-institutions of university's Schools, or even directly to a whole School, instead of being assigned to specific research centres. Based on this a more general approach was taken and information was attributed to Schools, instead of single research centres.

Another slight issue arose when the single Schools were categorised into macro areas. This occurred as each university has a different method in organising its Divisions into Faculties and consequently its Schools. For this reason, a common classification system has been created joining units of different Faculties into three main comprehensive areas: Health Sciences; Humanities & Social Sciences; and Engineering, Science & Related<sup>85</sup>.

A few issues also arose relating to the Public Research Centres. CSIRO is a national institution that has a rather complex structure as it has units that deal with different subjects, and each entity has, in turn, branches in different locations in Australia. For this reason, it is difficult to geographically identify the outcomes of a single unit. Due to this organisational configuration, it was decided to consider the results of the entities with an operational base in South Australia; a unit-base approach was deemed more appropriate and less biased than a branch-base approach.

## **6.2. Indicators**

The relative importance of research centres has been measured according to their outcome production, in terms of publications and patents. This perspective was taken in order to allow institutions working in both humanities and sciences fields to be considered. A mono-perspective, taking into consideration just one of the two outcomes, would jeopardise those organisations mostly operating in the area where this type of production is not particularly common. The largest amount of research centres is therefore taken into consideration.

It should be noted that any scientific production (both paper and patent) made in collaboration with various schools and institutions has been taken into account once for each unit present in South Australia; so, even if it is one elaboration, it has been counted as many times as the amount of units present in South Australia.

### *6.2.1. Publications*

The number of publications made by a research centre was considered as a relevant indicator of its activity, mainly if it deals with humanities subjects. Also

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<sup>85</sup> See *Attachment 2* for the complete list of Schools belonging to each macro-area.



the number of citations per publication was considered as a crucial mark, as it suggests the external consideration and importance given to the work.

The publications taken into account are those available on *Scopus*<sup>86</sup>, the online database utilised to find the information needed. The *Scopus* database was chosen because it is the largest abstract and citation database of peer-reviewed literature<sup>87</sup>. It contains publications in the form of articles, reviews, conference papers, conference reviews, letters, editorials, notes, short surveys, business articles or press and errata.

Publications collected include the name of the institutions as affiliations and, more specifically, the publications considered in this research are those that present one of the universities' Schools or of the federal research centres' units as affiliated contributors.<sup>88</sup>

### 6.2.2. Patents

Regarding patents, some decisions about search enquiries had to be taken. First of all, the most important choice to be made was deciding which registration offices to consider. Taking into account the three main organisations in the intellectual property rights' field was thought to be sufficient and these could give a good estimate of the whole IP production in South Australia. Thus, patents registered at the *IP Australia*, at the *European Patent Office* and at the *United States Patent and Trademark Office* were taken into consideration. For the Australian Patent Office, the AusPat search engine website<sup>89</sup> was used; in the European Patent Office website<sup>90</sup> we selected the European published applications database; while for the United States Patent and Trademark Office, the patent application full text and image database<sup>91</sup> was chosen.

As recognised, each patent has different dates: one refers to the time the applicants asked to register the mind creation for the first time in absolute

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<sup>86</sup> See: [www.scopus.com](http://www.scopus.com).

<sup>87</sup> As it brags about it on the website.

<sup>88</sup> Universities' schools and private research centres' units have been found looking for them as affiliation: this means that at least one of the authors is affiliated with that institution.

<sup>89</sup> See: [www.pericles.ipaustralia.gov.au/ols/auspat/](http://www.pericles.ipaustralia.gov.au/ols/auspat/).

<sup>90</sup> See: [www.ep.espacenet.com/quickSearch?locale=en\\_EP](http://www.ep.espacenet.com/quickSearch?locale=en_EP).

<sup>91</sup> See: [www.appft.uspto.gov/netahhtml/PTO/search-adv.html](http://www.appft.uspto.gov/netahhtml/PTO/search-adv.html).

terms (priority date), one stands for the date in which the authors require for first time the registration in a specific office (filing date), while the publication or registration dates relate to the date when the invention actually was published and registered. Based on this, the date in which applicants required the registration of their inventions in the three offices was taken into consideration. The filing date was identified as a better representation of the actual timing of the work made by research institutions rather than the publication date: it refers to the moment in which the invention is finished and ready to be protected by the patent, instead of relating to the moment in which the registration office has completed the filing process.

Patents were attributed to universities' Schools according to inventors' place of work: an invention was assigned to a certain school if its inventors work for that unit.

In relation to this this, few issues had to be taken into consideration during the patents' data gathering process due to the lack of all the basic information needed to categorise inventions according to universities' Schools and, so, required arbitrational decisions about the classification method.

The patent information database of the IP Australia office was the less complete among those considered, since in many case the names of the inventors were not provided.

In the case where the names of the inventors were not displayed, a patent search on the Internet was made to find out those names, in order to try to assign them to their school of origin. When it was not possible to find the missing information, or the information found could not objectively be attributed to any authors, so that to link the patent to a specific school, the invention was just assigned to the whole University that applied for the patent registration and put under the label "unassigned patents".

It happened to encounter some patents that just displayed the priority date but not the filing date: in this case it was decided not to consider them since the year in which their registration was required was unclear and, thus, it was not possible to know if they could fit our temporal range.

When the patents' inventors and filing date were identical but their names were similar, the two different creations were considered.

In the case where a South Australian university was included in applicants' list of one patent but none of the inventors' names could be linked to any South Australian university, the patent was assigned to a local school if the authors could all be referred to the same specific field of work; on the contrary, the patent was attributed to the whole university as unassigned.

Turning to a general perspective, an important feature characterising Flinders University and the University of Adelaide is that both of them are supported by separate organisations (*Flinders Partners* and *Adelaide Research and Innovation* respectively) for the commercialisation of their innovative ideas. Based on this, it has been decided to treat the patents registered under the name of these institutions as if their registration was required by the related university and therefore they were categorised according to universities' schools: these were treated as the universities' research centres. This means that the time when they were registered was checked, as well as the inventors' names in order to try to allocate them into the schools.

The last peculiarity discovered during the gathering of data was the fact that it could not be possible to differentiate patents made by the Commonwealth Scientific and Industrial Research Organisation and by the Defence Science and Technology Organisation according to the internal units that produced them. For this reason, it cannot be determined whether the centres based in South Australian collaborated in their creation or not. In relation with this, it was decided to consider all the patents the two organisations registered. For this reason, it is recognised that careful attention needs to be made before drawing any conclusion based on these data.

## 7. R&D IN SOUTH AUSTRALIA: DATA ON PUBLICATIONS AND PATENTS

The data collected according to the procedure described above was elaborated on in order to obtain a picture of the results of R&D activity in South Australia between 2005 and 2009. In this chapter the outcomes of our elaboration are presented.

The aim of this section is to offer a snapshot of the research system in South Australia per se, not compared to any other entity, in order to identify the most productive research centres of the State in terms of R&D activity outputs (publication and patents).

### 7.1. Publications

The results on publications are discussed in this section firstly comparing universities and public research centres, in order to get a general picture of the whole situation. Data are then presented specifically according to single organisations.

*Graph 66* represents the number of publications released by each institution throughout the reference time period. The three South Australia's universities have produced a higher number of outcomes than the public research centres. In particular, the University of Adelaide stands out in this field. It also leads the considered group of institutions in terms of total number of received citations (*Graph 67*). Regarding this, CSIRO can boast a fairly high amount of citations that allows it to be third among the other entities, outpacing the University of South Australia. Furthermore, the CSIRO gains the leading position when the average amount of citations received per publication is considered<sup>92</sup> (*Graph 68*). This first representation highlights the important role that the CSIRO plays in the research publication field, both generally speaking and compared to the other public research centres.

Considering only the South Australia's universities, without taking into account the public research centres, *Graphs 69-71* show the number of publications

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<sup>92</sup> The average number of citations is the Relative Citation Impact: both represent the amount of references in the five considered years out of the amount of papers published in the same period.

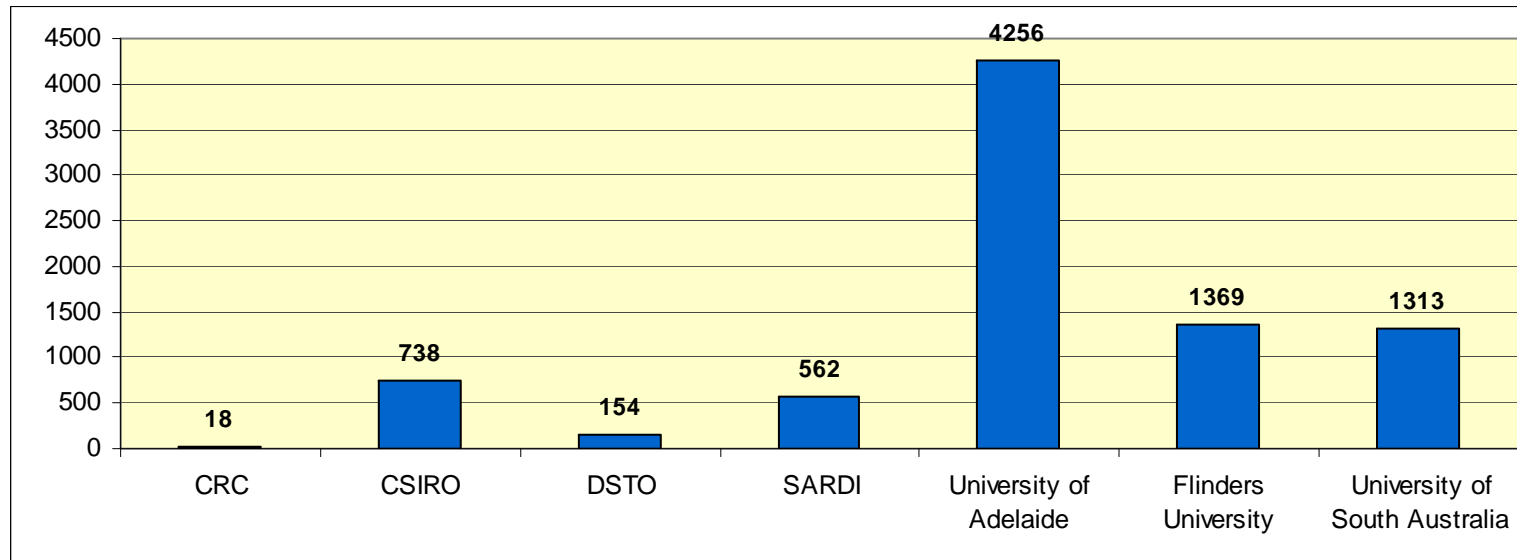
according to the three macro areas in which Schools have been categorised. Flinders University could boast a very high number of publications in the humanities field; it is the same also for the University of South Australia but with less emphasis. The University of Adelaide, instead, is more effective in the engineering and sciences field, given that 82% of its whole scientific paper production was in this area. However, the University of Adelaide was the most productive university in all the three areas, due to its higher amount of publications compared to the others. Nevertheless, this last figure is not confirmed considering the average number of citations (*Graph 72-74*). In this case, Flinders University emerges.

**Table 21: Number of Publications, Citations and Average Number of Citations**

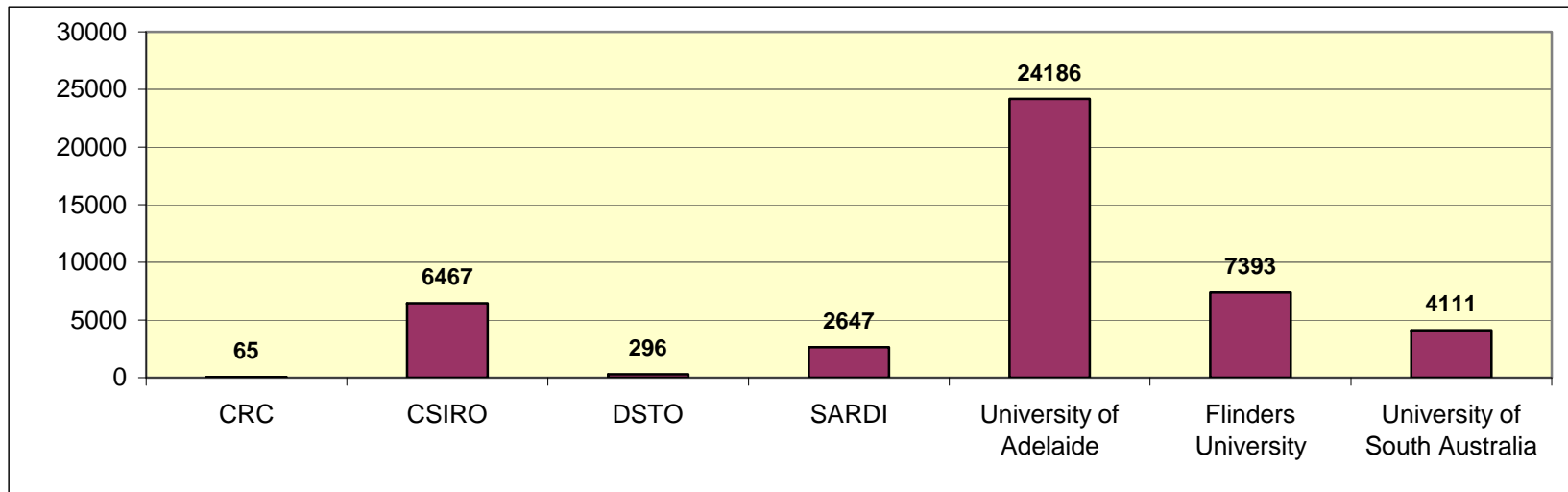
Institution	Number of publication	Total num. of citations	Average num. of citation
CRC	18	65	3.61
CSIRO	738	6,467	8.76
DSTO	154	296	1.92
SARDI	562	2,647	4.71
University of Adelaide	4,256	24,186	5.68
Flinders University	1,369	7,393	5.40
University of South Australia	1,313	4,111	3.13

Source: Scopus Database

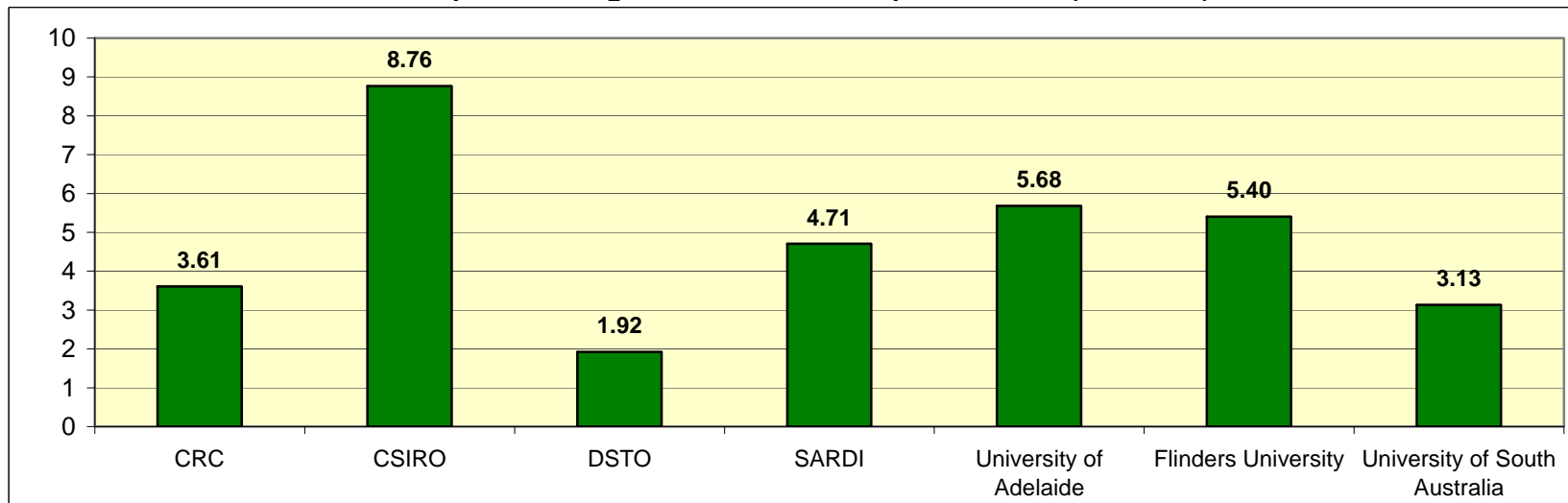
**Graph 66: Total Number of Publications according to Institutions (2005-2009)**



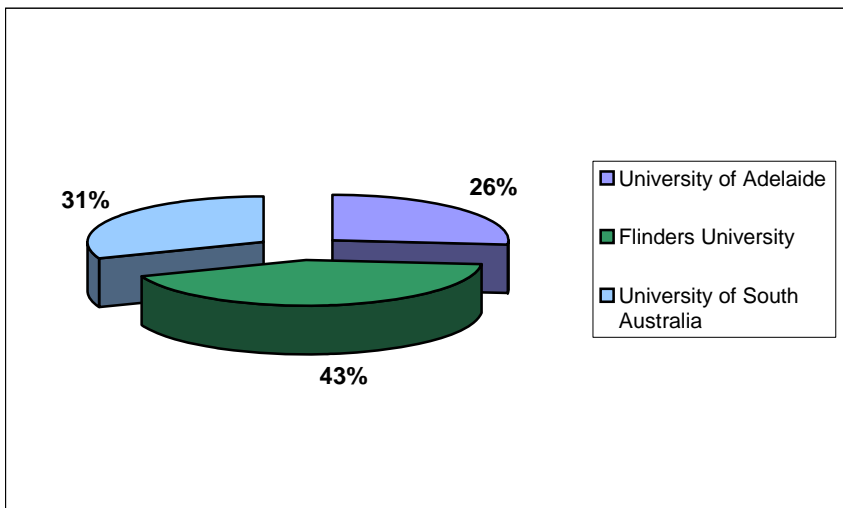
**Graph 67: Total number of Citations according to Institutions (2005-2009)**



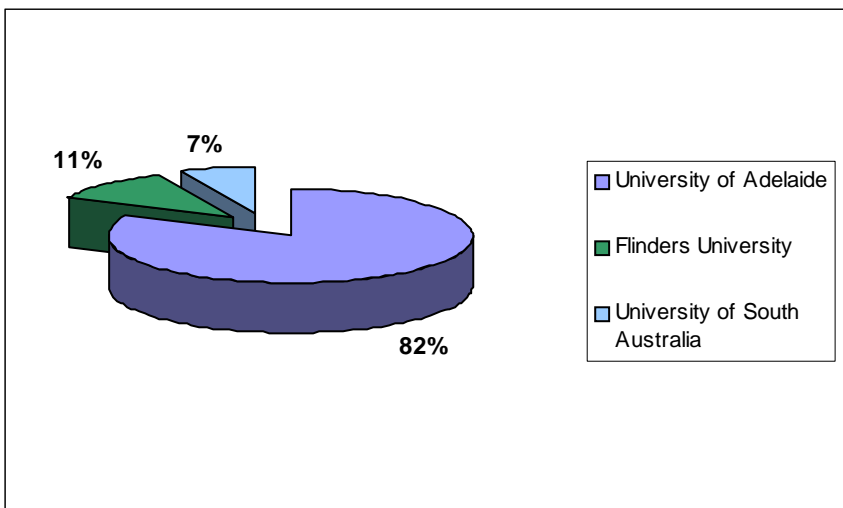
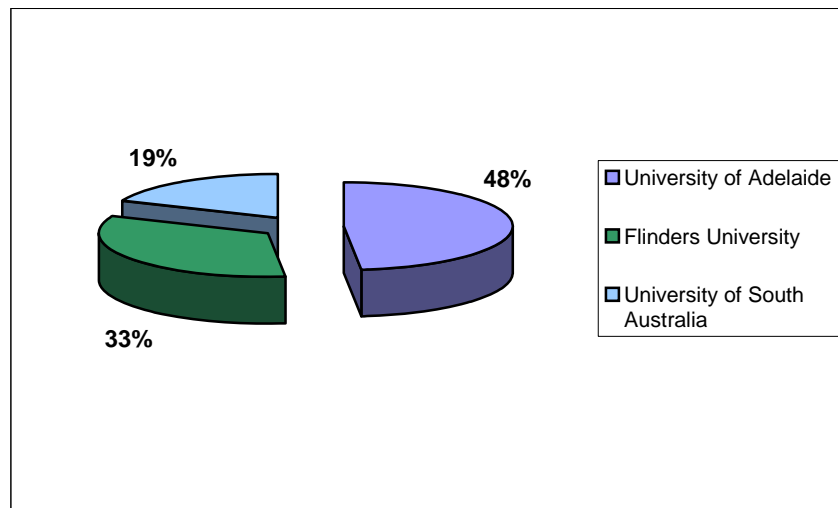
**Graph 68: Average number of Citations per Institution (2005-2009)**



**Graph 69: Number of Publications in the Humanities & Social Sciences Macro-area (2005-2009)**



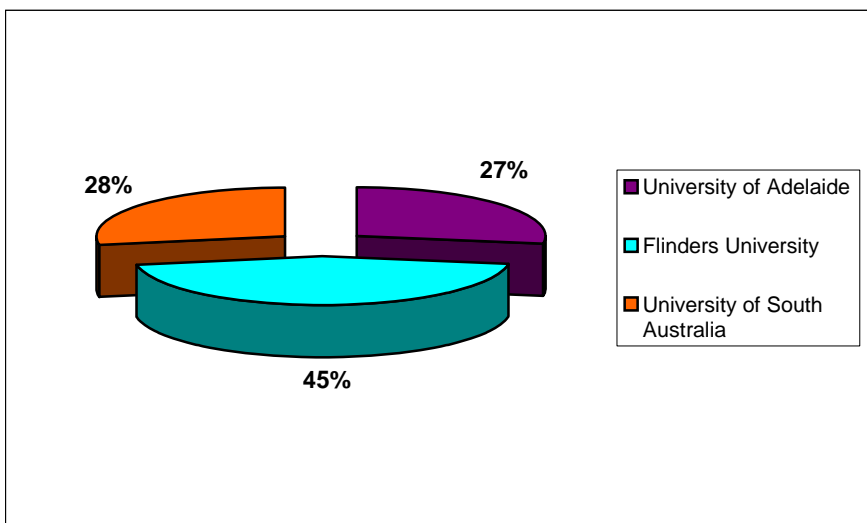
**Graph 70: Number of Publications in the Health Sciences Macro-area (2005-2009)**



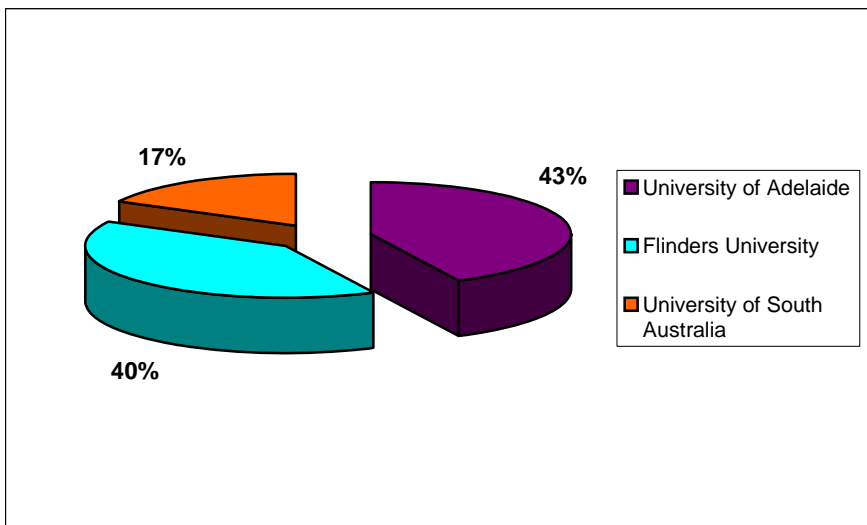
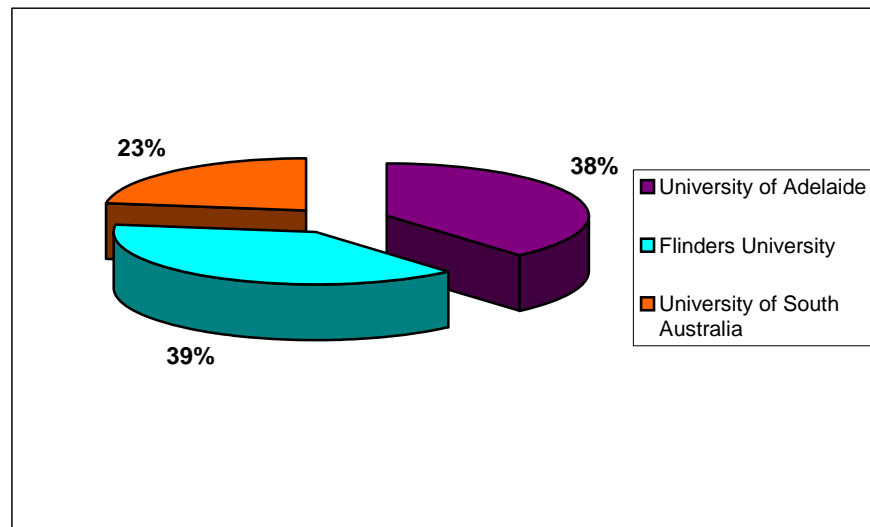
**Graph 71: Number of Publications in the Engineering, Science & Related Macro-area (2005-2009)**



**Graph 72: Average Number of Citations in the Humanities & Social Sciences field (2005-2009)**



**Graph 73: Average Number of Citations in the Health Sciences field (2005-2009)**



**Graph 74: Average Number of Citations in the Engineering, Science & related field (2005-2009)**

A higher level of precision is needed in order to identify the most productive schools within each university. The Attachment 3 displays all the data related to Publications.

#### *7.1.1. University of Adelaide*

In reference to the University of Adelaide, the publications of the School of Molecular & Biomedical Science and the School of Paediatrician & Reproductive Health are the most quoted, with more than ten citations per paper on average (*Graph 77*). However, this does not imply that they are also the most productive, since the School of Earth and Environmental Sciences released almost 948 publications, while the School of Molecular & Biomedical Science 535 (the second most prolific) and the School of Paediatrician & Reproductive Health only 149 (*Graph 75*). In terms of absolute values, there are five other units that published more than the School of Paediatrician & Reproductive Health. However, the 149 publications of that School received more 1558 citations (*Graph 76*): that is why on average it is the second most quoted unit. Moreover, looking at *Graph 78* it becomes even more evident the weight of this School, since it is the unit that received the largest number of citations on a unique paper. Also the School of Molecular & Biomedical Science reconfirms its importance through this indicator. Therefore, it is one of the three most significant units in all the measures used. It is the same also for the School of Earth and Environmental Sciences, but it is due mainly to its huge amount of publications (6764 released in five years).

Considering the categorisation of the schools according to the three macro-areas, the Engineering, Sciences & Related area leads the number of publications and the total number of citations measures (*Graph 79-80*). However, on average the University's papers in the Health Sciences field received more references (*Graph 81*) and one of these<sup>93</sup> obtained the highest number of citations. This could be interpreted as if the Health Division of the University of Adelaide is more internationally relevant and recognised than the other divisions.

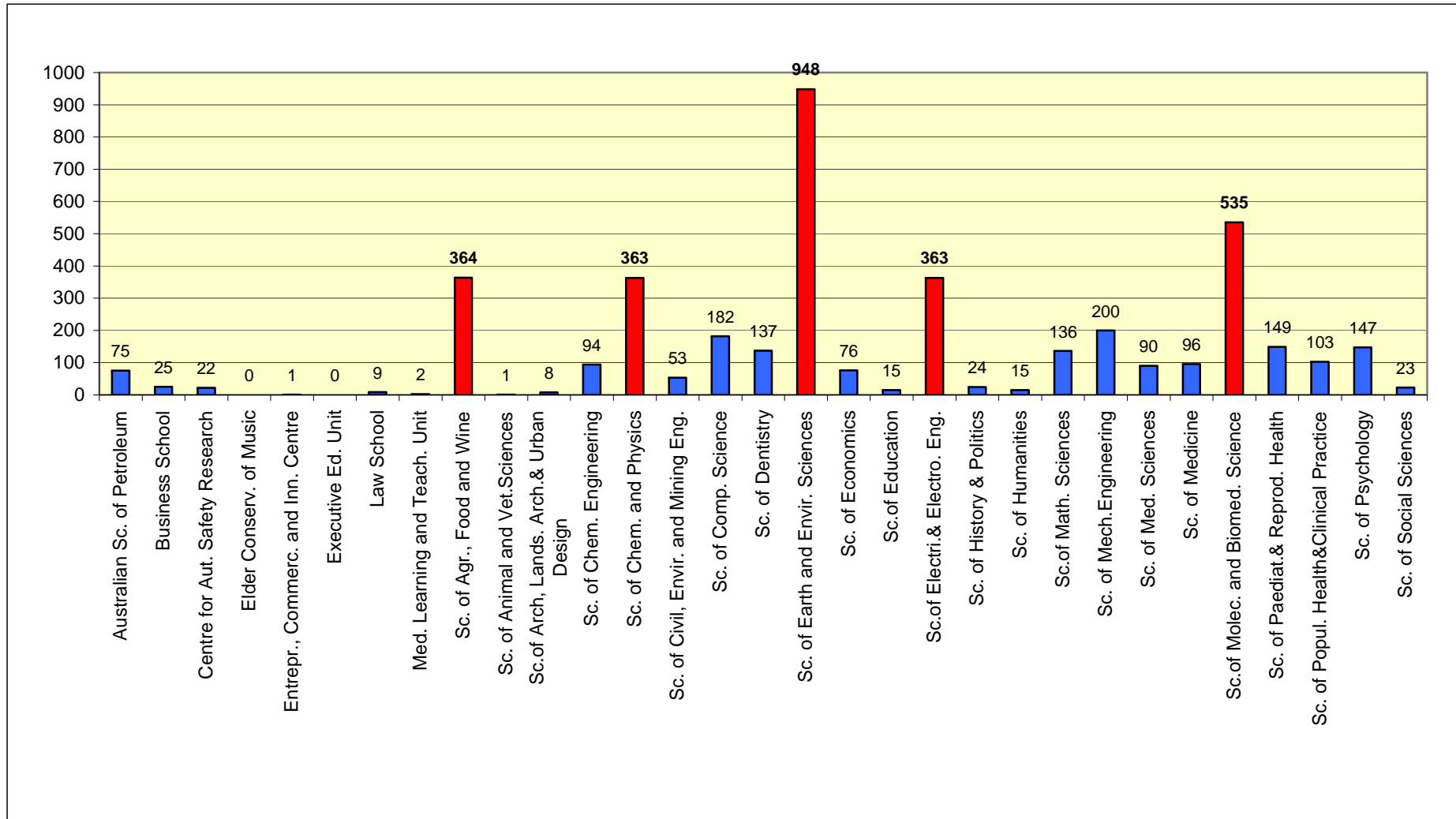
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<sup>93</sup> Gregory, P.A., Bert, A.G., Paterson, E.L., et al. (2008). The miR-200 family and miR-205 regulate epithelial to mesenchymal transition by targeting ZEB1 and SIP1. *Nature Cell Biology* (2008); Vol. 10, No. 5: pp. 593-601.

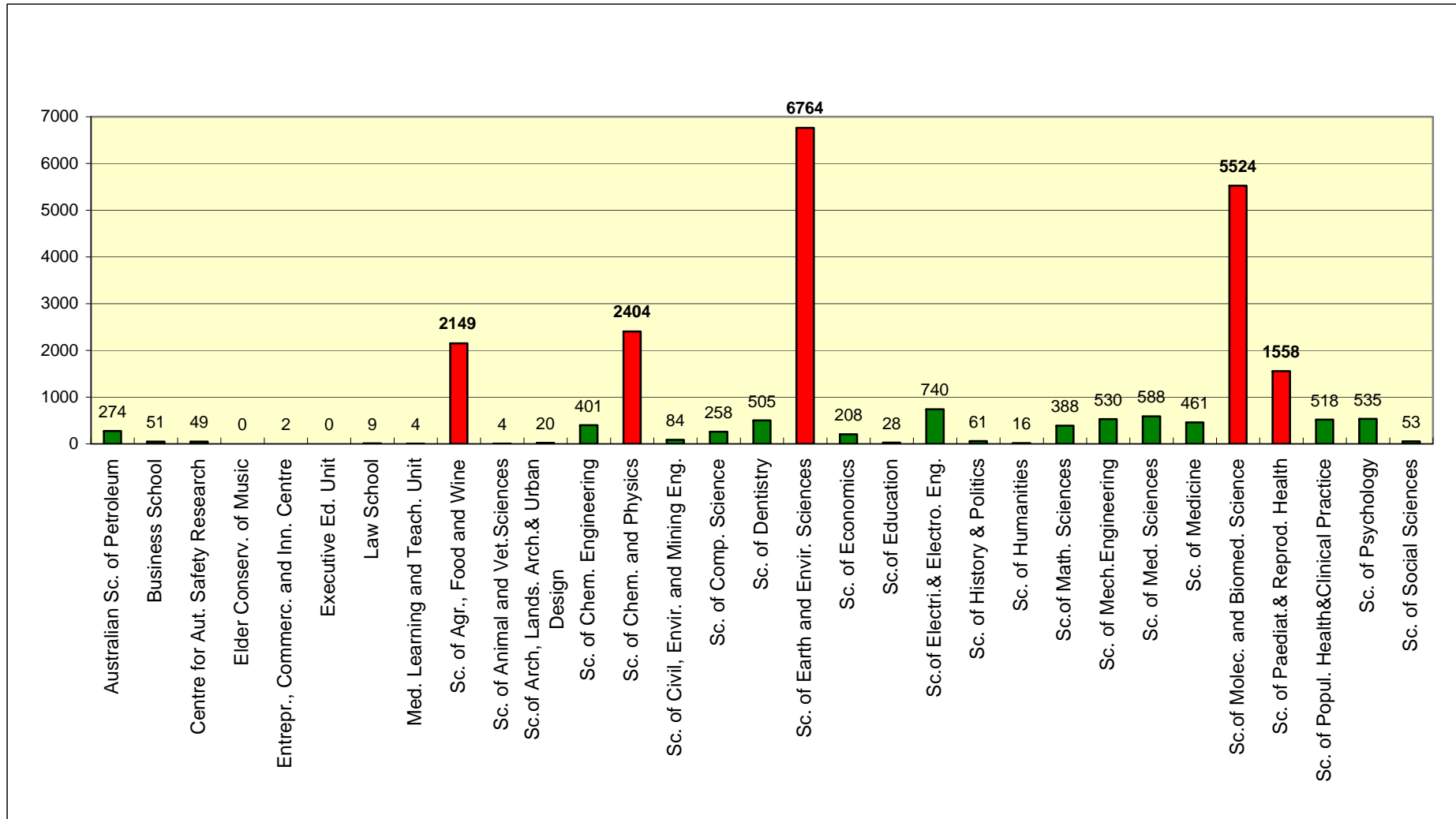
*Graph 82* represents the evolution of the publication production throughout our reference time period. The more productive macro-area was the Engineering, Science and Related. However, the publications in all the three macro-area increased in the considered five years (especially in the Health Science area, from three in 2005 to more than two hundred in 2009). *Graph 83* displays the evolution of total publications assigned to the University of Adelaide. Between 2005 and 2009 the total number of publications almost tripled.

The annual data on citations are not displayed in graphs because their evolution is not very representative. As a matter of fact, in most cases citations throughout our reference period are characterised by a decreasing trend. This is not surprising as an older publication has a higher probability of receiving a larger amount of citations than a more recent one.

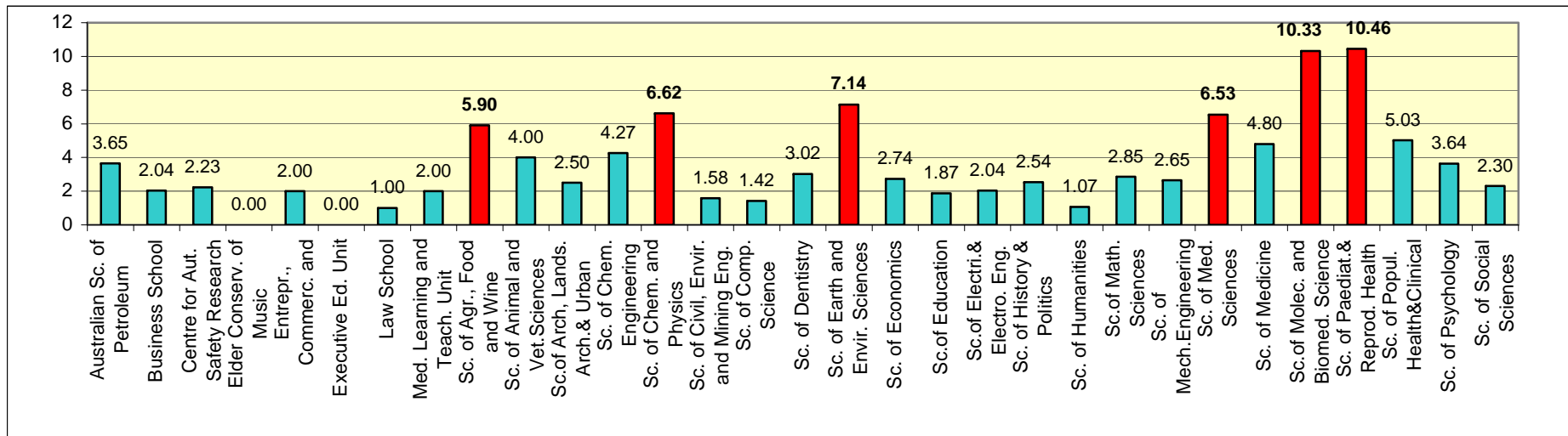
**Graph 75: Total Number of Publications per School – University of Adelaide (2005-2009)**



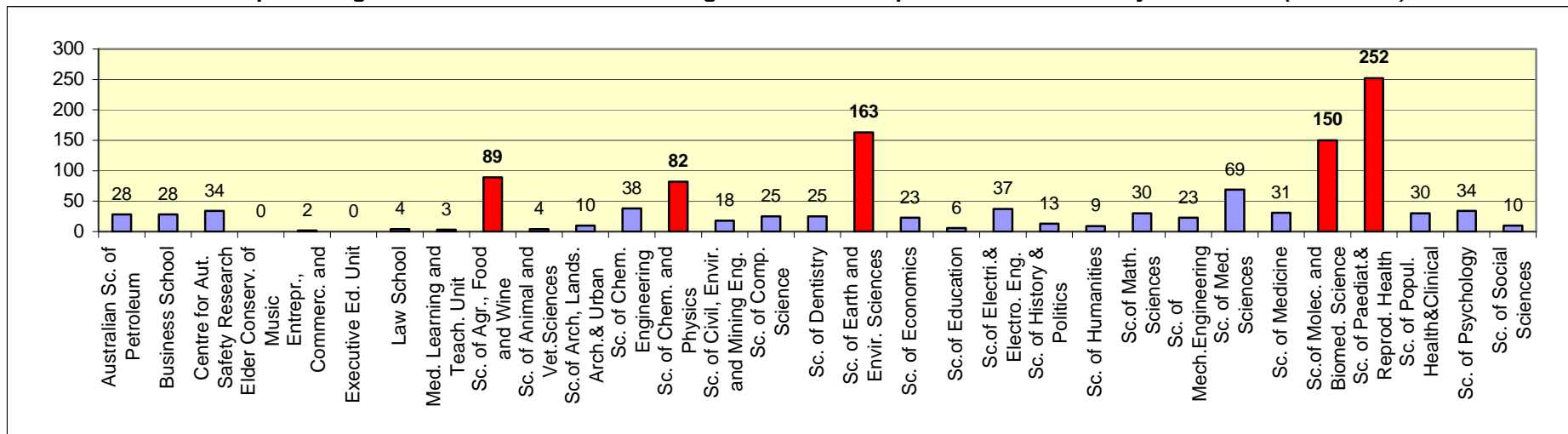
**Graph 76: Total Number of Citations per School – University of Adelaide (2005-2009)**



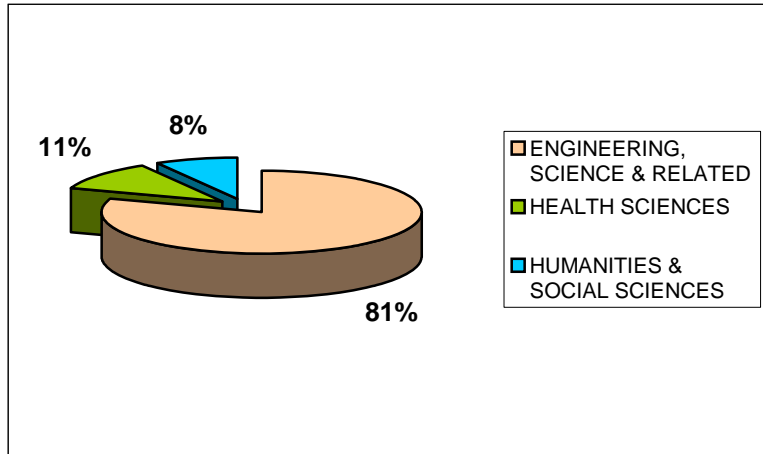
**Graph 77: Average Number of Citations per School – University of Adelaide (2005-2009)**



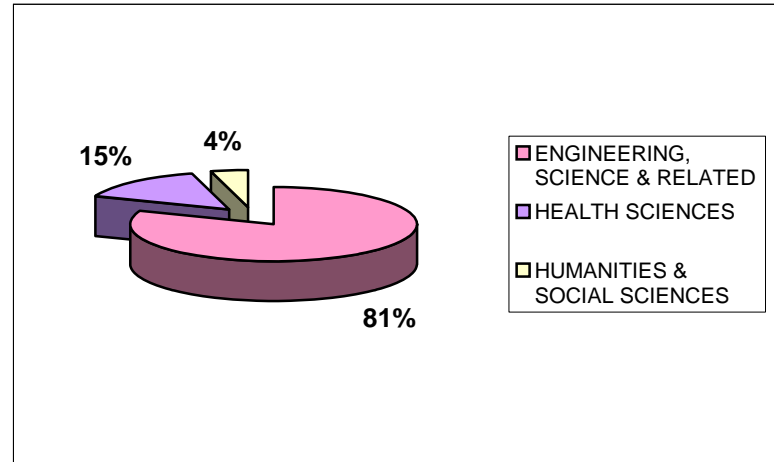
**Graph 78: Highest Number of Citations among all Publications per School – University of Adelaide (2005-2009)**



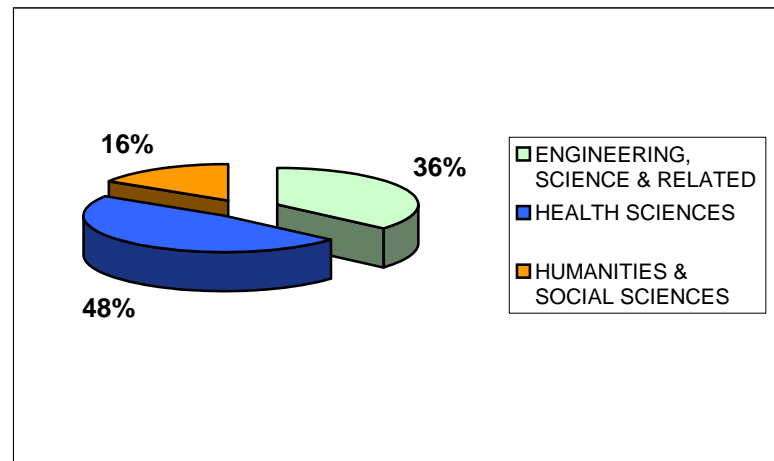
**Graph 79: Total Number of Publications according to fields – University of Adelaide (2005-2009)**



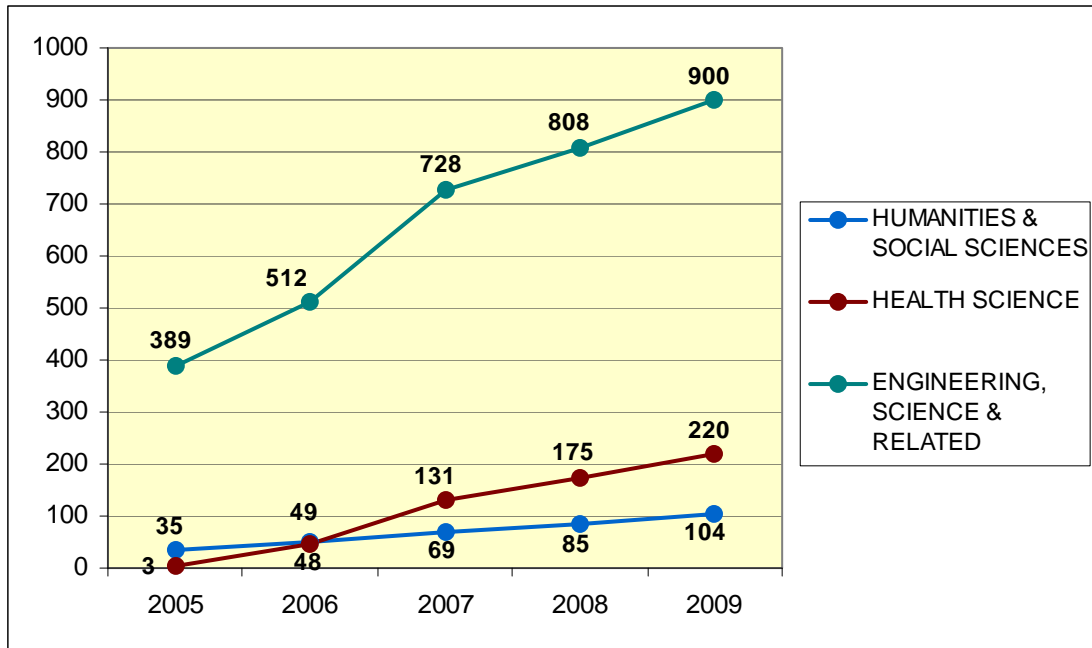
**Graph 80: Total Number of Citations according to fields – University of Adelaide (2005-2009)**



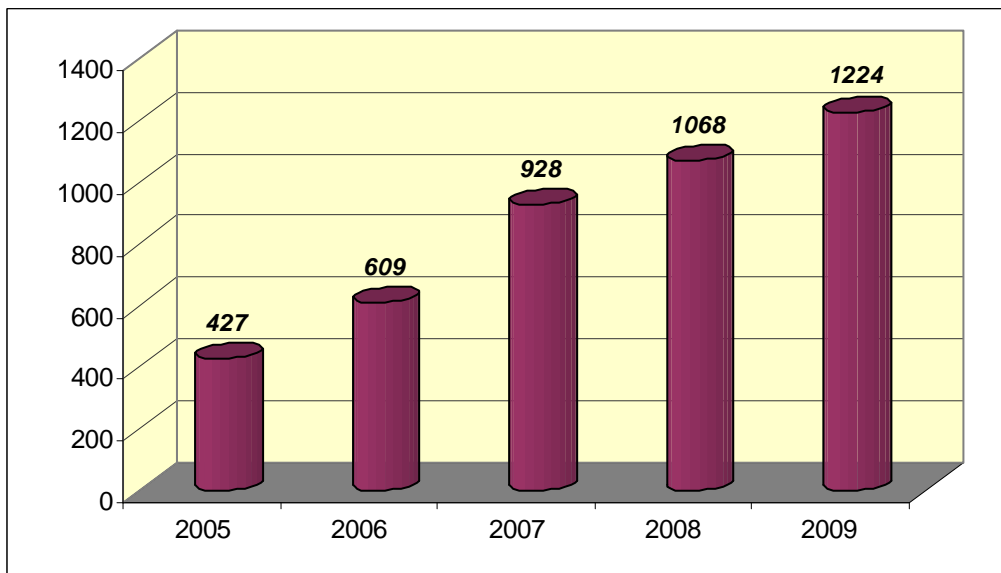
**Graph 81: Average Number of Citations according to fields – University of Adelaide (2005-2009)**



**Graph 82: Number of Publications according to Macro-areas (2005-2009) – University of Adelaide**



**Graph 83: Total Number of Publication (2005-2009) – University of Adelaide**





### 7.1.2. Flinders University

The more productive Schools at the Flinders University, in terms of publications, are the School of Biological Sciences (with 398 papers), the School of Medicine (301) and the School of Psychology (257) (*Graph 84*). Only eleven units out of twenty-five released more than ten publications in the considered five years; all the others produced on average almost 1.8 papers, with even ten schools making no more than one document.

Considering the number of citations per school (*Graph 85*), six units received at least 100 quotations, but only three could boast more than 300 mentions. However, these do not reach the amount of citations that the Schools at the University of Adelaide have, since they received around 2000 quotations, while at the University of Adelaide the two units that performed better received more than 5000 references. The same happens with the average number of citations per school, since the average amount is about 1.75, while for the University of Adelaide is 3.49 that is almost half of the average number of citations.

The Schools that received, on average, the highest amount of references are the School of Biological Sciences, the School of Medicine and the Flinders Centre for Science Education in the 21<sup>st</sup> Century, which had between 7 and 8.2 mentions (*Graph 86*). However, it has to be taken into account the fact that the Flinders Centre for Science Education in the 21<sup>st</sup> Century wrote just one paper in 2008 that received seven citations; that it is why it falls into the group of the best units.

The School of Medicine has received the highest amount of references in absolute terms (193) and the also most cited paper in absolute terms belongs to this School<sup>94</sup>. The School of Biological Sciences, that has 108 mentions, and the School of Psychology, with 66, follow. Considering the macro-areas, it is worth of notice that the three units belong to all different fields (*Graph 87*).

*Graphs 88-89* represent the total number of publications and the total number of citations. In this case, the three considered macro-areas split the total amount of papers and references almost equally, such that each field has

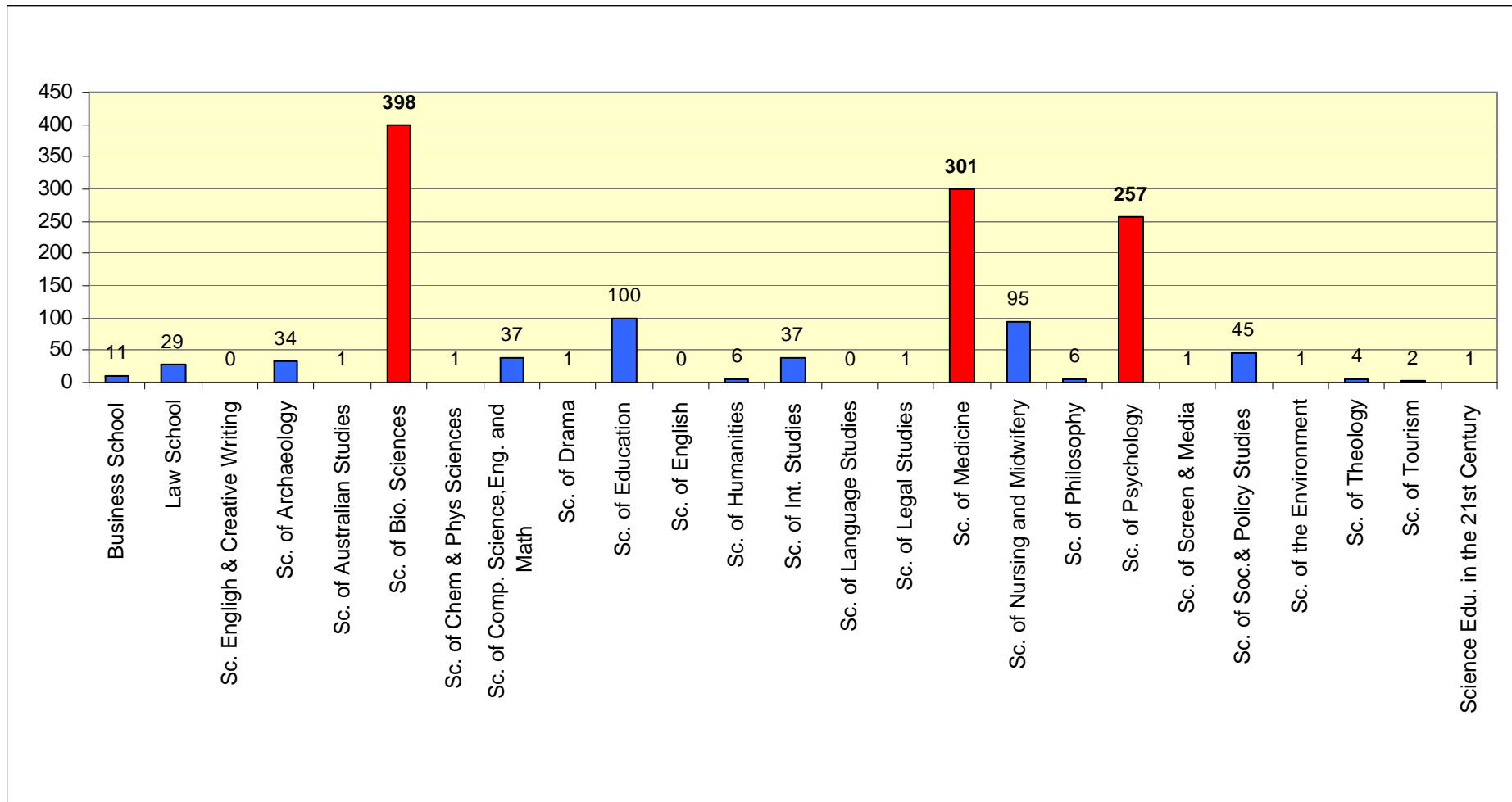
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<sup>94</sup> Mackenzie, P.I., Bock, K.W., Burchell, B., at al. (2005). Nomenclature update for the mammalian UDP glycosyltransferase (UGT) gene superfamily. *Pharmacogenetics and Genomics* (2005); No. 15: pp. 667-685.

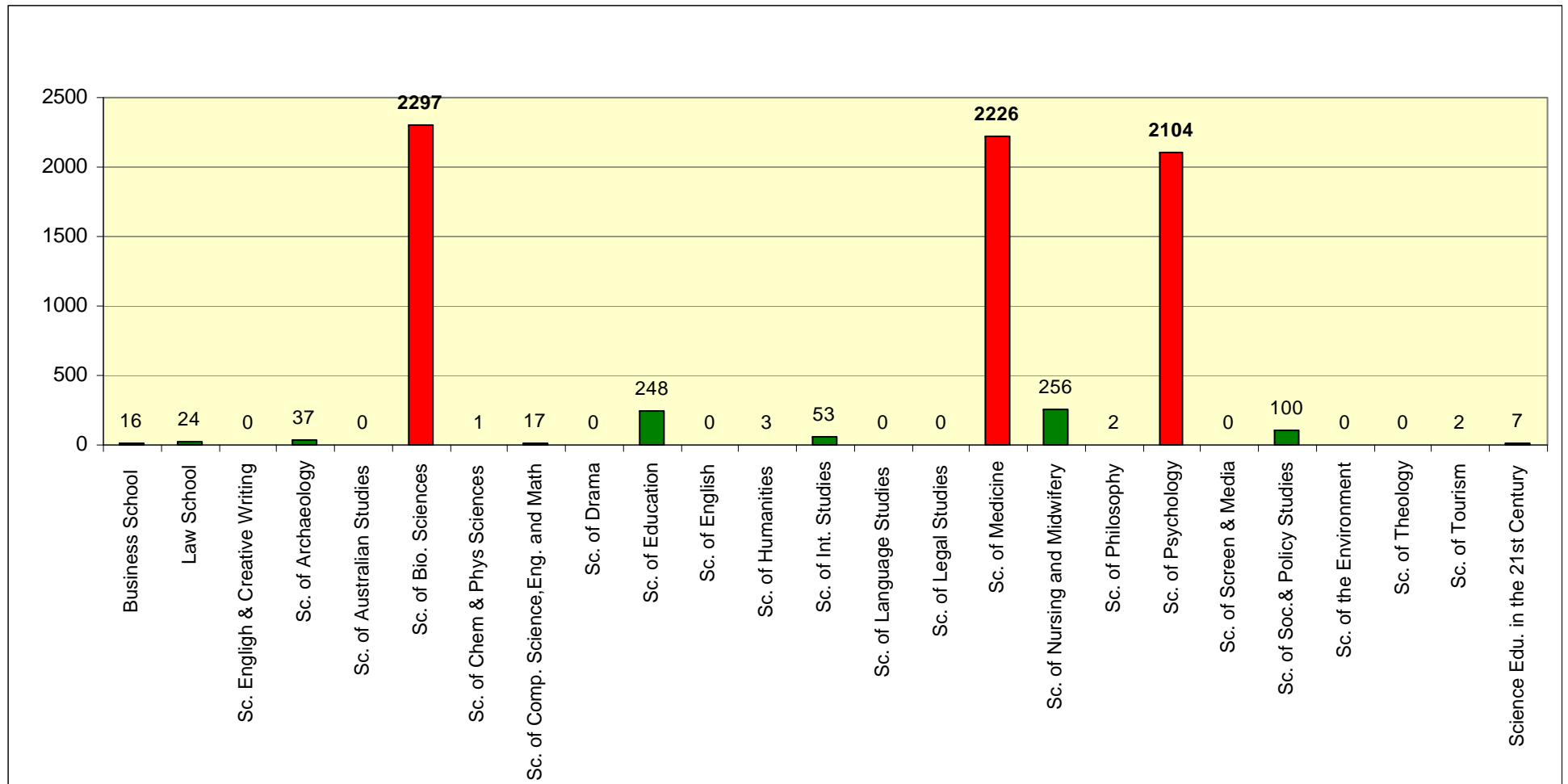
approximately 30% of the whole quantity. This is not the case for the average number of citations per school (*Graph 90*), where the Health Sciences stands out.

*Graph 91* displays the evolution of publications in the single macro-areas between 2005 and 2009. The School of the Engineering, Science and Related field produced the most increasing number of publications, which almost tripled throughout the reference period. At the end of the time period the amount of publications in each field overall increased. Therefore, also the total number of publications released by the Flinders University augmented (*Graph 92*).

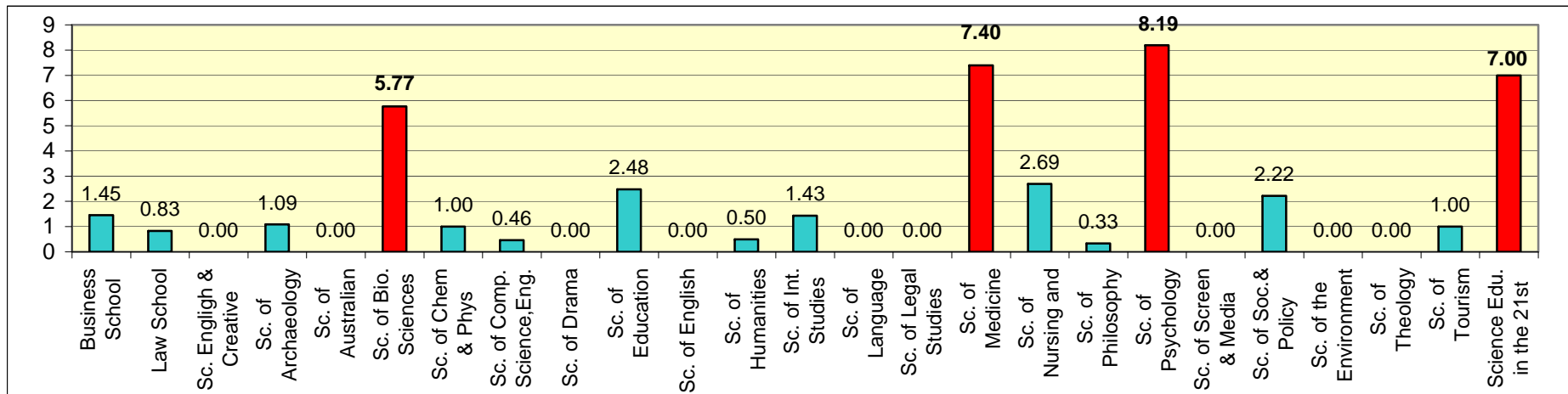
**Graph 84: Total Number of Publications per School – Flinders University (2005-2009)**



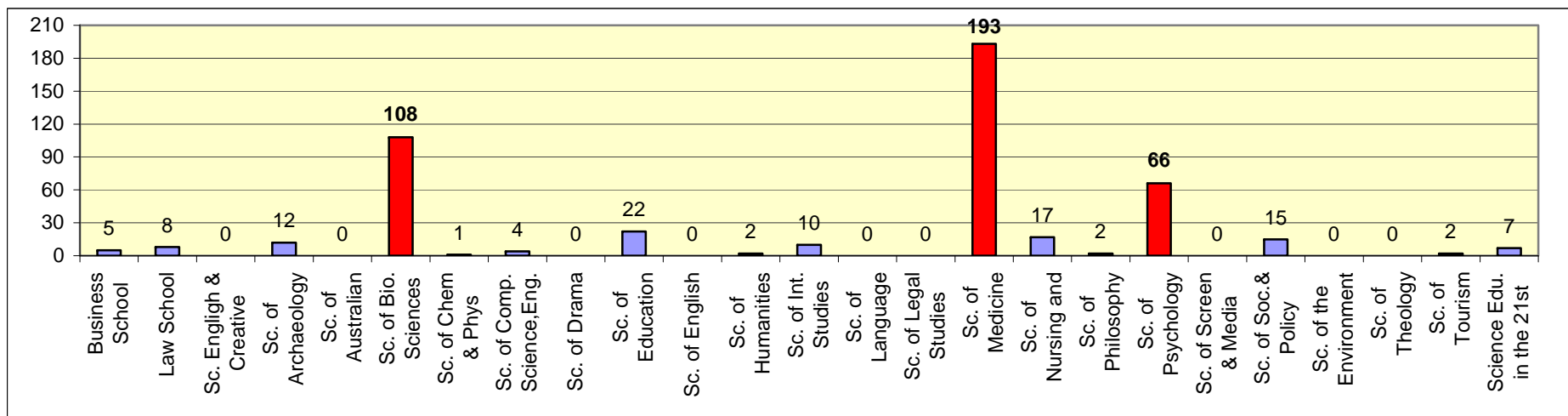
**Graph 85: Total Number of Citations per School – Flinders University (2005-2009)**



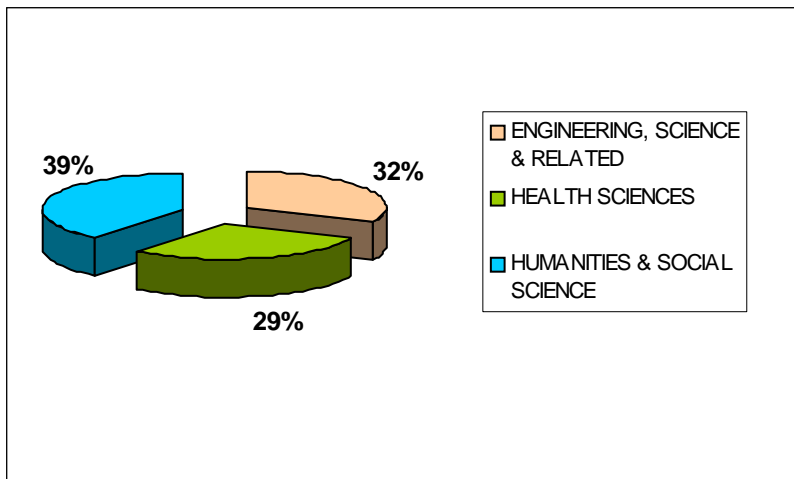
**Graph 86: Average Number of Citations per School – Flinders University (2005-2009)**



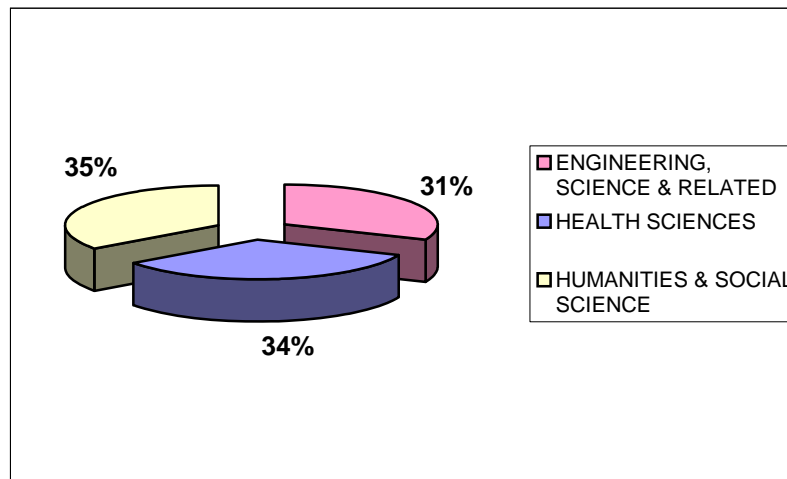
**Graph 87: Highest Number of Citations among all Publications per School – Flinders University (2005-2009)**



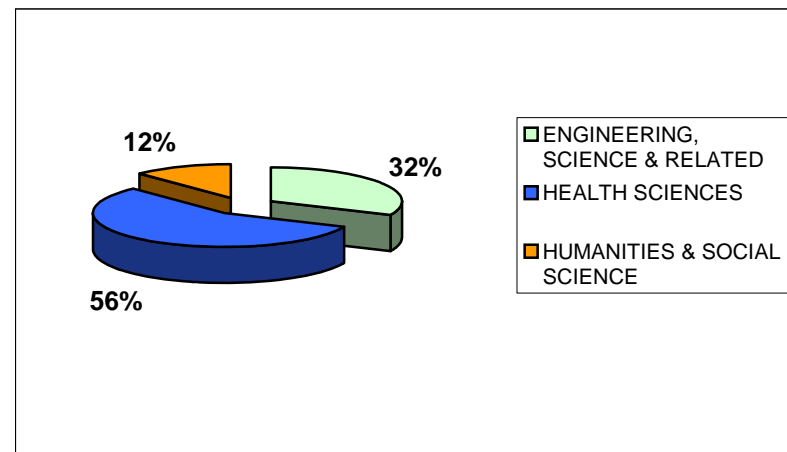
**Graph 88: Total Number of Publications according to fields – Flinders University (2005-2009)**



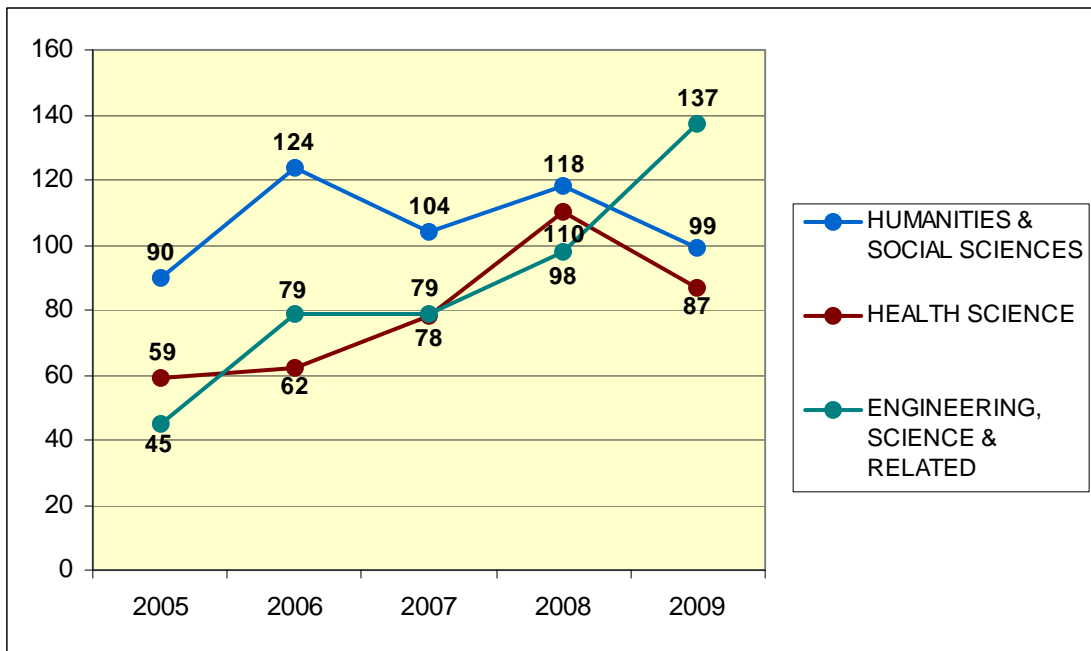
**Graph 89: Total Number of Citations according to fields – Flinders University (2005-2009)**



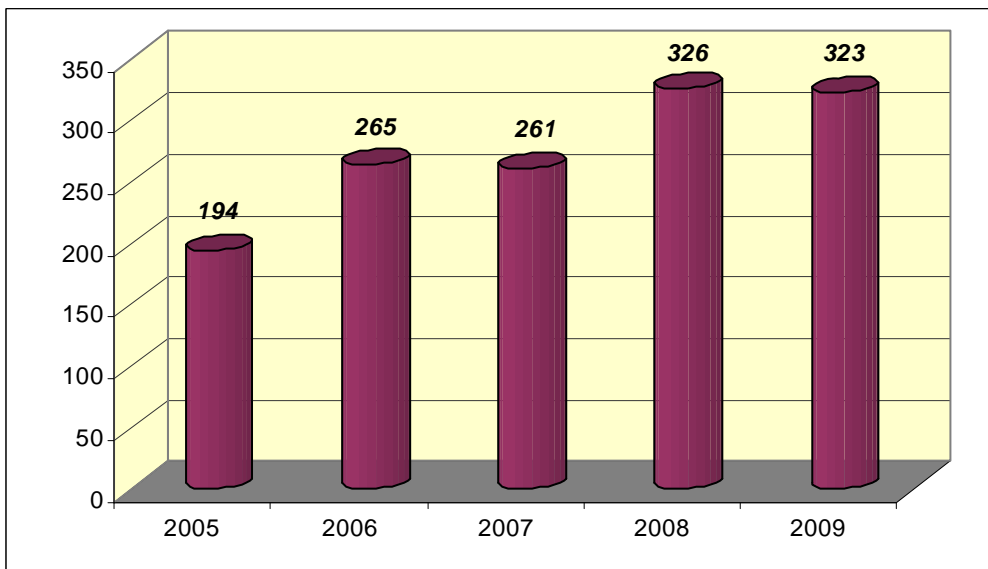
**Graph 90: Average Number of Citations according to fields – Flinders University (2005-2009)**



**Graph 91: Number of Publications according to Macro-areas (2005-2009) – Flinders University**



**Graph 92: Total Number of Publications (2005-2009) – Flinders University**



### 7.1.3. University of South Australia

Throughout our reference time period, the Schools of the University of South Australia published almost one third of the publications issued by those of the University of Adelaide. The total number of elaborations published by the Schools of the University of South Australia is 1313, almost the same as Flinders University (1369), while at the University of Adelaide 4256 publications were released.

The best performing units of the University of South Australia are the School of Health Sciences and the School of Pharmacy and Medical Sciences, both with 350 files, followed by the School of Electrical and Information Engineering that published 197 documents (*Graph 93*). The School of Health Sciences, with 1981 papers, holds the highest number of citations per school (*Graph 94*).

An important figure that has to be emphasised is that, on a whole, the publications made by the institutions of the University of South Australia received one sixth of the references obtained by the University of Adelaide: relatively 4111 and 24186. However, considering the average number of quotations, the Schools at the University of South Australia performed better than those at the Flinders University, since the average amount of mentions per publication across all the units is 2.37 instead of 1.75.

*Graph 95* shows that the Schools that received on average the highest amount of references are the School of Health Sciences, the School of Pharmacy and Medical Sciences, and the School of Psychology, Social Work and Social Policy. Nevertheless, it has to be highlighted the fact that these units did not receive as many citations as those at the Flinders University: this means that the variance among data about schools is not very high compared to that of Flinders University's Schools.

The Schools that received the highest number of citations per paper are the School of Pharmacy and Medical Sciences<sup>95</sup> and the School of Health Sciences, both belonging to the same macro area: Health Sciences (*Graph 96*).

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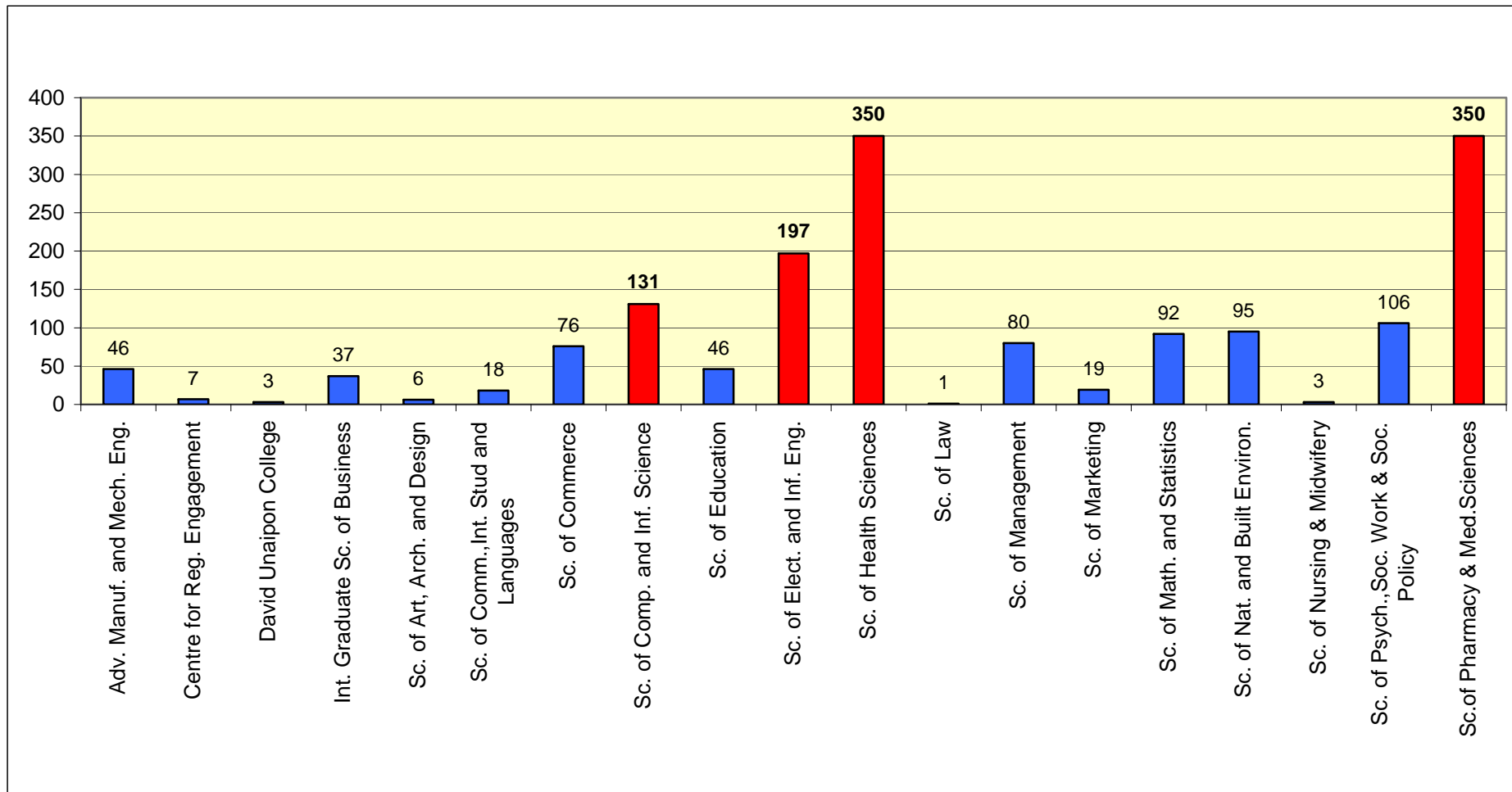
<sup>95</sup> Li J., Nation R.L., Owen R.J., et al. (2007). Antibigrams of multidrug-resistant clinical *Acinetobacter baumannii*: promising therapeutic options for treatment of colistin-resistant strains. *Clinical Infectious Diseases* (2007); No. 45: pp. 594-598.



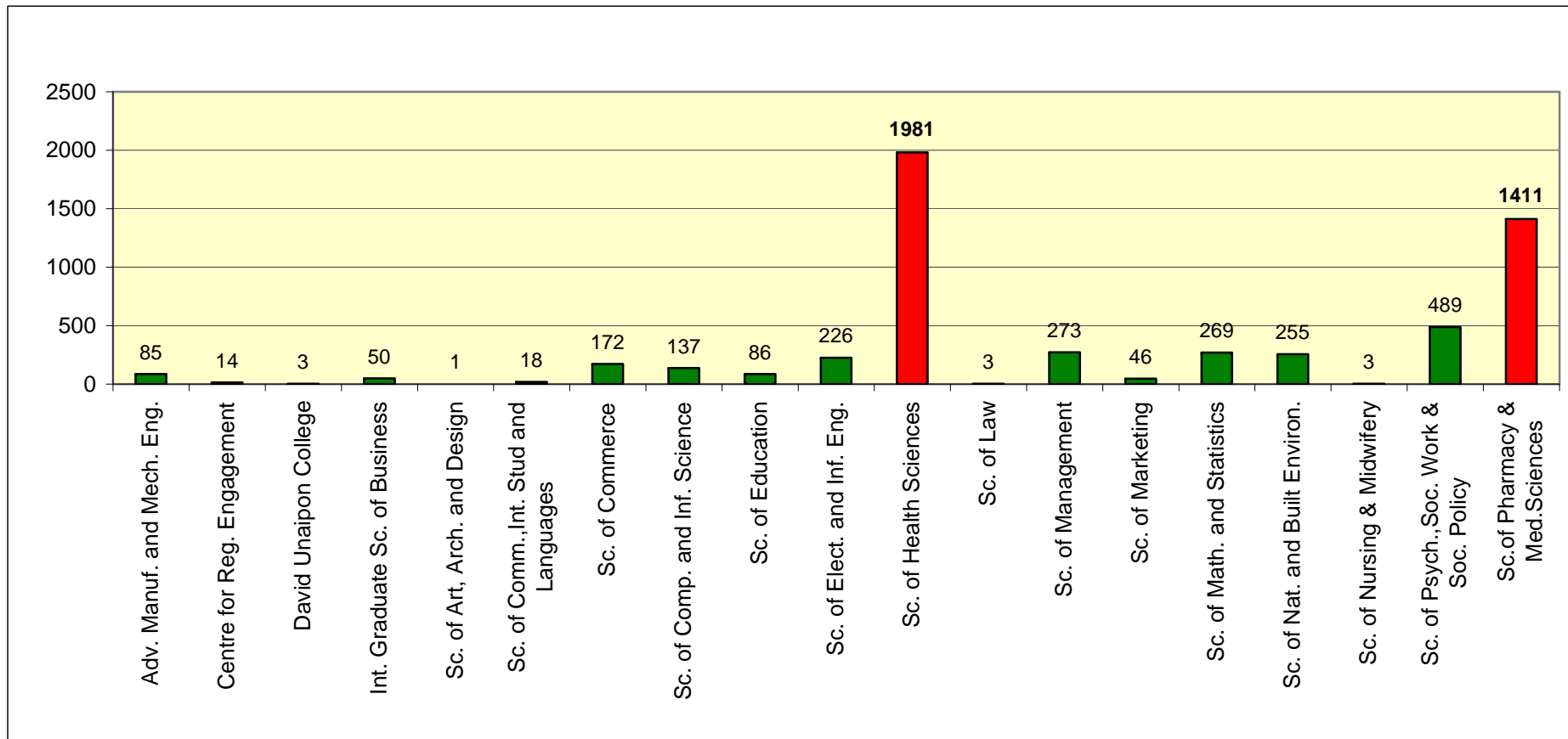
Concerning the three macro-areas (*Graphs 97-99*), the Health Sciences stands out among all the measures taken into account, while the other two share almost equally the remaining part. A slight difference occurs for the amount of publications per School, where dominance of the Health Sciences field is not so strongly accomplished.

*Graph 100* represents how the number of publications of each macro-area changed throughout our reference time period. The amount of publications considerably augmented in all the three considered fields, with the Engineering, Science and Related area experiencing the highest increase, from 68 in 2005 to 157 in 2009. Overall, the total number of publications more than doubled throughout the considered five years (*Graph 101*).

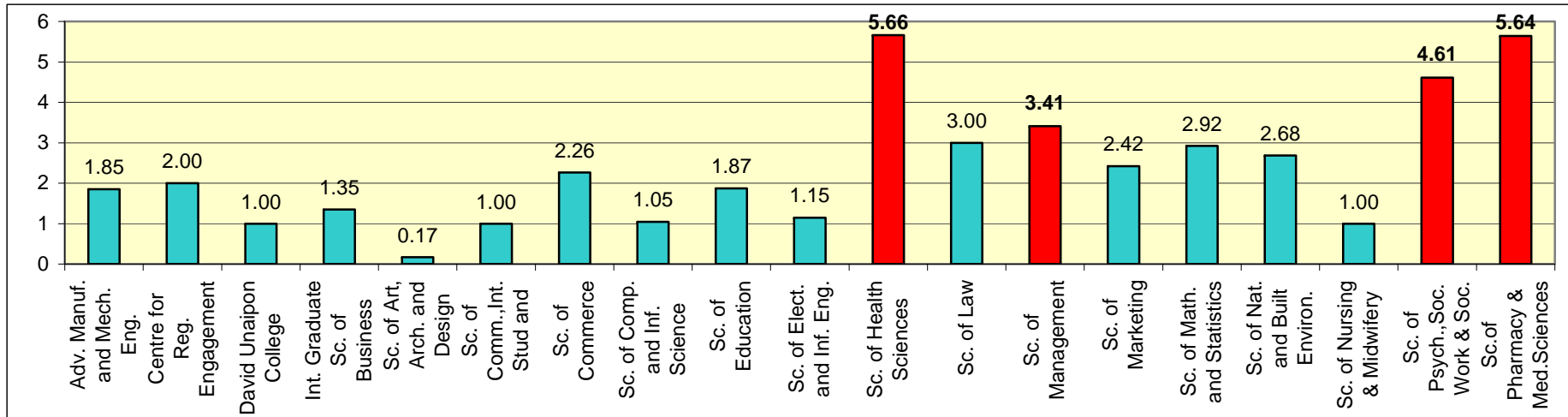
**Graph 93: Total Number of Publications per School – University of South Australia (2005-2009)**



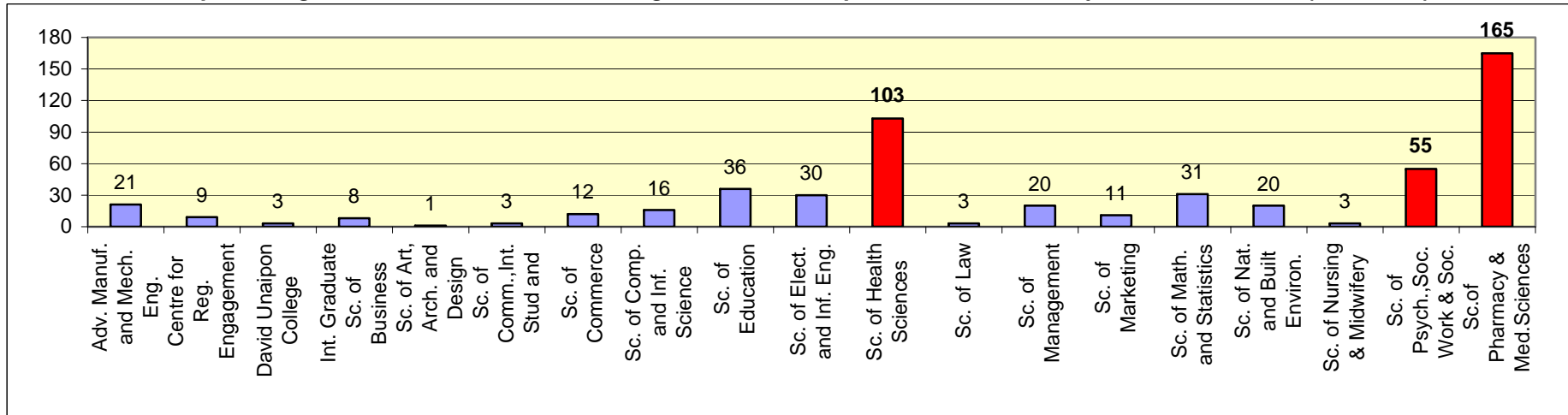
**Graph 94: Total Number of Citations per School – University of South Australia (2005-2009)**



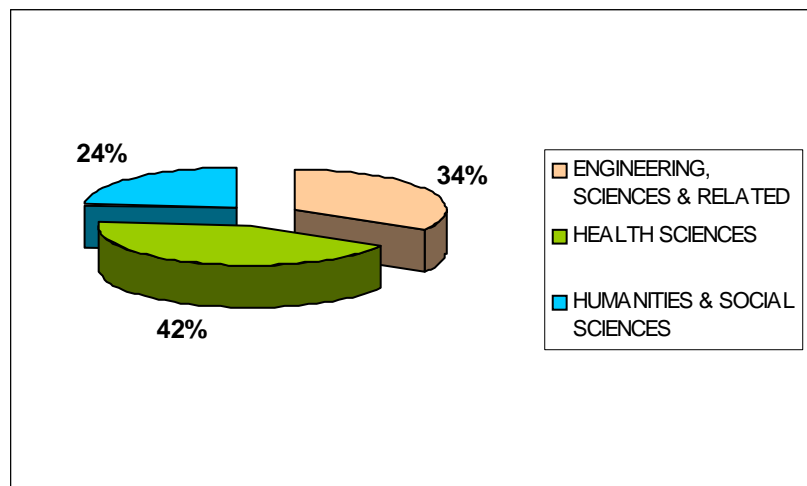
**Graph 95: Average Number of Citations per School – University of South Australia (2005-2009)**



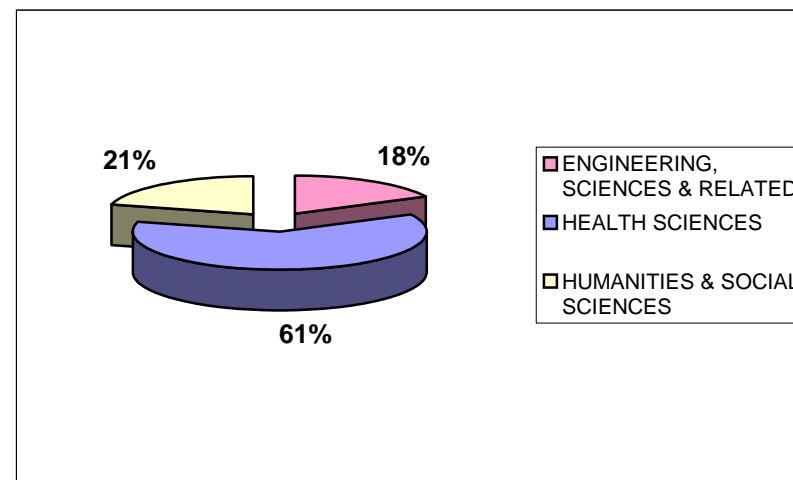
**Graph 96: Highest Number of Citations among all Publications per School – University of South Australia (2005-2009)**



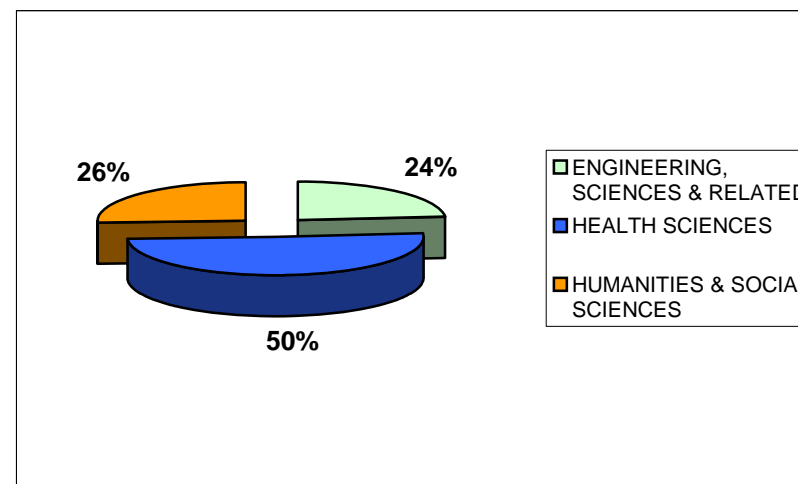
**Graph 97: Total Number of Publications according to fields – University of South Australia (2005-2009)**



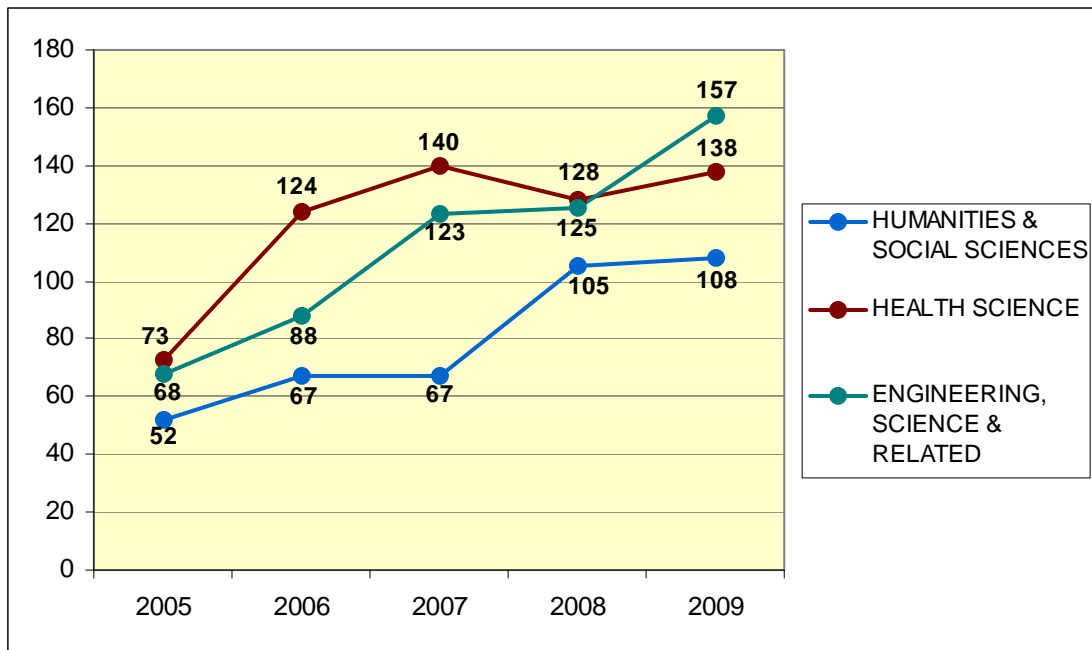
**Graph 98: Total Number of Citations according to fields – University of South Australia (2005-2009)**



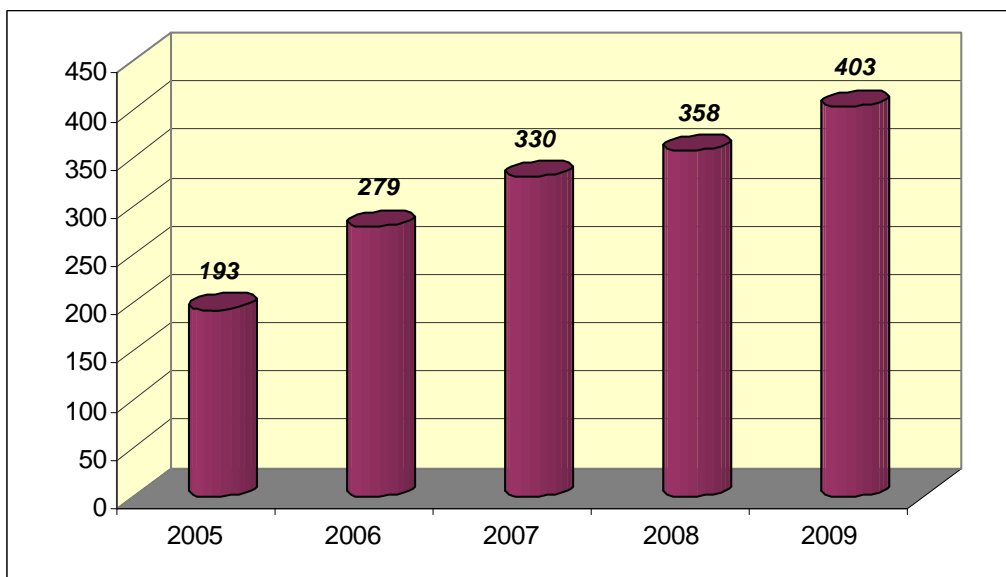
**Graph 99: Average Number of Citations according to fields – University of South Australia (2005-2009)**



**Graph 100: Number of Publications according to Macro-areas (2005-2009) – University of South Australia**



**Graph 101: Total Number of Publications (2005-2009) – University of South Australia**



#### 7.1.4. Federal Research Centres

In this section the publications' results of the Federal Research Centres are explained in their own right and not compared to the universities.

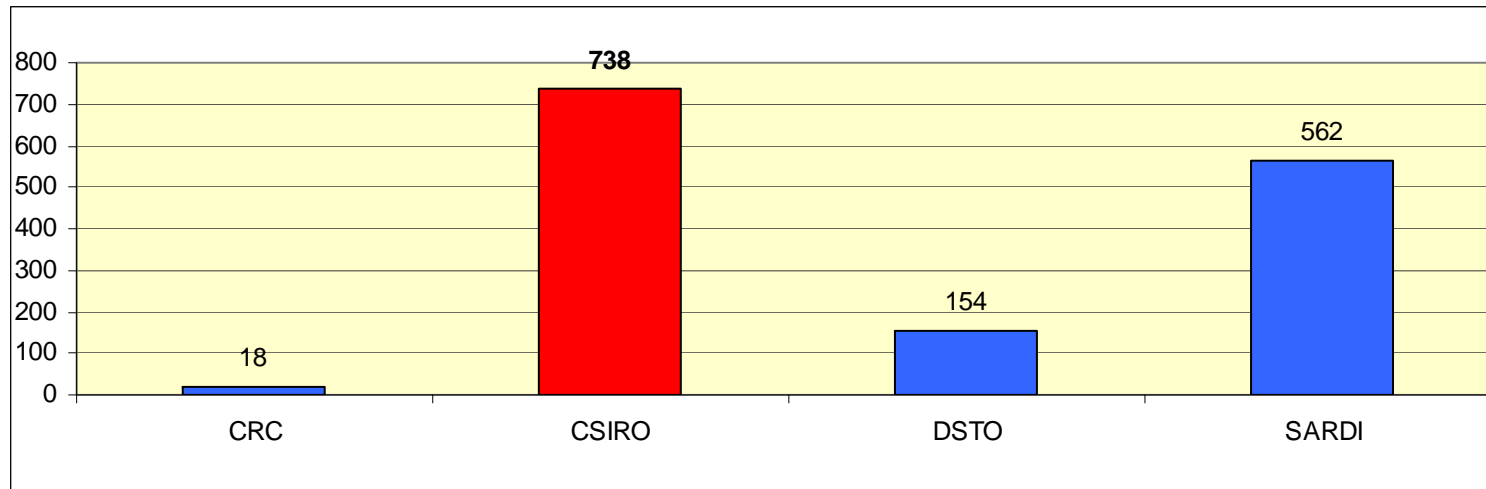
The most productive institution is the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) with 738 published documents, followed by the South Australian Research and Development Institute (SARDI), with 562 (*Graph 102*).

Due to the massive amount of citations that the units based in South Australia of the CSIRO received (almost 6500) (*Graph 103*), they also have the highest average number of references and the highest number of mentions in absolute terms: respectively 8.763 and 176 (*Graph 104-105*). The second most productive research centre is the SARDI. The units of CRC in South Australia published only 18 papers that received on average almost 3.6 citations each, while DSTO released more than 8 times the amount of publications but obtained less than two references each.

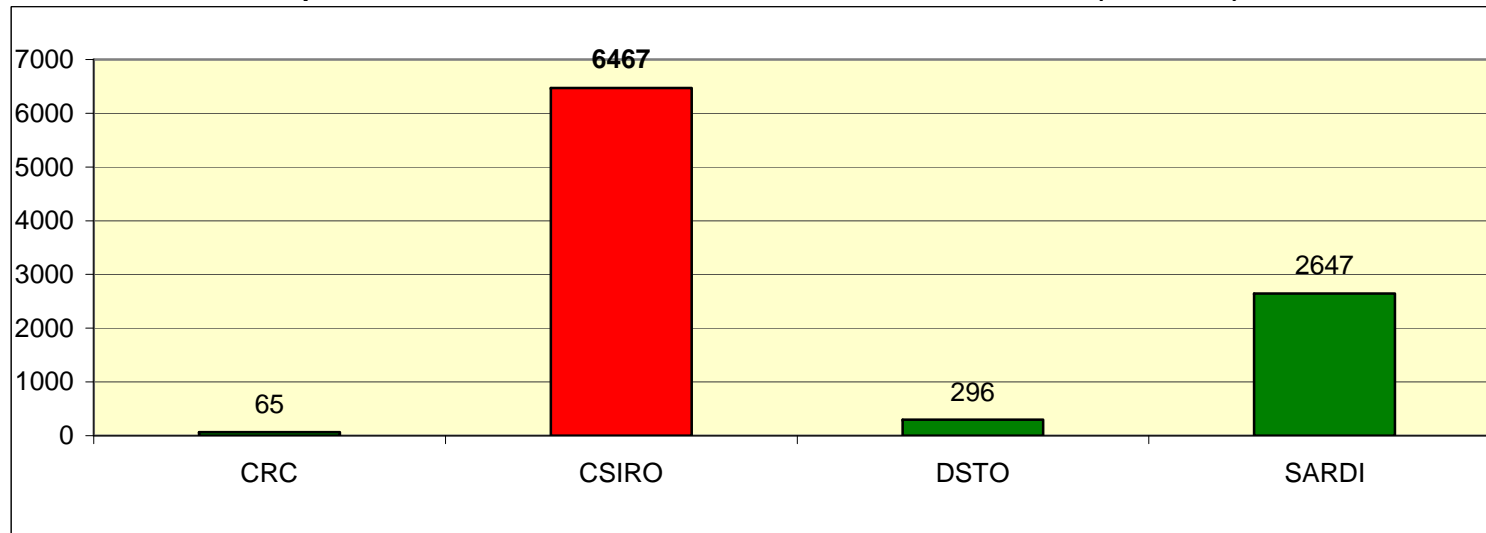
The fact that the highest amount of citations received by CRC in South Australia is only 14 means that there is a very low variance amongst the number of references the publications received.

*Graph 106* displays the evolvement of the number of publications between 2005 and 2009. At the end of the reference period all Research Centres recorded an increase in the amount of publications, apart from the DSTO. The most productive centres throughout the time range are the CSIRO and the SARDI.

**Graph 102: Total Number of Publications – Federal Research Centres (2005-2009)**

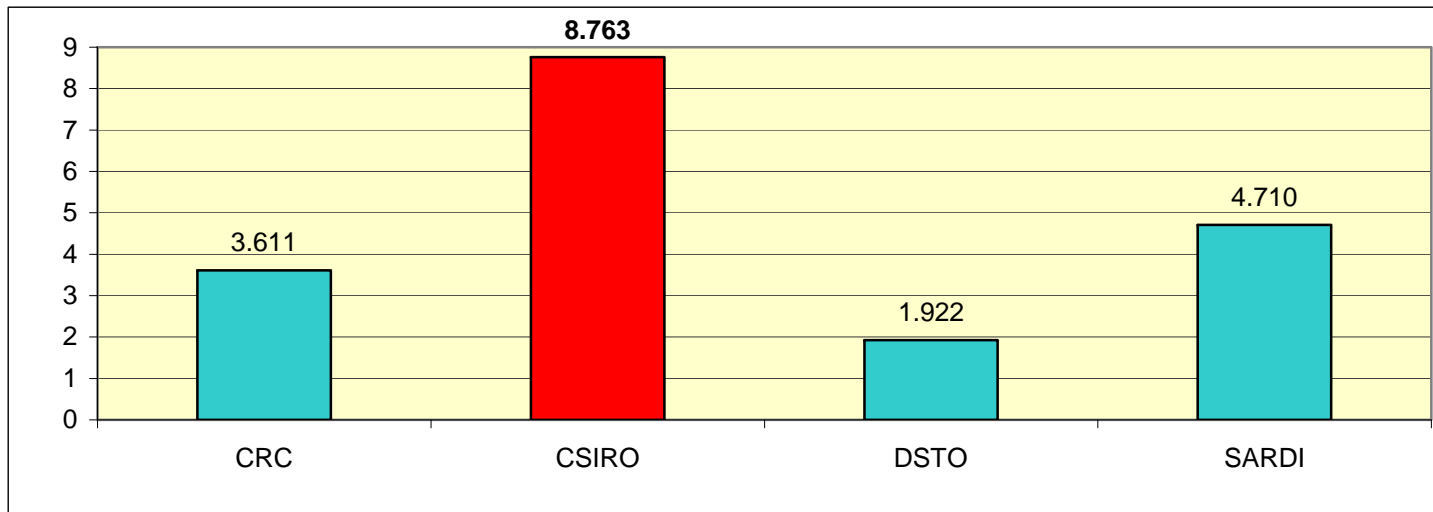


**Graph 103: Total Number of Citations – Federal Research Centres (2005-2009)**

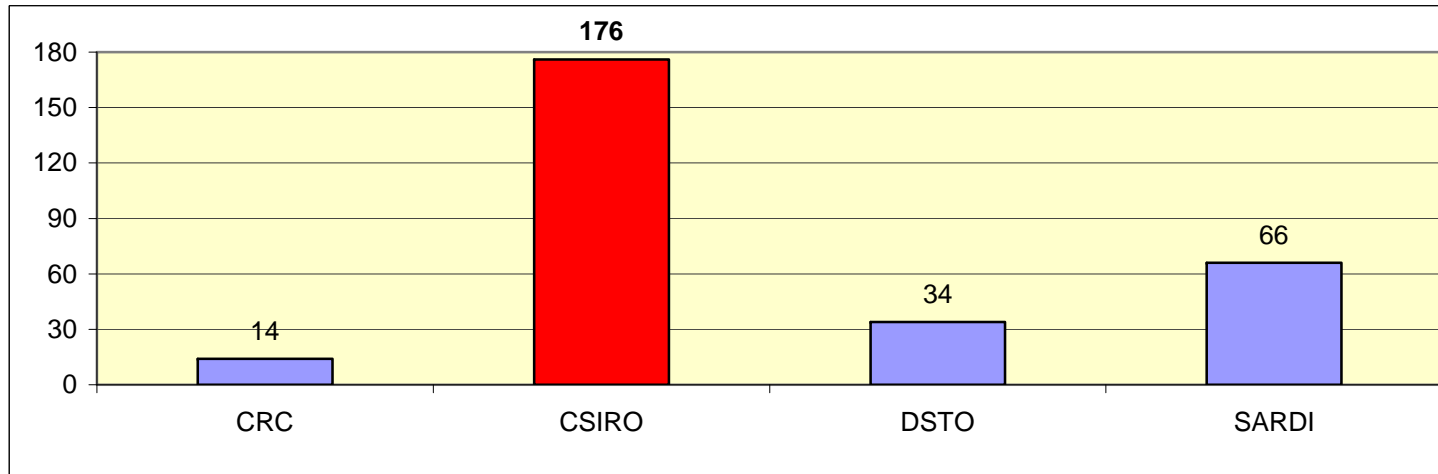




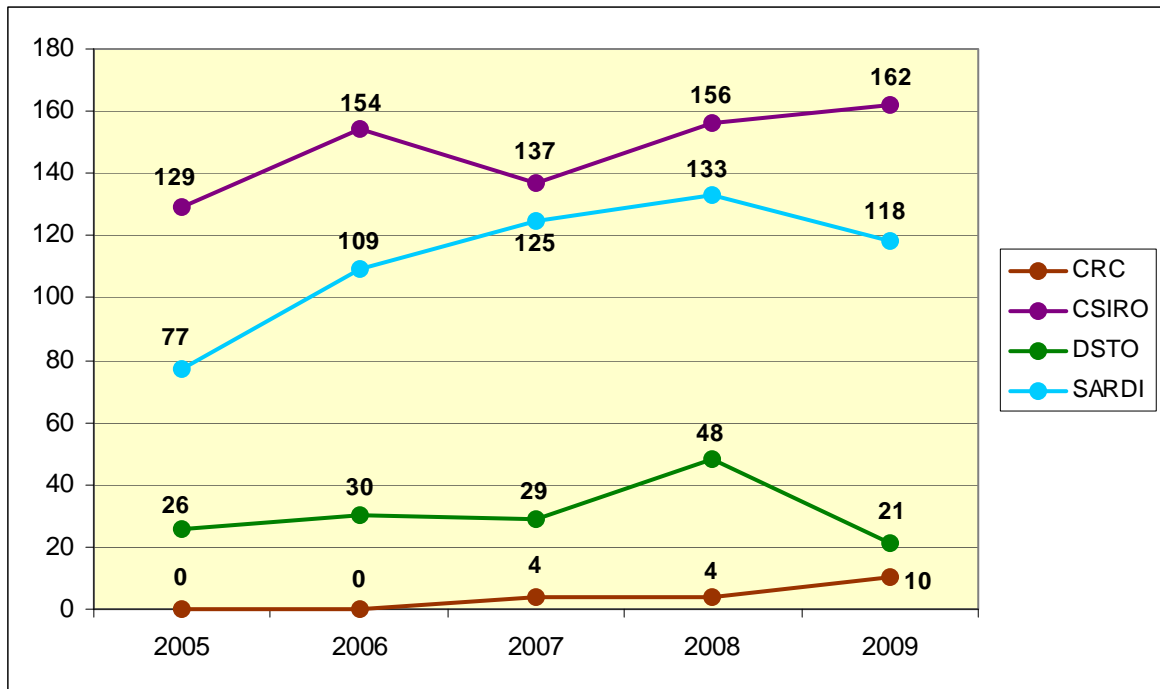
**Graph 104: Average Number of Citations per Centre – Federal Research Centres (2005-2009)**



**Graph 105: Highest Number of Citations among all Publications per Centre – Federal Research Centres (2005-2009)**



**Graph 106: Number of Publications (2005-2009) – Federal Research Centres**

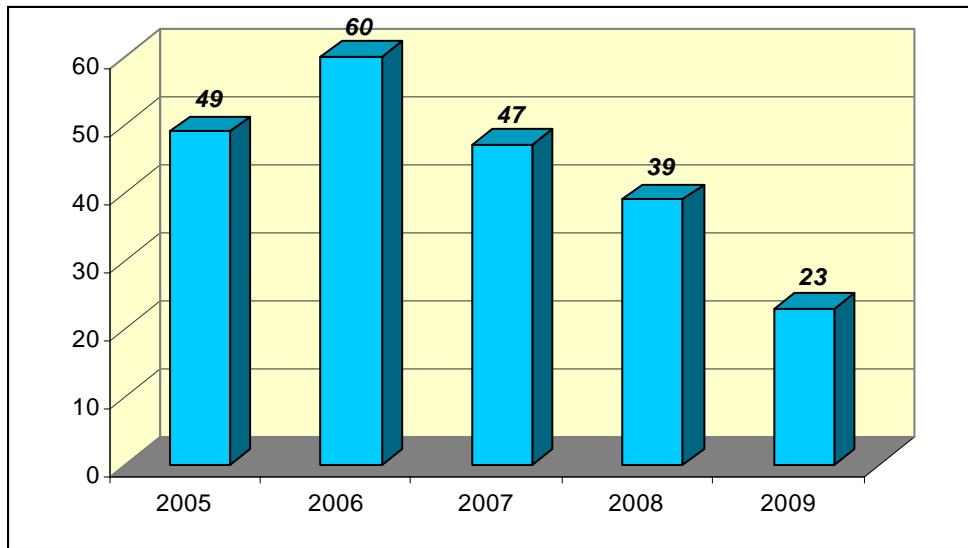


## 7.2. Patents

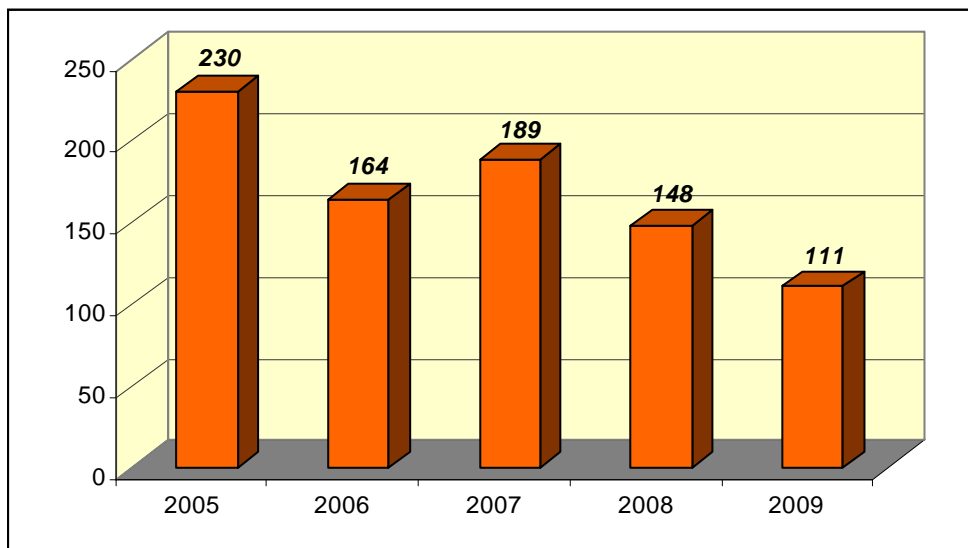
Beside publications, patents represent the other typical and crucial outcome of research and development activity. This section presents the data on the number of patents registered between 2005 and 2009 by the three South Australia's universities and the Federal Research Centres operating in the State.

For what concerns the South Australian universities as a whole, throughout the five considered years the patent registration trend followed a decreasing path (*Graph 107*). Even though the total number of patents is different between the universities and the Federal Research Centres (218 and 842, respectively), the number of patents filed by the Public Research Centres presented an analogous tendency, with a reduction in the amount of registrations between 2005 and 2009 (*Graph 108*).

**Graph 107: Number of Patents registered by South Australia's Universities (2005-2009)**



**Graph 108: Number of Patents registered by Federal Research Centres (2005-2009)**



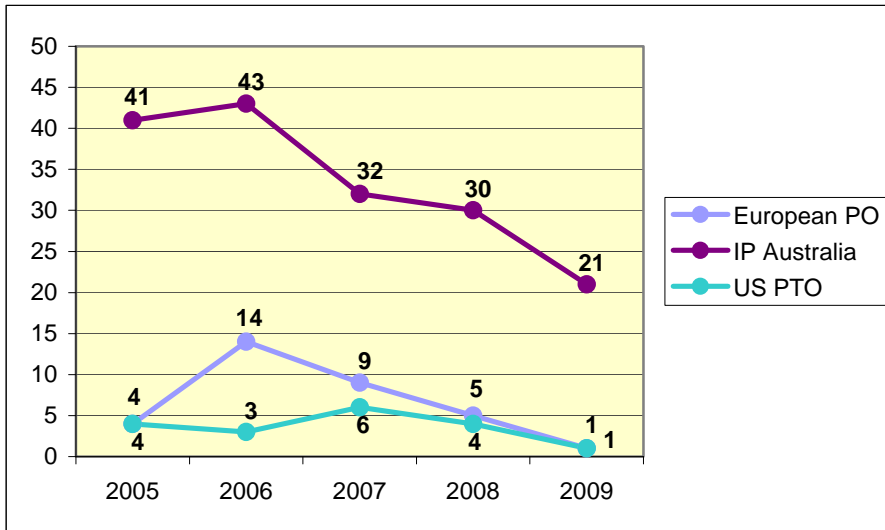
A similar character is found also when the three patent offices are considered separately, both for the South Australia's universities and the Federal Research Centres (*Graphs 109-110*). Throughout the reference period, the Australian Patent Office received the majority of patents' registrations. This is a physiological feature, because for every institution it is easier and more convenient to register a patent in its country. The decision of filing an innovation in an office abroad is based on the opportunity of widely exploiting the new product, its potential diffusion at the international level, as well as

economic and procedural evaluations to judge its affordability. Therefore, only a limited number of patents are registered also at foreign Patent Offices.

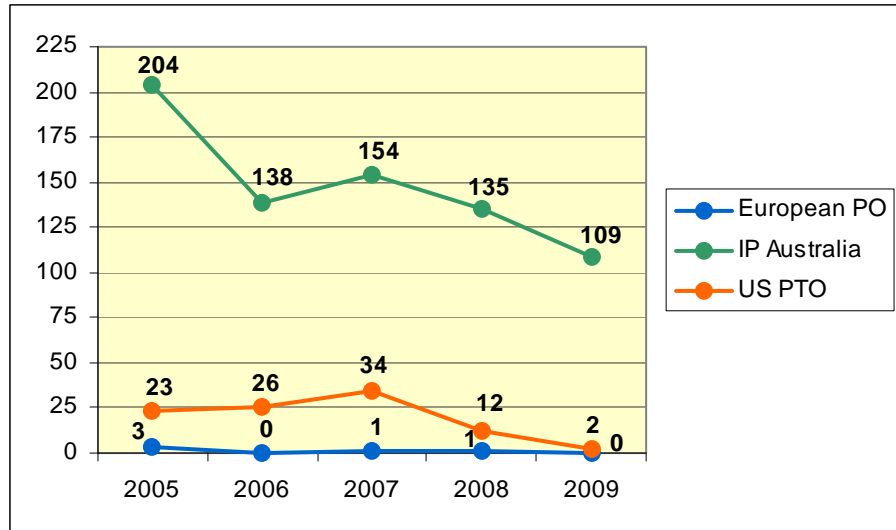
In relation to the research centres, the number of registered patents decreased after 2007. Also the three curves representing the patents filed by the universities had negative inclinations. The only different feature among them is that the amount of registrations at the US Patent and Trademark Office started declining in 2007, while in the other two Patent Offices it began in 2006. However, the insignificant weight of the American trend, due to the very small number of innovations recorded at this office, did not considerably affect the general trend.

A characteristic of the universities' registered patents dissimilar from the Federal Research Centres, is that for the higher education institutions the European Patent Office is more pivotal than the US one (*Graphs 111-112*). As a matter of fact, in the five years the European PO received almost the double amount of registrations by the South Australia's universities than the US PTO: respectively, 15.14% and 8.26%.

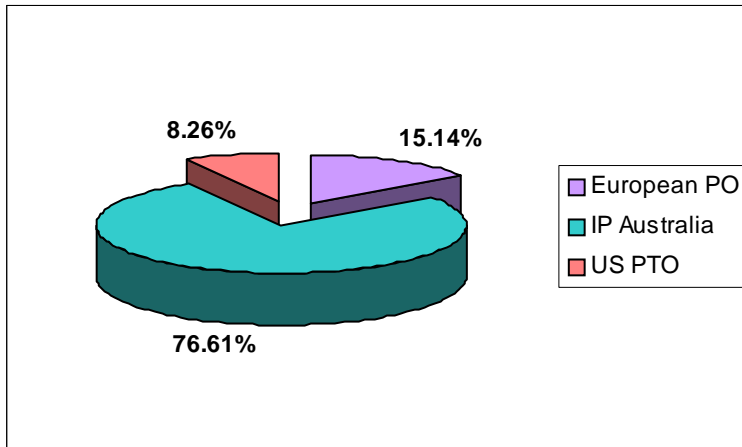
**Graph 109: Number of Patents registered by South Australia's Universities according to Patent Office (2005-2009)**



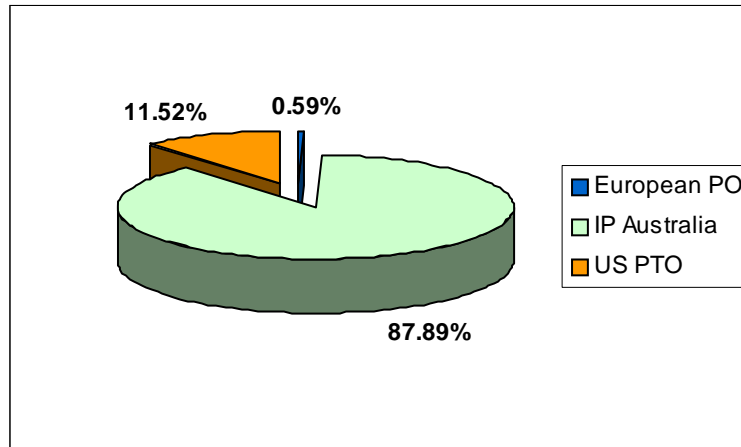
**Graph 110: Number of Patents registered by Federal Research Centres according to Patent Office (2005-2009)**



**Graph 111: Total Number of Patents registered by South Australia's Universities (2005-2009)**



**Graph 112: Total Number of Patents registered by Federal Research Centres (2005-2009)**

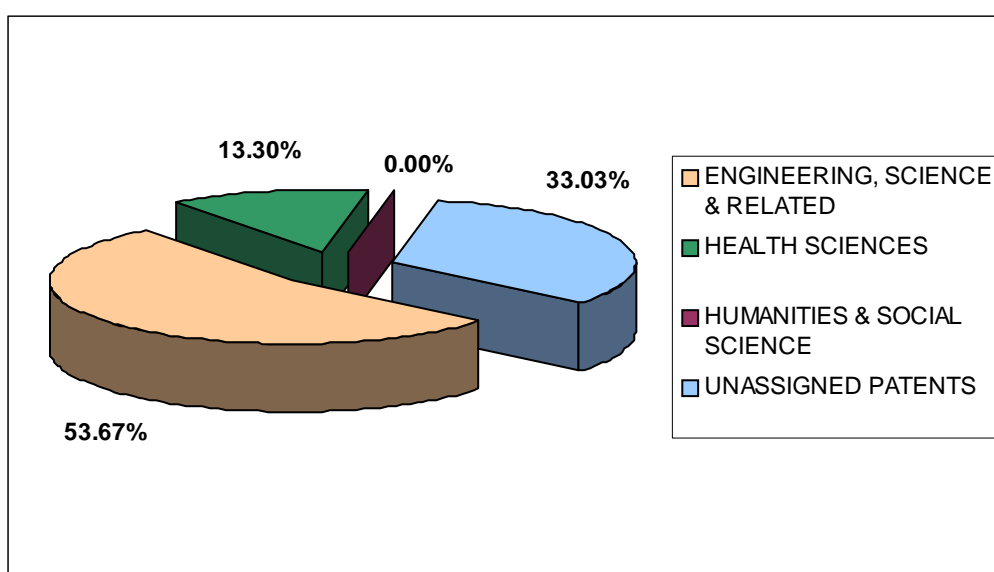


Graph 113 displays data on patents according to their affiliation macro-area. The Engineering, Science and Related area is the most productive in the research activity, as the highest number of registered innovations belonged to this field. On the other hand, none of the filed patents belonged to the Humanities and Social Science. This is not surprising because of the low utility of patents in the humanities field, while rights protections is crucial in the engineering and scientific one.

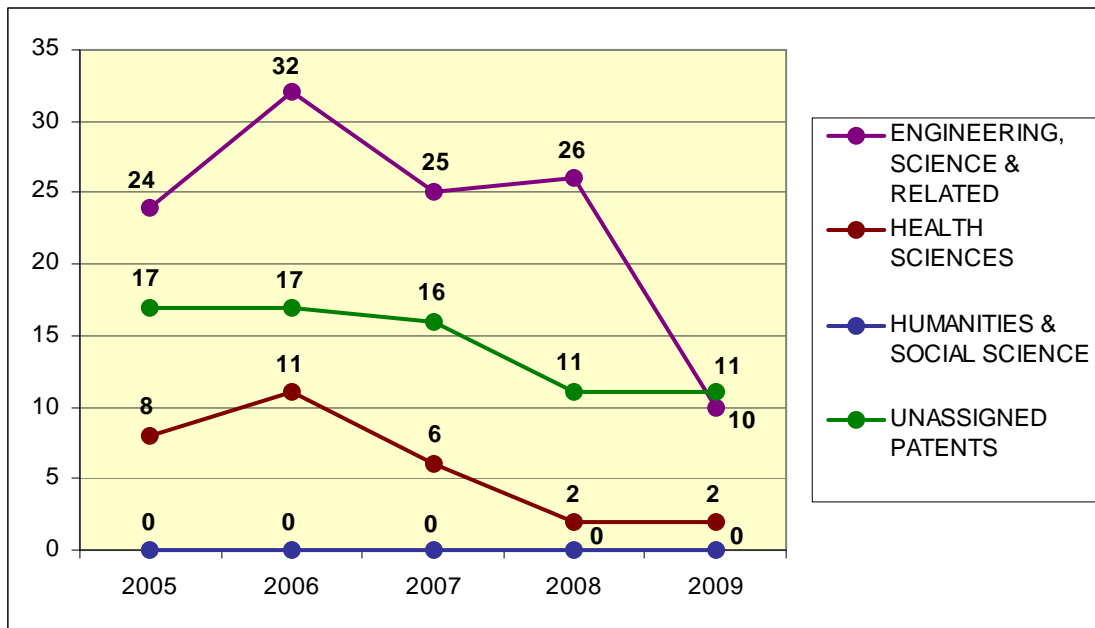
In line with the previous general trends, also for the single areas the patent production diminished throughout the considered five years (Graph 114).

Finally, Graph 115 shows how the registered patents in each macro-area shared among the three Patent Offices. As mentioned above, the Australian Patent Office received the highest amount of registrations, while the European PO was the second most chosen office by South Australia's universities. This figure is true also for the single fields of research. The Schools belonging to the Health Sciences macro-area registered a relatively high number of patents at the European Patent Office. In particular, 9 patents in the Health Science field were filed at the European PO and 18 at Australian Patent Office, while 23 and 80 innovations in the Engineering and Scientific area were registered respectively at the EPO and at the IP Australia.

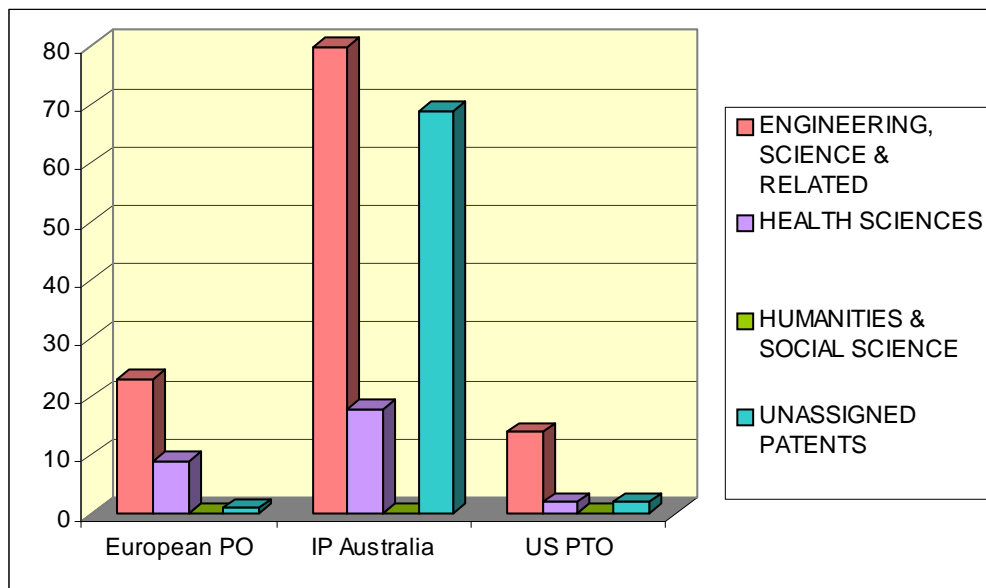
**Graph 113: Total Number of Patents registered by South Australia's Universities according to Macro-areas (2005-2009)**



**Graph 114: Number of Patents registered by South Australia's Universities according to Macro-areas (2005-2009)**



**Graph 115: Total Number of Patents registered by South Australia's Universities according to Macro-areas and Patent Office (2005-2009)**



A higher level of specificity is needed in order to identify the most productive schools within each university in terms of registered patents. The Attachment 4 displays all the data related to Publications.

### 7.2.1. University of Adelaide

Throughout our reference time period, at the University of Adelaide the most productive research field was the agriculture one, since the School of Agriculture, Food and Wine registered 26 patents, the highest number in the five years considered (*Graph 116*). The School of Paediatrics and Reproductive Health and the School of Chemistry and Physics follow, with 10 and 8 patents respectively. However, while evaluating this data, it must be highlighted that 52 patents could not be assigned to any specific school and they represented more than 40% of the total amount.

As noted in the previous general analysis, also the Schools of the University of Adelaide registered most of their patents at the Australian Patent Office, followed by the European one (*Graph 117*).

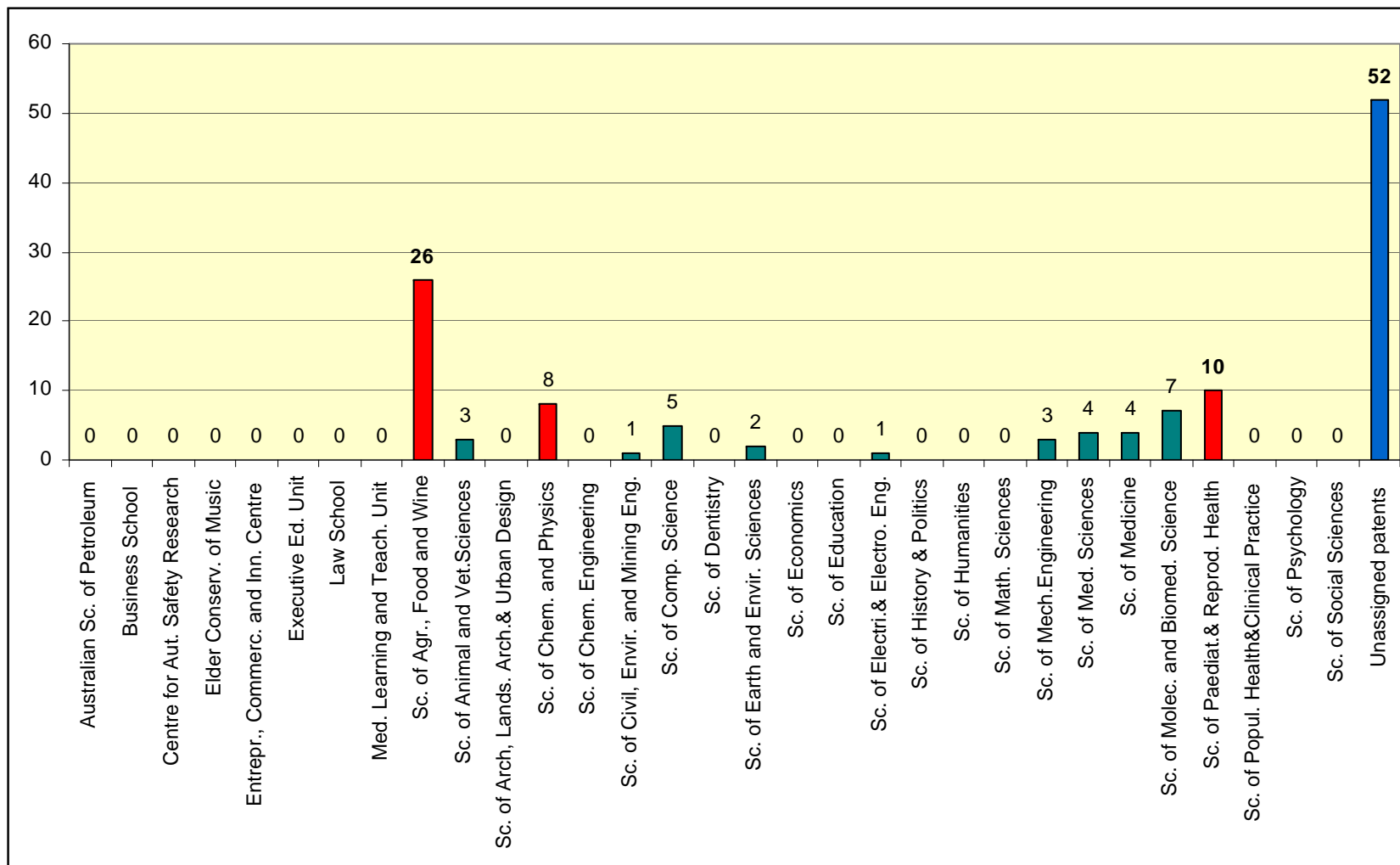
Also the declining trend of the patents' registrations throughout the considered five years (*Graph 118*) is in line with the general trends. In particular, the number of filed patents changed from 27 in 2005 to only 7 in 2009. This tendency characterises all the considered macro-areas (with the exception of the Humanities and Social Sciences area where no patents at all were recorded). The more marked falling curve is the one of the Engineering, Science and Related area (*Graph 121*).

At the University of Adelaide, the highest amount of patents was registered in the Engineering, Science and Related area (*Graph 119*).

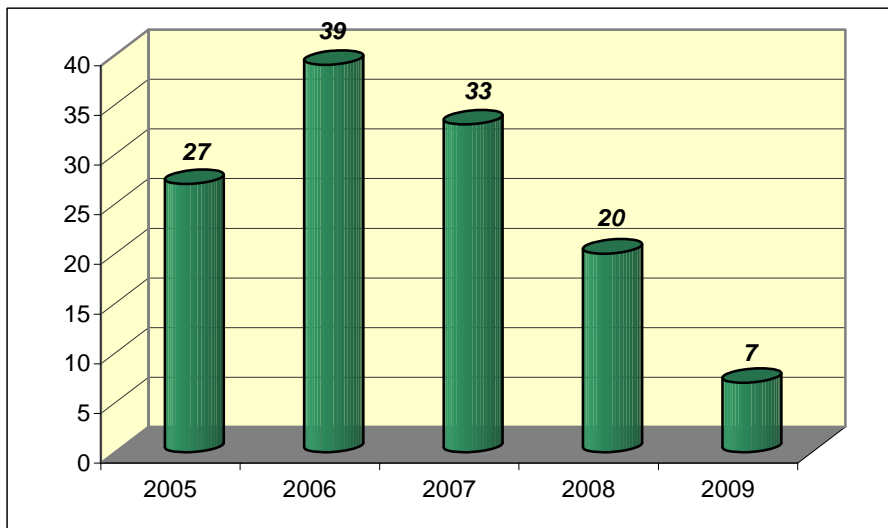
In every macro-area, the Schools of the University of Adelaide chose to register the majority of their patents at the IP Australia (*Graph 120*). Similar to the previous general analysis, also in this case the Schools belonging to the Health Science area registered a relatively high number of patents at the European Patent Office. This is due to the fact that the University of Adelaide counts for almost the 58% of the total amount of patents registered by South Australia's universities, and thus its trends had a great influence on the general figures.



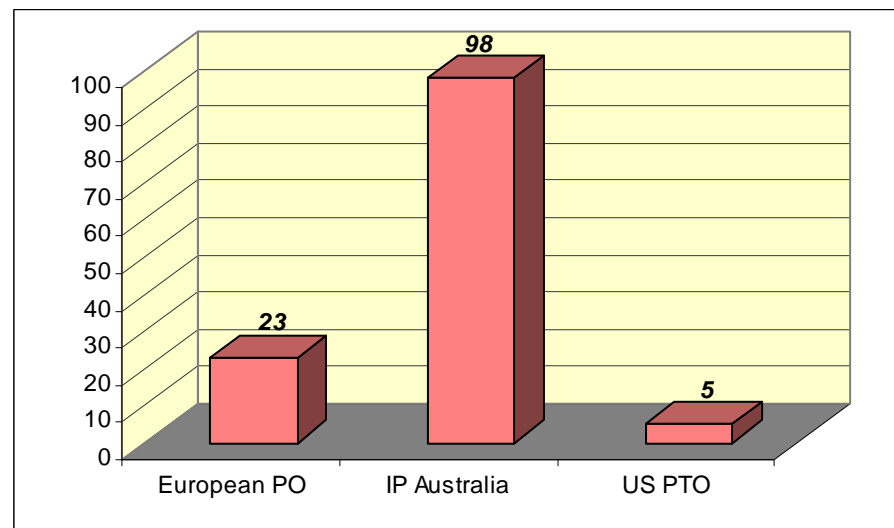
**Graph 116: Total Number of Patents registered by each School (2005-2009) – University of Adelaide**



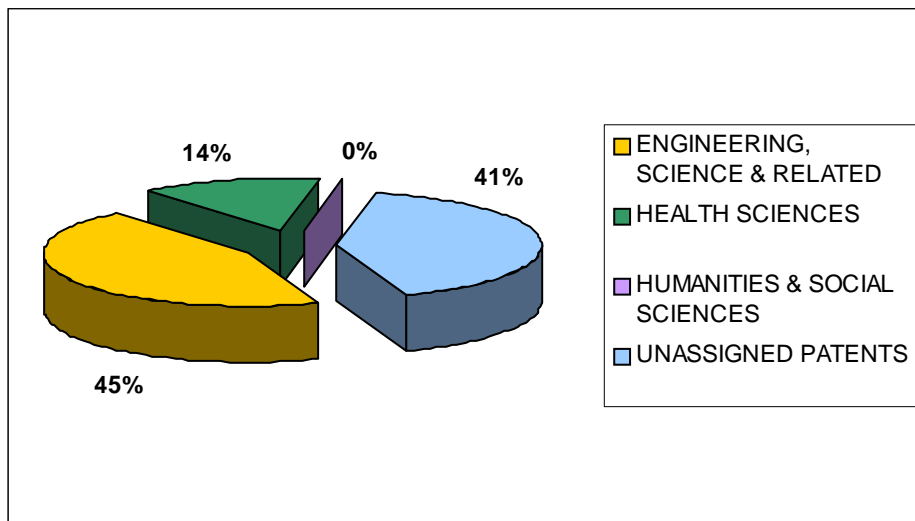
**Graph 117: Number of Patents (2005-2009) – University of Adelaide**



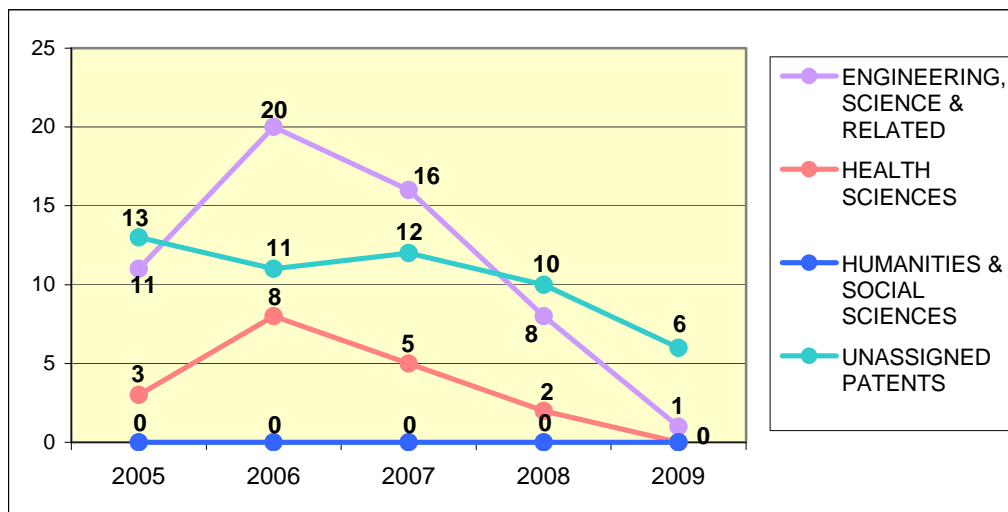
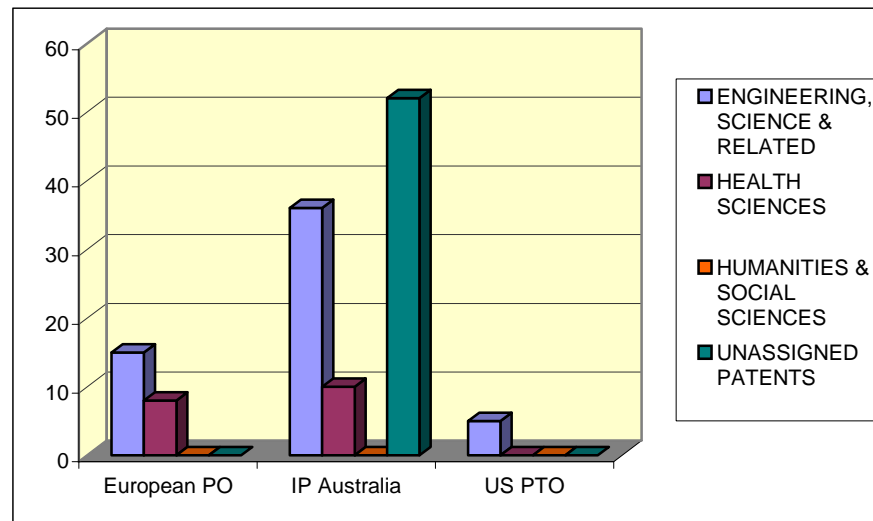
**Graph 118: Total Number of Patents according to Patent Office (2005-2009) – University of Adelaide**



**Graph 119: Number of Patents according to Macro-areas (2005-2009) – University of Adelaide**



**Graph 120: Total Number of Patents according to Macro-area and Patent Office (2005-2009) – University of Adelaide**



**Graph 121: Total Number of Patents according to Macro-areas (2005-2009) – University of Adelaide**

### 7.2.2. Flinders University

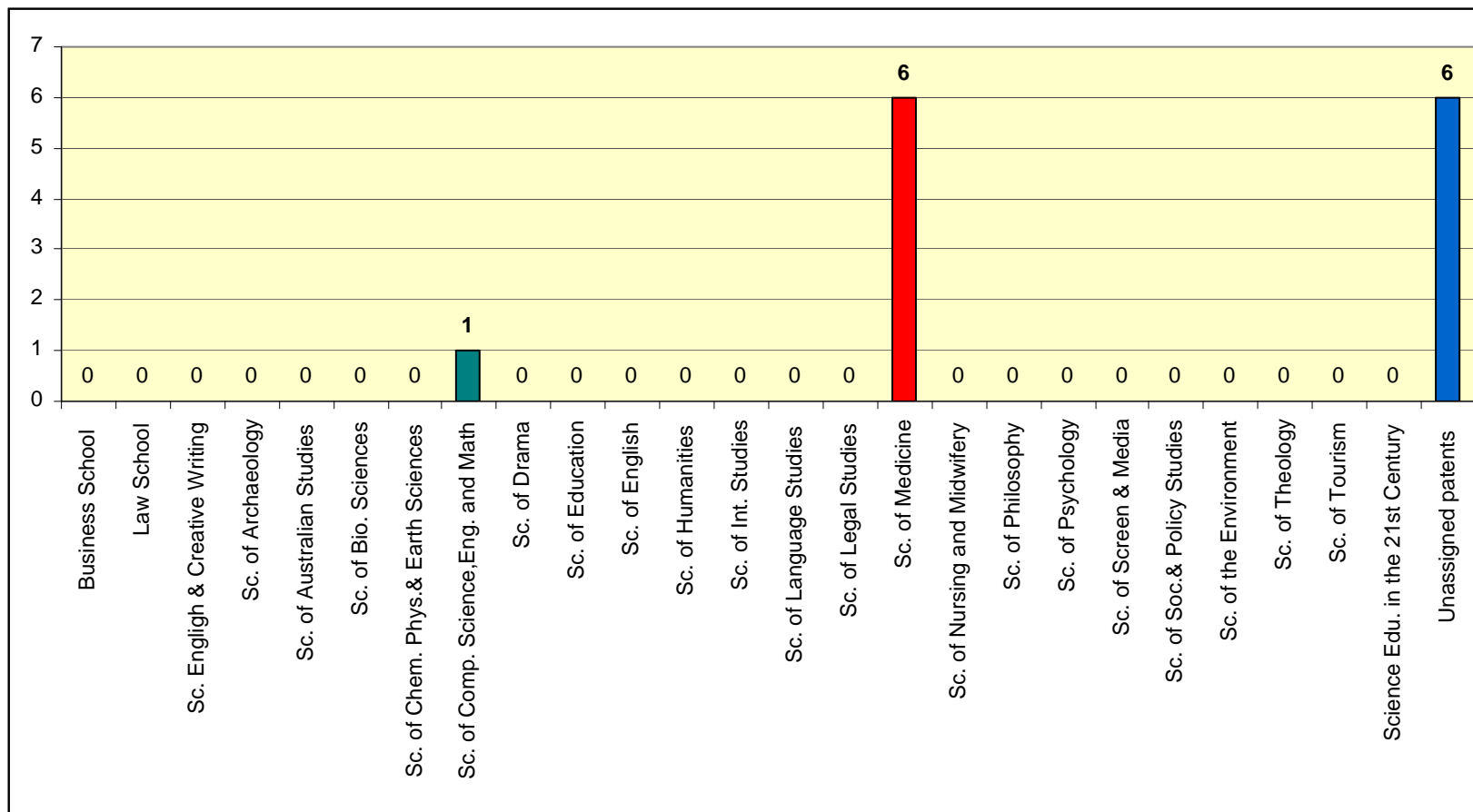
The Flinders University did not hold significant weight on the total amount of patents registered by South Australia's universities: only 13 patents were registered throughout the considered five years. Moreover, it must be highlighted that almost half of the patents registered by this university could not be assigned to any specific school (6 out of 13).

The School of Medicine filed almost the rest of patents (*Graph 122*). This can be interpreted as if the research activity was carried out mainly in the Health Science field. Furthermore, the Flinders University experienced a falling trend in its patents' registrations since 2005, the first year we considered (*Graph 123*).

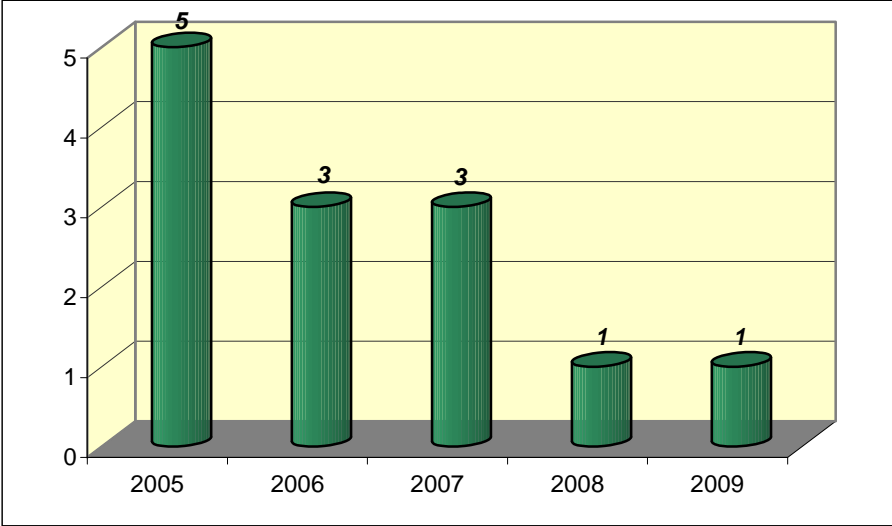
The most productive macro-area throughout our reference period was the Health Sciences one, while the Schools belonging to the Engineering, Science and Related area registered only one patent in 2005 (*Graphs 125-126*). This figure confirms the snapshot previously highlighted by *Graph 122*. Between 2005 and 2009, the number of registered patents declined in every macro-area (*Graph 125*). This is in line with the general trend discussed above.

Also the Schools at the Flinders University filed most of their patents at the Australian Patent Office. However, the second most popular office was the United States Patent and Trademark Office, and not the European one (*Graph 127*).

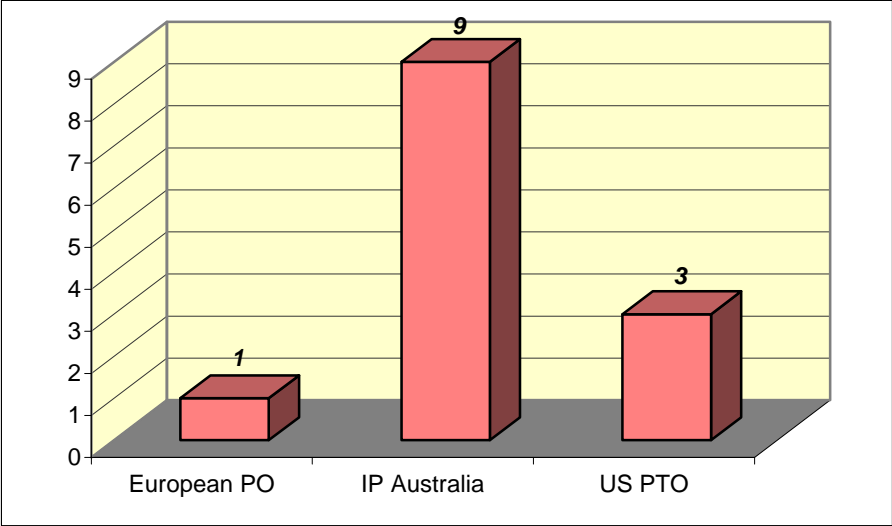
**Graph 122: Total Number of Patents registered by each School (2005-2009) – Flinders University**



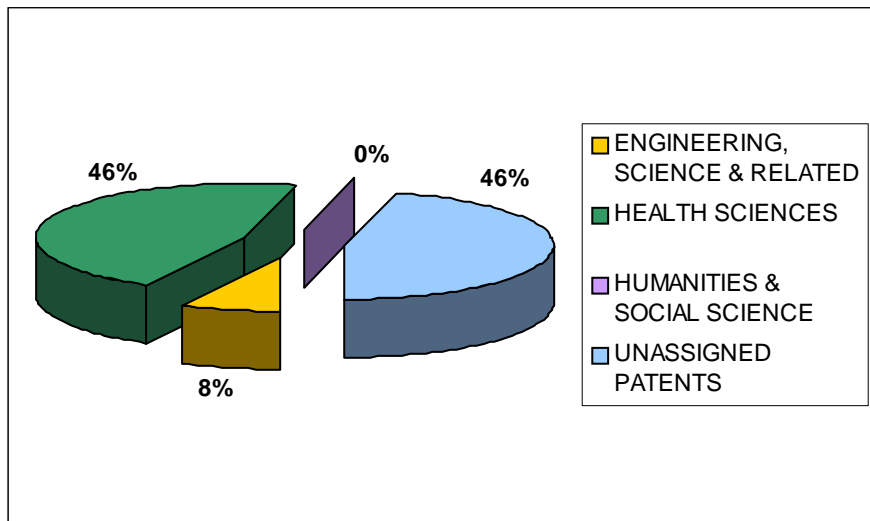
**Graph 123: Number of Patents (2005-2009) – Flinders University**



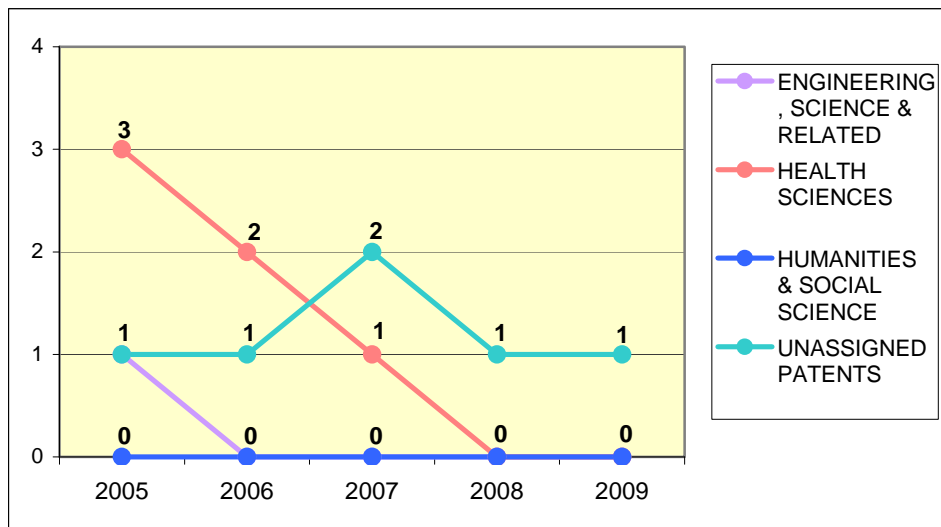
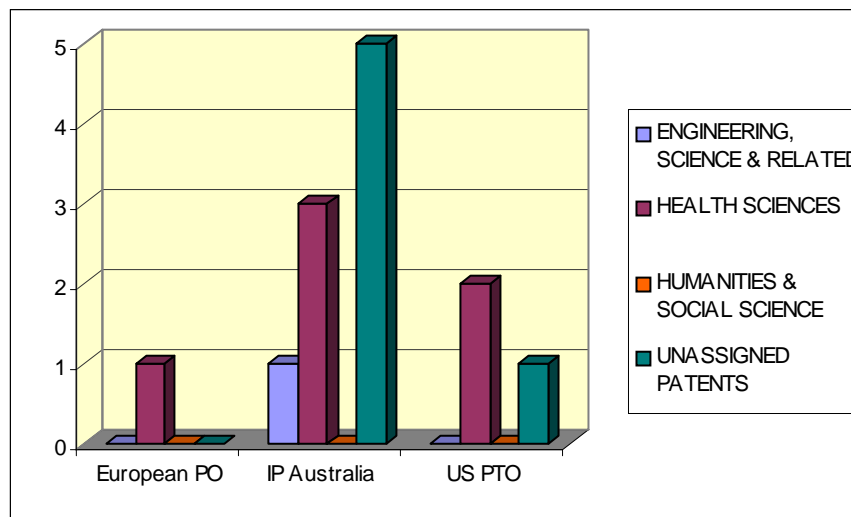
**Graph 124: Total Number of Patents according to Patent Office (2005-2009) – Flinders University**



**Graph 125: Number of Patents according to Macro-areas (2005-2009) – Flinders University**



**Graph 126: Total Number of Patents according to Macro-area and Patent Office (2005-2009) – Flinders University**



**Graph 127: Total Number of Patents according to Macro-areas (2005-2009) – Flinders University**

### 7.2.3. University of South Australia

Compared to the two higher education institutions previously analysed, in the case of the University of South Australia there are fewer patents that could not be assigned to any School (14 out of 79, which is less than the 18%).

At the University of South Australia, the most productive School throughout our reference time period was the School of Electrical and Information Engineering, which registered 38 patents. The School of Advanced Manufacturing and Mechanical Engineering followed with 15 filed patents (*Graph 128*).

In this case, the number of registered patents decreased between 2005 and 2009, but less sharply than in the previous cases, changing from 17 to 15 (*Graph 129*).

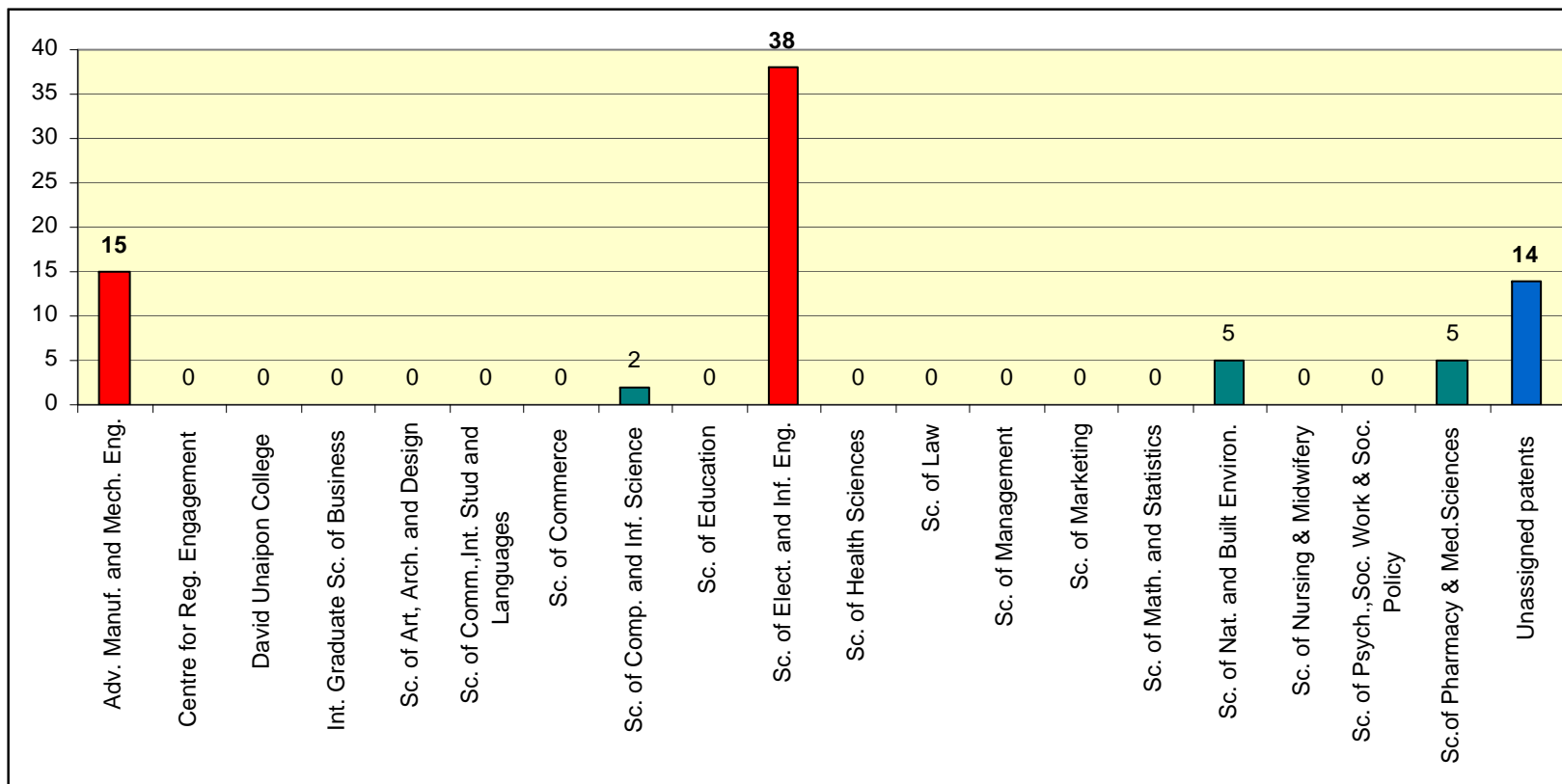
Once again, the majority of patents were registered at the Australian Patent Office. The number of patents filed at the European Patent Office and at the US one was almost the same throughout the considered period (*Graph 130*). The registrations at the IP Australia remained unchanged apart from 2007, when they decreased. On the other hand, the number of filed innovations both at the European PO and at the American PO decreased (*Graph 131*).

At the University of South Australia, research units belonging to the Engineering, Science and Related macro-area developed most of registered patents (60 out of 79) (*Graph 132*). Between 2005 and 2009, the number of filed patents declined in all three macro-areas, however the trend is not as drastic as in the previous cases (in 2005, 12 and 2 patents were registered respectively in the Scientific field and in the Health Science area, while in 2009 the amounts were respectively 9 and 2) (*Graph 134*).

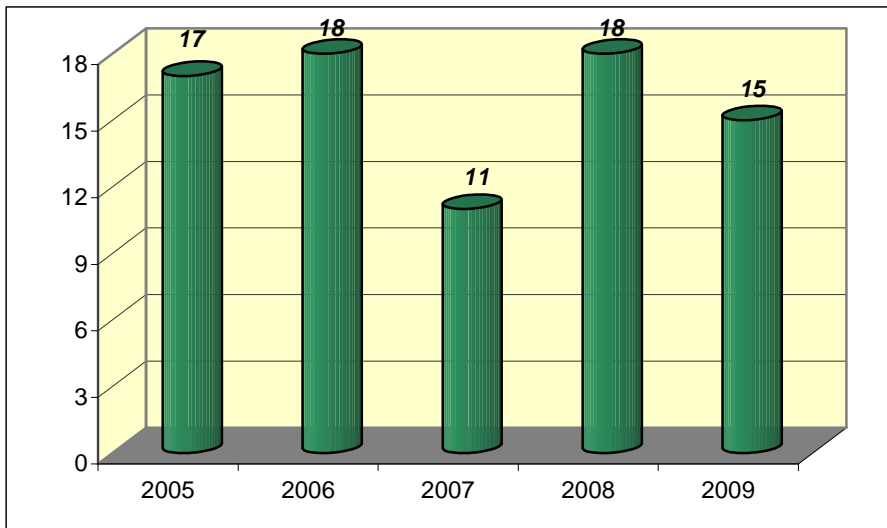
Also when considering the three macro-areas separately, the amounts of patents filed at the European Patent Office and at the United States Patent and Trademark Office were substantially equal (*Graph 133*). Differently from the other two South Australia's universities, in this case the Schools belonging to the Health Science area chose to register the whole amount of their patents at IP Australia.



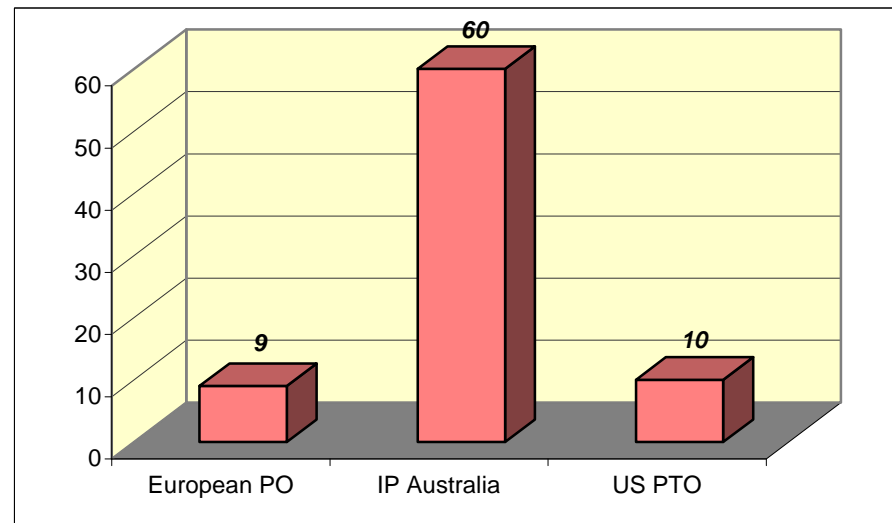
**Graph 128: Total Number of Patents registered by each School (2005-2009) – University of South Australia**



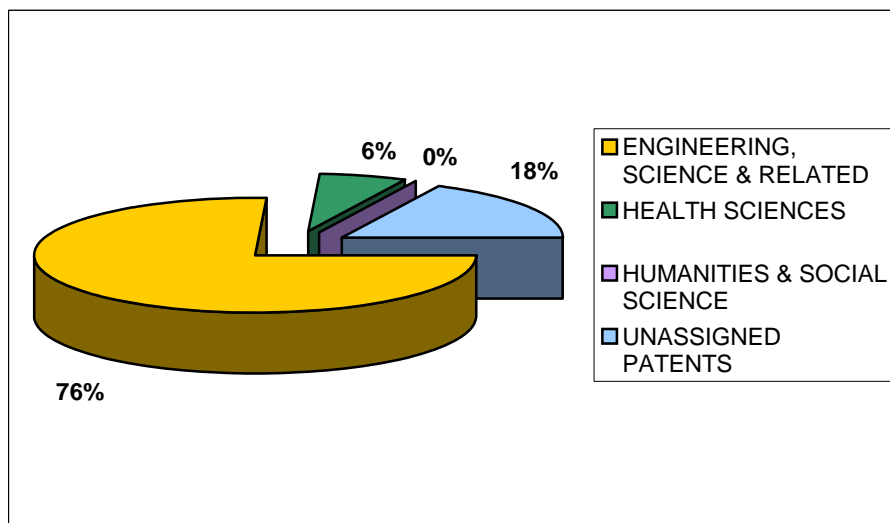
**Graph 129: Number of Patents (2005-2009) – University of South Australia**



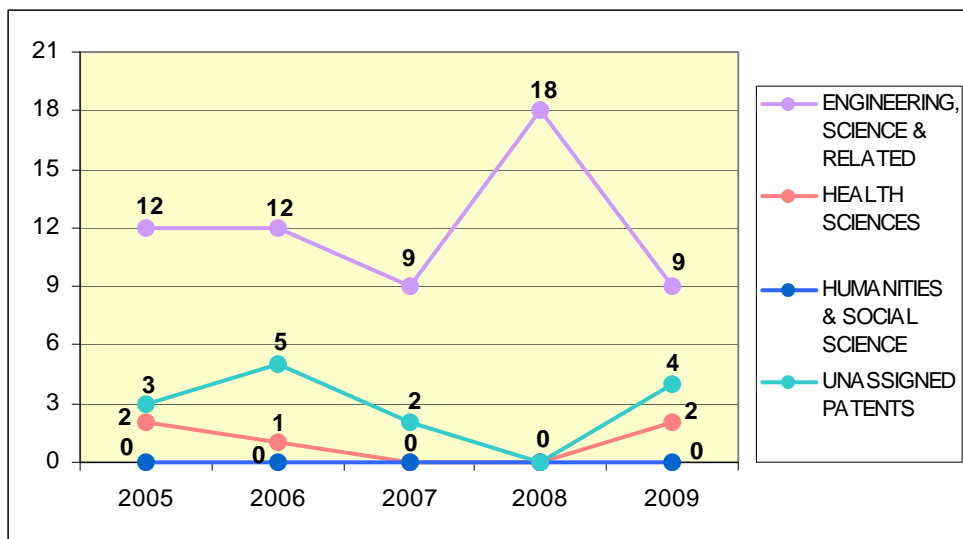
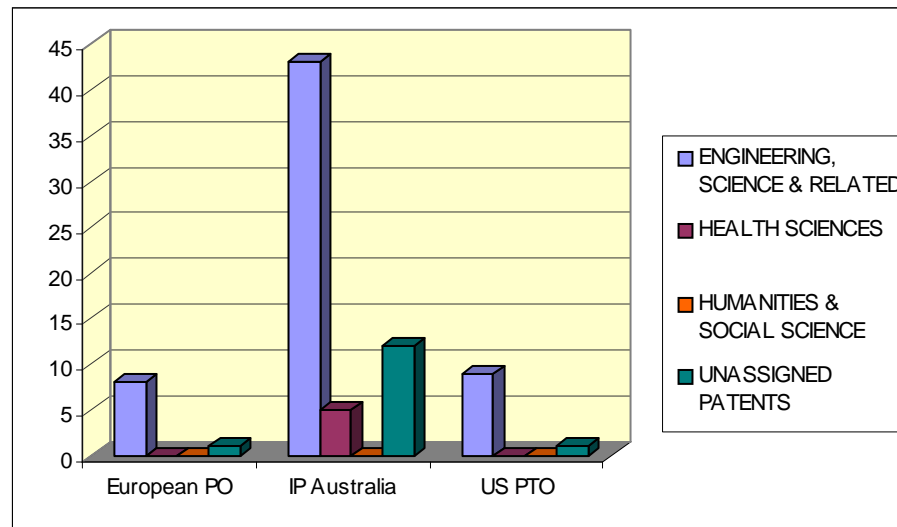
**Graph 130: Total Number of Patents according to Patent Office (2005-2009) – University of south Australia**



**Graph 131: Number of Patents according to Macro-areas (2005-2009) – University of South Australia**



**Graph 132: Total Number of Patents according to Macro-area and Patent Office (2005-2009) – University of South Australia**



**Graph 133: Total Number of Patents according to Macro-areas (2005-2009) – University of South Australia**

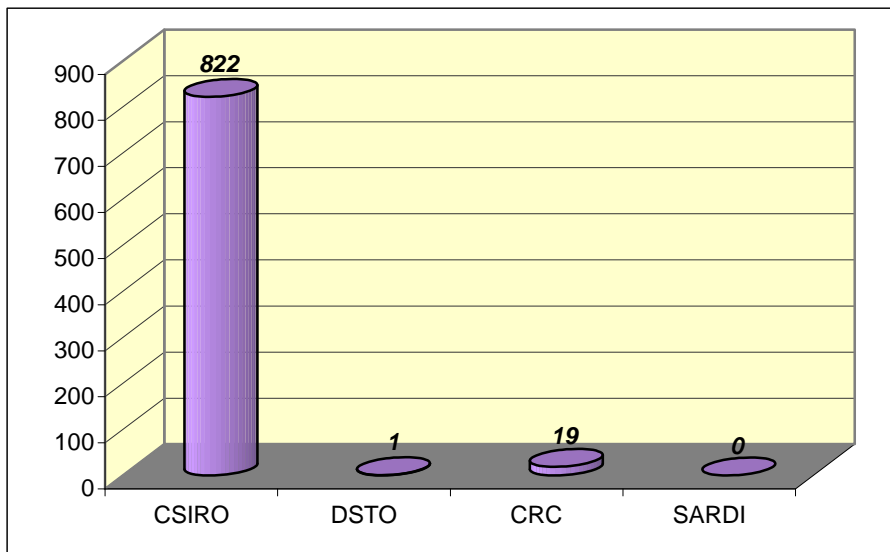
#### 7.2.4. Federal Research Centres

In reference to the Federal Research Centres, the first point to highlight is that the South Australian Research and Development Institute (SARDI) did not register any patent between 2005 and 2009, while the Defence Science and Technology Organisation (DSTO) only filed one patent at the IP Australia office in 2008.

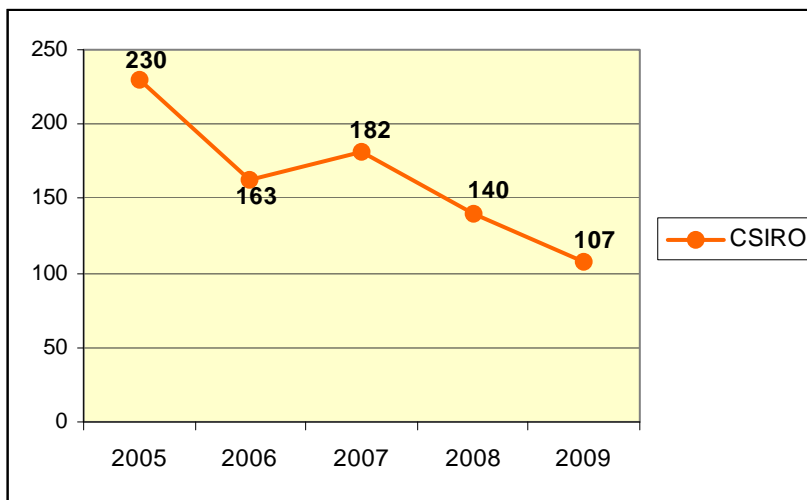
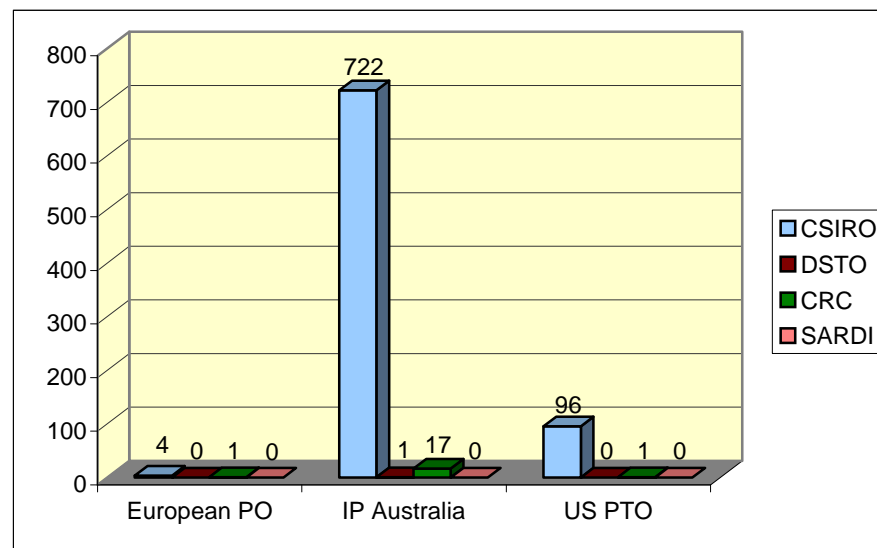
The Commonwealth Scientific and Industrial Research Organisation (CSIRO) was the most productive among the Federal Research Centres, with 822 patents registered throughout the reference period (*Graph 134*). However, also its patent registration trend was characterised by a decreasing evolvment over time (*Graphs 136(A)*). The second most productive Research Centre was the CRC, with 19 filed patents throughout the considered five years (*Graph 134*). The decrement in the number of registered patents characterised the CSIRO since 2007, while it interested the CRC and the DSTO only in the last year (2009) (*Graphs 136(A)-136(B)*). In particular, taking into consideration the difference of filed innovations between the first and the last considered years, the CRC experienced an increment (from zero to four) and the data remained unchanged for the DSTO (no patents both in 2005 and in 2009) (*Graph 136(B)*).

The large majority of patents were registered at the Australian Patent Office. The CSIRO filed also a considerable number of patents at the United States Patent and Trademark Office, while only few innovations were registered at the European PO (*Graph 135*).

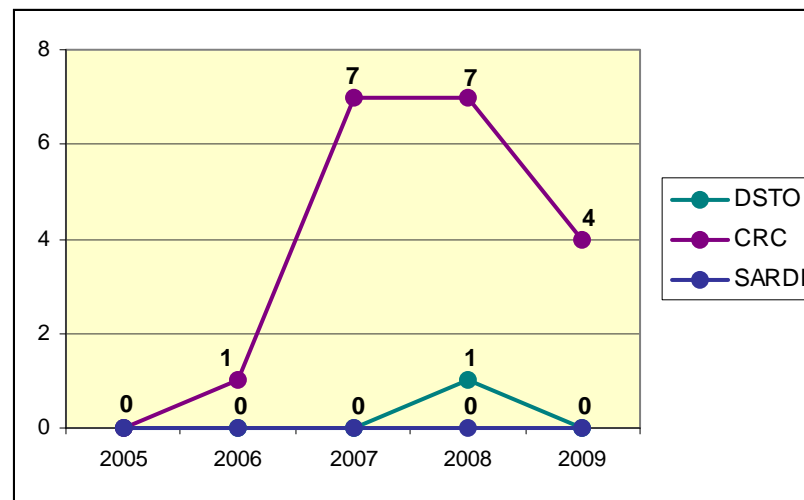
**Graph 134: Total Number of Patents registered by Federal Research Centres (2005-2009)**



**Graph 135: Total Number of Patents registered by Federal Research Centres according to Patent Office (2005-2009)**



**Graph 136(A): Number of Patents registered by Federal Research Centres (2005-2009)**



**Graph 136(B): Number of Patents registered by Federal Research Centres (2005-2009)**

## 8. CONCLUSIONS

The key purpose of this research project was to analyse South Australia's research and development system. All the South Australian institutions involved in this field considered the improvement of R&D activity and the support of technological transfer as crucial elements for the sustainable development of the State. And the results obtained by this analysis emphasises how public entities, universities, as well as Federal Research Centres, are focusing their attention on research and innovation activities.

In 2009, South Australia could boast the third highest Gross Expenditure on R&D (GERD) as percentage of GSP among Australian States and Territories, following Western Australia and Victoria. Moreover, between 2002-03 and 2008-09, the South Australia's ratio increased by 22.05%. Through the analysis of the single components of the GERD, it emerged that at the end of the considered period South Australia enjoyed the highest total Government GERD as percentage of GSP in Australia, with the second highest ratio of Commonwealth (National) GERD on GSP and the highest ratio of State GERD on GSP. Furthermore, it recorded the highest Australian level of Higher Education Gross Expenditure on R&D as percentage of GSP throughout all the considered period, with an increase of 42.22% between 2002-03 and 2008-09. These figures highlight the commitment of both public and higher education institutions to support the research and development activity, in order to make South Australia a leading State in the innovation field. The outstanding position of South Australia emerges also through the international comparison of GERD data.

With three local and two international outstanding universities, as well as various Federal Research Centres based in the State, South Australia is very dynamic and involved in research and development activity. Particularly, throughout the last years, the institutions active in this field had successfully implemented an internalisation strategy, which aimed at further boost South Australia's innovation model. In response to these efforts, in 2009 the number of international students enrolled in South Australia's universities reached 23161 out of the 78087, which means almost the 30% of the total student population, with an increase of 33.16% in the last five years. Among these,

also the study load of international students engaged in the universities' research programmes and activities increased throughout the considered five years by around 25%. Taking into consideration the percentage of international research students on universities' total research students, this increased by 18.51% between 2005 and 2009<sup>96</sup>. The presence of an incrementing international university population suggests the growing attractiveness of the State in terms of both universities' programmes and R&D. Moreover, this helps in improving South Australia international networks with foreign institutions, as international students and researches bring with them to South Australia new ideas and points of view, skills and knowledge, as well as a wide and strengthened range of contacts, relations and connections in their home countries.

This first part of the analysis suggested an improving and growing R&D activity and a strong commitment by the institutions active in the innovation field (State Government, local and international universities, Federal Research Centres, private companies).

Thus, after the description of South Australia's research and development system, the outcomes of these research activities were investigated, through the elaboration of data on released publications and registered patents assignable to South Australia's universities and Federal Research Centres based in the State between 2005 and 2009. The general figure that emerges from this analysis suggests that South Australia can boast noteworthy R&D results and its acting institutions are considerably active in this area.

More precisely, the data elaboration highlighted the main areas of excellence in the Health Science field, as well as in the Engineering, Scientific and Agro-food one. It was possible to identify the most active universities' Schools throughout the five considered years (2005-2009).

At the University of Adelaide, the most productive units in terms of publications were the School of Molecular & Biomedical Science; the School of Paediatrician & Reproductive Health; the School of Earth and Environmental Sciences; the School of Chemistry and Physics; and the School of Agriculture, Food and Wine. The outstanding Schools at the

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<sup>96</sup> According to the data published by South Australian universities (See Chapter 5, Paragraph 5.1.4.).

Flinders University were the School of Medicine; the School of Psychology; and the School of Biological Sciences. Finally, at the University of South Australia, the School of Health Sciences; the School of Pharmacy and Medical Science; and the School of Electrical and Information Engineering were the most effective ones. Overall, the School that released the highest number of publications between 2005 and 2009 was the School of Earth and Environmental Sciences at the University of Adelaide, with 948 releases.

Regarding registered patents, the most prolific units at the University of Adelaide were the School of Agriculture, Food and Wine; the School of Paediatrician & Reproductive Health; and the School of Chemistry and Physics. The School of Medicine could boast the highest number of filed innovations among the Flinders University. At the University of South Australia, the two most productive Schools in terms of patents belong to the Engineering field: the School of Advanced Manufacturing and Mechanical Engineering and the School of Electrical and Information Engineering. Throughout the five considered years, this last unit was also the overall most active one, with 38 registered patents.

Among the Federal Research Centres, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) was the most productive in terms of both publications and patents (738 and 822 respectively). However, in this case it is necessary to note that, due to some procedural issues widely explained in Section 6, we had to assign to the CSIRO all the research results attributable to the CSIRO divisions represented at the South Australia locations of the Organisation (CSIRO Land and Water; CSIRO Plant Industry; CSIRO Ecosystem Sciences; CSIRO Mathematics, Informatics and Statistics; CSIRO Process Science and Engineering; and CSIRO Education). In fact, it is highly probable that the South Australia's CSIRO Centres substantially contributed to the released publications and the registered patents. The second most effective Federal Research Centres was the South Australia Research and Development Institute (SARDI) in terms of publications (562) and the Cooperative Research Centres (CRCs) operating in the State as regards patents (19).

In conclusion, the final purpose of this research project can be identified in the promotion of international cooperation in determined sectors, either in those



cases where excellent competences emerge or in those situations where an international network could improve and boost the research outcomes. Thanks to its effective R&D system, the engagement of Government, universities and Federal Research Centres, as well as private companies, to improve the quality and amount of investments in innovation activities, and the presence of the identified areas of excellence in R&D, South Australia can play a more and more relevant role in attracting investments and people and in establishing networks and agreements with distinguished and world-class international institutions involved in the research and development sector. Furthermore, it is foreseeable that South Australia's role is going to increase in the years to come as a result of the State proximity to the fast growing and developing ASEAN<sup>97</sup> Countries and its remarkable and strengthen system of relationships with this strategic geopolitical area of the world.

As a matter of fact, for an European institution that would like to invest in an international network in the R&D field, the cooperation with South Australia and Australia in general would not only represent a connection with an efficient system, well-funded by private and public institutions, with high-level universities and research centres, and whose research investments and commitment recorded prominent outcomes. This collaboration would also give access to a favourable and well-established system of relationships with the Asian and South Pacific Countries. Therefore, from the European point of view, the investments in cooperative research and development activities with Australia could definitely turn out strategic and decisive if considered in the perspective of a new and growing geopolitical area (ASEAN and Australasia<sup>98</sup>), where Australia is going to play a crucial and principal role among the Asian and South Pacific Countries.

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<sup>97</sup> The Association of Southeast Asian Nations (ASEAN), whose members are Brunei, Burma (Myanmar), Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

<sup>98</sup> Australasia is a region of Oceania which includes Australia, New Zealand, the island of New Guinea, and neighbouring islands in the Pacific Ocean.





# ATTACHMENTS

## 1. Data on Gross Expenditure on Research and Development (Australian Capital Territory included)

*Table 1: Gross Expenditure on Research and Development – Australian States/Territories*

		2002-03		2004-05		2006-07		2008-09	
		\$'000	% of total	\$'000	% of total	\$'000	% of total	\$'000	% of total
SA	<b>BUSINESS</b>	539,969	47.95%	542,508	44.55%	844,573	50.88%	932,488	49.57%
SA	<b>GOVERNMENT Commonwealth</b>	225,466	20.02%	243,268	19.98%	301,960	18.19%	308,136	16.38%
SA	<b>GOVERNMENT State/Territory</b>	96,617	8.58%	104,552	8.58%	115,224	6.94%	132,621	7.05%
SA	<b>GOVERNMENT TOTAL</b>	322,083	28.60%	347,821	28.56%	417,183	25.13%	440,758	23.43%
SA	<b>HIGHER EDUCATION</b>	257,957	22.91%	325,383	26.72%	395,085	23.80%	505,080	26.85%
SA	<b>PRIVATE NON-PROFIT</b>	6,135	0.54%	2,146	0.18%	3,131	0.19%	2,887	0.15%
SA	<b>TOTAL</b>	1,126,143	100.00%	1,217,857	100.00%	1,659,972	100.00%	1,881,213	100.00%
NSW	<b>BUSINESS</b>	2,715,399	62.83%	3,235,611	62.71%	4,025,614	62.29%	5,204,198	63.01%
NSW	<b>GOVERNMENT Commonwealth</b>	267,382	6.19%	257,842	5.00%	368,474	5.70%	469,506	5.68%
NSW	<b>GOVERNMENT State/Territory</b>	270,693	6.26%	285,195	5.53%	308,742	4.78%	310,897	3.76%
NSW	<b>GOVERNMENT TOTAL</b>	538,075	12.45%	543,037	10.53%	677,216	10.48%	780,403	9.45%
NSW	<b>HIGHER EDUCATION</b>	991,884	22.95%	1,225,522	23.75%	1,565,337	24.22%	2,015,432	24.40%
NSW	<b>PRIVATE NON-PROFIT</b>	76,168	1.76%	155,072	3.01%	194,730	3.01%	259,287	3.14%
NSW	<b>TOTAL</b>	4,321,527	100.00%	5,159,242	100.00%	6,462,897	100.00%	8,259,320	100.00%
VIC	<b>BUSINESS</b>	2,048,823	55.54%	2,418,126	55.62%	3,458,242	58.08%	4,121,902	57.97%
VIC	<b>GOVERNMENT Commonwealth</b>	374,969	10.17%	404,402	9.30%	527,560	8.86%	554,501	7.80%
VIC	<b>GOVERNMENT State/Territory</b>	170,277	4.62%	190,955	4.39%	218,605	3.67%	256,856	3.61%
VIC	<b>GOVERNMENT TOTAL</b>	545,246	14.78%	595,357	13.69%	746,166	12.53%	811,357	11.41%
VIC	<b>HIGHER EDUCATION</b>	863,174	23.40%	1,062,312	24.43%	1,414,520	23.76%	1,774,909	24.96%
VIC	<b>PRIVATE NON-PROFIT</b>	231,474	6.28%	271,987	6.26%	335,273	5.63%	402,305	5.66%
VIC	<b>TOTAL</b>	3,688,717	100.00%	4,347,782	100.00%	5,954,200	100.00%	7,110,473	100.00%
QLD	<b>BUSINESS</b>	819,756	45.37%	1,073,255	49.03%	1,718,509	55.62%	2,323,031	59.76%
QLD	<b>GOVERNMENT Commonwealth</b>	147,701	8.18%	152,136	6.95%	189,677	6.14%	192,762	4.96%
QLD	<b>GOVERNMENT State/Territory</b>	255,288	14.13%	234,938	10.73%	237,171	7.68%	288,010	7.41%
QLD	<b>GOVERNMENT TOTAL</b>	402,989	22.31%	387,074	17.68%	426,848	13.81%	480,771	12.37%
QLD	<b>HIGHER EDUCATION</b>	574,285	31.79%	715,574	32.69%	911,949	29.51%	1,061,473	27.30%
QLD	<b>PRIVATE NON-PROFIT</b>	9,647	0.53%	13,052	0.60%	32,627	1.06%	22,218	0.57%
QLD	<b>TOTAL</b>	1,806,677	100.00%	2,188,955	100.00%	3,089,932	100.00%	3,887,494	100.00%
WA	<b>BUSINESS</b>	588,535	53.30%	1,089,096	62.45%	2,080,780	72.14%	3,616,593	78.69%
WA	<b>GOVERNMENT Commonwealth</b>	89,099	8.07%	83,717	4.80%	98,285	3.41%	136,649	2.97%
WA	<b>GOVERNMENT State/Territory</b>	108,114	9.79%	100,974	5.79%	126,174	4.37%	137,955	3.00%
WA	<b>GOVERNMENT TOTAL</b>	197,213	17.86%	184,691	10.59%	224,459	7.78%	274,605	5.97%

WA	<b>HIGHER EDUCATION</b>	296,117	26.82%	441,761	25.33%	544,816	18.89%	662,123	14.41%
WA	<b>PRIVATE NON-PROFIT</b>	22,388	2.03%	28,449	1.63%	34,487	1.20%	42,595	0.93%
WA	<b>TOTAL</b>	<b>1,104,252</b>	<b>100.00%</b>	<b>1,743,997</b>	<b>100.00%</b>	<b>2,884,542</b>	<b>100.00%</b>	<b>4,595,916</b>	<b>100.00%</b>
TAS	<b>BUSINESS</b>	60,862	24.61%	78,746	27.96%	105,078	23.24%	135,795	26.37%
TAS	<b>GOVERNMENT Commonwealth</b>	109,668	44.35%	115,428	40.99%	113,052	25.00%	118,523	23.01%
TAS	<b>GOVERNMENT State/Territory</b>	8,801	3.56%	3,564	1.27%	9,842	2.18%	6,759	1.31%
TAS	<b>GOVERNMENT TOTAL</b>	118,469	47.91%	118,992	42.25%	122,894	27.17%	125,282	24.33%
TAS	<b>HIGHER EDUCATION</b>	67,714	27.38%	83,673	29.71%	101,372	22.42%	128,652	24.98%
TAS	<b>PRIVATE NON-PROFIT</b>	235	0.10%	199	0.07%	na	na	na	na
TAS	<b>TOTAL</b>	<b>247,280</b>	<b>100.00%</b>	<b>281,610</b>	<b>100.00%</b>	<b>452,238</b>	<b>100.00%</b>	<b>515,011</b>	<b>100.00%</b>
NT	<b>BUSINESS</b>	na	na	40,715	28.38%	108,760	44.86%	101,476	41.33%
NT	<b>GOVERNMENT Commonwealth</b>	20,622	16.76%	20,159	14.05%	18,360	7.57%	32,748	13.34%
NT	<b>GOVERNMENT State/Territory</b>	29,439	23.92%	14,708	10.25%	27,542	11.36%	16,243	6.62%
NT	<b>GOVERNMENT TOTAL</b>	50,061	40.68%	34,867	24.30%	45,902	18.93%	48,990	19.95%
NT	<b>HIGHER EDUCATION</b>	27,329	22.21%	33,022	23.02%	41,873	17.27%	46,073	18.76%
NT	<b>PRIVATE NON-PROFIT</b>	na	na	na	na	na	na	na	na
NT	<b>TOTAL</b>	<b>123,065</b>	<b>100.00%</b>	<b>143,471</b>	<b>100.00%</b>	<b>242,437</b>	<b>100.00%</b>	<b>245,530</b>	<b>100.00%</b>
ACT	<b>BUSINESS</b>	43,155	4.37%	77,503	9.85%	94,020	6.69%	93,327	8.75%
ACT	<b>GOVERNMENT Commonwealth</b>	290,553	29.39%	263,679	33.50%	423,100	30.09%	435,524	40.82%
ACT	<b>GOVERNMENT State/Territory</b>	6,528	0.66%	2,851	0.36%	3,653	0.26%	13,469	1.26%
ACT	<b>GOVERNMENT TOTAL</b>	297,081	30.06%	266,530	33.86%	426,753	30.35%	448,993	42.09%
ACT	<b>HIGHER EDUCATION</b>	351,136	35.52%	439,915	55.89%	458,578	32.61%	523,370	49.06%
ACT	<b>PRIVATE NON-PROFIT</b>	na	na	3,199	0.41%	na	na	1,129	0.11%
ACT	<b>TOTAL</b>	<b>988,453</b>	<b>100.00%</b>	<b>787,147</b>	<b>100.00%</b>	<b>1,406,104</b>	<b>100.00%</b>	<b>1,066,819</b>	<b>100.00%</b>

Source: Australian Bureau of Statistics

**Table 2: Ratio of Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

	2002-03	2004-05	2006-07	2008-09
ACT	5.75%	4.06%	6.17%	4.11%
WA	1.27%	1.71%	2.08%	2.70%
VIC	1.77%	1.86%	2.28%	2.44%
SA	1.95%	1.92%	2.31%	2.38%
TAS	1.59%	1.54%	2.13%	2.22%
NSW	1.56%	1.65%	1.88%	2.12%
QLD	1.28%	1.28%	1.48%	1.59%
NT	1.28%	1.26%	1.69%	1.43%

Source: Australian Bureau of Statistics (Authors' calculations)

**Table 3: Government Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

		2002-03	2004-05	2006-07	2008-09
SA	Commonwealth	0.39%	0.38%	0.42%	0.39%
SA	State/Territory	0.17%	0.16%	0.16%	0.17%
SA	<i>Total</i>	<i>0.56%</i>	<i>0.55%</i>	<i>0.58%</i>	<i>0.56%</i>
NSW	Commonwealth	0.10%	0.08%	0.11%	0.12%
NSW	State/Territory	0.10%	0.09%	0.09%	0.08%
NSW	<i>Total</i>	<i>0.19%</i>	<i>0.17%</i>	<i>0.20%</i>	<i>0.20%</i>
VIC	Commonwealth	0.18%	0.17%	0.20%	0.19%
VIC	State/Territory	0.08%	0.08%	0.08%	0.09%
VIC	<i>Total</i>	<i>0.26%</i>	<i>0.25%</i>	<i>0.29%</i>	<i>0.28%</i>
QLD	Commonwealth	0.10%	0.09%	0.09%	0.08%
QLD	State/Territory	0.18%	0.14%	0.11%	0.12%
QLD	<i>Total</i>	<i>0.29%</i>	<i>0.23%</i>	<i>0.20%</i>	<i>0.20%</i>
WA	Commonwealth	0.10%	0.08%	0.07%	0.08%
WA	State/Territory	0.12%	0.10%	0.09%	0.08%
WA	<i>Total</i>	<i>0.23%</i>	<i>0.18%</i>	<i>0.16%</i>	<i>0.16%</i>
TAS	Commonwealth	0.70%	0.63%	0.53%	0.51%
TAS	State/Territory	0.06%	0.02%	0.05%	0.03%
TAS	<i>Total</i>	<i>0.76%</i>	<i>0.65%</i>	<i>0.58%</i>	<i>0.54%</i>
NT	Commonwealth	0.21%	0.18%	0.13%	0.19%
NT	State/Territory	0.31%	0.13%	0.19%	0.09%
NT	<i>Total</i>	<i>0.52%</i>	<i>0.31%</i>	<i>0.32%</i>	<i>0.29%</i>
ACT	Commonwealth	1.69%	1.36%	1.86%	1.68%
ACT	State/Territory	0.04%	0.01%	0.02%	0.05%
ACT	<i>Total</i>	<i>1.73%</i>	<i>1.37%</i>	<i>1.87%</i>	<i>1.73%</i>

Source: Australian Bureau of Statistics (Authors' calculations)

**Table 4: Business Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

	2002-03	2004-05	2006-07	2008-09
WA	0.68%	1.07%	1.50%	2.13%
VIC	0.98%	1.03%	1.32%	1.41%
NSW	0.98%	1.04%	1.17%	1.33%
SA	0.93%	0.86%	1.18%	1.18%
QLD	0.58%	0.63%	0.82%	0.95%
TAS	0.39%	0.43%	0.49%	0.59%
NT	na	0.36%	0.76%	0.59%
ACT	0.25%	0.40%	0.41%	0.36%

Source: Australian Bureau of Statistics (Authors' calculations)

**Table 5: Higher Education Gross Expenditure on R&D (GERD) on Gross State Product (GSP) – Australian States/Territories**

	2002-03	2004-05	2006-07	2008-09
<i>Australia</i>	0.43%	0.47%	0.50%	0.54%
SA	0.45%	0.51%	0.55%	0.64%
NSW	0.36%	0.39%	0.46%	0.52%
VIC	0.41%	0.45%	0.54%	0.61%
QLD	0.41%	0.42%	0.44%	0.44%
WA	0.34%	0.43%	0.39%	0.39%
TAS	0.43%	0.46%	0.48%	0.56%
NT	0.28%	0.29%	0.29%	0.27%
ACT	2.04%	2.27%	2.01%	2.02%

Source: Australian Bureau of Statistics (Authors' calculations)

## **2. Schools' Classification into Macro-areas**

### ***I) Health Sciences***

#### *University of South Australia:*

- School of Health Sciences
- School of Nursing and Midwifery
- School of Pharmacy and Medical Sciences

#### *Flinders University:*

- School of Medicine
- School of Nursing and Midwifery

#### *University of Adelaide:*

- Medicine Learning and Teaching Unit
- School of Dentistry
- School of Medical Sciences
- School of Medicine
- School of Paediatrics and Reproductive Health
- School of Population Health and Clinical Practice

### ***II) Humanities & Social Sciences***

#### *University of South Australia:*

- Centre for Regional Engagement
- International Graduate School of Business
- School of Arts, Architecture and Design
- School of Commerce
- School of Communication, International Studies and Language
- School of Education
- School of Law
- School of Management
- School of Marketing
- School of Psychology, social work and social policy
- The David Unaipon College of Indigenous Education and Research

#### *Flinders University:*

- Flinders Business School
- Flinders Law School



School of Archaeology  
School of Australian Studies  
School of Drama  
School of Education  
School of English  
School of English and Creative Writing  
School of Humanities  
School of International Studies  
School of Language Studies  
School of Legal Studies  
School of Philosophy  
School of Psychology  
School of Screen and Media  
School of Social and Political Studies  
School of Theology  
School of Tourism

*University of Adelaide:*

Business School  
Elder Conservatorium of music  
Executive Education Unit  
Law School  
School of Architecture, Landscapes Architecture and Urban design  
School of Economics  
School of Education  
School of History and Politics  
School of Humanities  
School of Psychology  
School of Social Science

***III) Engineering, Science & related***

*University of South Australia:*

School of Advanced Manufacturing and Mechanical Engineering  
School of Computer and Information Science  
School of Electrical and Information Engineering

School of Mathematics and Statistics  
School of Natural and Build Environments

*Flinders University:*

Flinders Centre for Science Education in the 21st Century  
School of Biological Sciences  
School of Chemical and Physical Sciences  
School of Computer Science, Engineering and Mathematics  
School of Environment

*University of Adelaide:*

Australian School of Petroleum  
Centre for Automotive Safety Research  
Entrepreneurship, Commercialization and Innovation Centre  
School of Agriculture, Food and Wine  
School of Animal and Veterinary Sciences  
School of Chemical Engineering  
School of Chemistry and Physics  
School of Civil, Environmental and mining Engineering  
School of Computer Science  
School of Earth and Environmental Sciences  
School of Electrical and Electronic Engineering  
School of Mathematical sciences  
School of Mechanical engineering  
School of Molecular and Biomedical Sciences

### 3. Data on Publications according to Institution (2005-2009)

**Table 1: Data on Publications – University of Adelaide (2005-2009)**

Division	FIELDS	Number of publications	Total number of citations	Average number of citation	Median	Highest num of citations
Australian Sc. of Petroleum	ENGINEERING, SCIENCE & RELATED	75	274	3.65	4	28
Business School	HUMANITIES & SOCIAL SCIENCES	25	51	2.04	1.5	28
Centre for Aut. Safety Research	ENGINEERING, SCIENCE & RELATED	22	49	2.23	1	34
Elder Conserv. of Music	HUMANITIES & SOCIAL SCIENCES	0	0	0.00	0	0
Entrepr., Commerc. and Inn. Centre	ENGINEERING, SCIENCE & RELATED	1	2	2.00	2	2
Executive Ed. Unit	HUMANITIES & SOCIAL SCIENCES	0	0	0.00	0	0
Law School	HUMANITIES & SOCIAL SCIENCES	9	9	1.00	2	4
Med. Learning and Teach. Unit	HEALTH SCIENCES	2	4	2.00	2	3
Sc. of Agr., Food and Wine	ENGINEERING, SCIENCE & RELATED	364	2149	5.90	4	89
Sc. of Animal and Vet. Sciences	ENGINEERING, SCIENCE & RELATED	1	4	4.00	4	4
Sc. of Arch, Lands. Arch. & Urban Design	HUMANITIES & SOCIAL SCIENCES	8	20	2.50	2	10
Sc. of Chem. Engineering	ENGINEERING, SCIENCE & RELATED	94	401	4.27	3	38
Sc. of Chem. and Physics	ENGINEERING, SCIENCE & RELATED	363	2404	6.62	6	82
Sc. of Civil, Envir. and Mining Eng.	ENGINEERING, SCIENCE & RELATED	53	84	1.58	3	18
Sc. of Comp. Science	ENGINEERING, SCIENCE & RELATED	182	258	1.42	2	25
Sc. of Dentistry	HEALTH SCIENCES	137	505	3.02	3	25
Sc. of Earth and Envir. Sciences	ENGINEERING, SCIENCE & RELATED	948	6764	7.14	5	163
Sc. of Economics	HUMANITIES & SOCIAL SCIENCES	76	208	2.74	2	23
Sc. of Education	HUMANITIES & SOCIAL SCIENCES	15	28	1.87	1.5	6
Sc. of Electri. & Electro. Eng.	ENGINEERING, SCIENCE & RELATED	363	740	2.04	3	37
Sc. of History & Politics	HUMANITIES & SOCIAL SCIENCES	24	61	2.54	3	13
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCES	15	16	1.07	1.5	9

Sc.of Math. Sciences	ENGINEERING, SCIENCE & RELATED	136	388	2.85	3	30
Sc. of Mech.Engineering	ENGINEERING, SCIENCE & RELATED	200	530	2.65	3	23
Sc. of Med. Sciences	HEALTH SCIENCES	90	588	6.53	3	69
Sc. of Medicine	HEALTH SCIENCES	96	461	4.80	4	31
Sc.of Molec. and Biomed. Science	ENGINEERING, SCIENCE & RELATED	535	5524	10.33	7	150
Sc. of Paediat.& Reprod. Health	HEALTH SCIENCES	149	1558	10.46	6	252
Sc. of Popul. Health&Clinical Practice	HEALTH SCIENCES	103	518	5.03	5	30
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCES	147	535	3.64	3	34
Sc. of Social Sciences	HUMANITIES & SOCIAL SCIENCES	23	53	2.30	3	10
<b>University of Adelaide</b>		<b>4256</b>	<b>24186</b>	<b>3.49</b>		<b>252</b>

Source: Scopus Database (Authors' elaboration)

**Table 2: Data on Publications per Year (2005-2009) – University of Adelaide**

Division	FIELDS	2005		2006		2007		2008		2009	
		Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.
Australian Sc. of Petroleum	ENGINEERING, SCIENCE & RELATED	9	11.33	9	1.78	15	2.07	27	3.33	15	2.33
Business School	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	1	28.00	6	1.67	18	0.72
Centre for Aut. Safety Research	ENGINEERING, SCIENCE & RELATED	5	0.20	5	8.60	3	1.00	5	0.20	4	0.25
Elder Conserv. of Music	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Entrepr., Commerc. and Inn. Centre	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	1	2.00	0	0.00	0	0.00
Executive Ed. Unit	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Law School	HUMANITIES & SOCIAL SCIENCES	1	2.00	1	2.00	3	1.67	1	0.00	3	0.00
Med. Learning and Teach. Unit	HEALTH SCIENCES	0	0.00	0	0.00	0	0.00	1	3.00	1	1.00
Sc. of Agr., Food and Wine	ENGINEERING, SCIENCE & RELATED	0	0.00	42	12.60	94	7.97	103	4.66	125	3.13
Sc. of Animal and Vet. Sciences	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	0	0.00	0	0.00	1	4.00
Sc. of Arch, Lands. Arch.& Urban Design	HUMANITIES & SOCIAL SCIENCES	0	0.00	2	5.50	4	1.50	1	1.00	1	2.00
Sc. of Chem. Engineering	ENGINEERING, SCIENCE & RELATED	15	7.80	10	7.70	19	2.79	16	4.13	34	2.59
Sc. of Chem. and Physics	ENGINEERING, SCIENCE & RELATED	25	10.80	47	8.26	70	11.89	105	5.17	116	3.27

Sc. of Civil, Envir. and Mining Eng.	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	1	1.00	18	3.56	34	0.56
Sc. of Comp. Science	ENGINEERING, SCIENCE & RELATED	21	3.48	22	1.36	44	2.36	35	1.03	60	0.25
Sc. of Dentistry	HEALTH SCIENCES	3	9.33	15	4.80	35	4.23	43	3.72	41	2.37
Sc. of Earth and Envir. Sciences	ENGINEERING, SCIENCE & RELATED	130	13.26	156	9.63	199	6.76	222	6.90	241	2.74
Sc. of Economics	HUMANITIES & SOCIAL SCIENCES	16	6.63	14	3.50	6	2.50	18	1.44	22	0.55
Sc. of Education	HUMANITIES & SOCIAL SCIENCES	7	3.29	4	1.00	3	0.33	0	0.00	1	0.00
Sc. of Electri. & Electro. Eng.	ENGINEERING, SCIENCE & RELATED	68	3.19	61	2.69	88	1.61	74	2.07	72	0.89
Sc. of History & Politics	HUMANITIES & SOCIAL SCIENCES	1	13.00	4	2.25	7	3.14	6	1.67	6	1.17
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCES	2	0.00	1	2.00	4	2.25	5	0.40	3	1.00
Sc. of Math. Sciences	ENGINEERING, SCIENCE & RELATED	23	6.00	23	4.87	36	2.19	27	1.59	27	0.59
Sc. of Mech. Engineering	ENGINEERING, SCIENCE & RELATED	37	3.65	29	3.52	43	3.12	46	2.46	45	1.02
Sc. of Med. Sciences	HEALTH SCIENCES	0	0.00	10	15.20	18	12.17	27	4.15	35	3.00
Sc. of Medicine	HEALTH SCIENCES	0	0.00	2	16.00	21	9.10	27	3.74	46	2.98
Sc. of Molec. and Biomed. Science	ENGINEERING, SCIENCE & RELATED	56	18.48	108	13.03	115	12.40	130	9.23	126	3.62
Sc. of Paediat. & Reprod. Health	HEALTH SCIENCES	0	0.00	16	9.75	38	16.74	40	13.75	55	3.93
Sc. of Popul. Health & Clinical Practice	HEALTH SCIENCES	0	0.00	5	5.80	19	6.74	37	5.68	42	3.60
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCES	4	1.75	16	6.44	35	6.29	43	3.67	49	1.04
Sc. of Social Sciences	HUMANITIES & SOCIAL SCIENCES	4	3.50	7	3.57	6	2.00	5	0.40	1	0.00
<b>TOTAL HUMANITIES &amp; SOCIAL SCIENCES</b>		<b>35</b>	<b>2.74</b>	<b>49</b>	<b>2.39</b>	<b>69</b>	<b>4.33</b>	<b>85</b>	<b>0.93</b>	<b>104</b>	<b>0.59</b>
<b>TOTAL HEALTH SCIENCE</b>		<b>3</b>	<b>1.56</b>	<b>48</b>	<b>8.59</b>	<b>131</b>	<b>8.16</b>	<b>175</b>	<b>5.67</b>	<b>220</b>	<b>2.81</b>
<b>TOTAL ENGINEERING, SCIENCE &amp; RELATED</b>		<b>389</b>	<b>5.59</b>	<b>512</b>	<b>5.29</b>	<b>728</b>	<b>4.08</b>	<b>808</b>	<b>3.17</b>	<b>900</b>	<b>1.80</b>
<b>TOTAL</b>		<b>427</b>	<b>3.80</b>	<b>609</b>	<b>4.90</b>	<b>928</b>	<b>4.96</b>	<b>1068</b>	<b>2.86</b>	<b>1224</b>	<b>1.57</b>

Source: Scopus Database (Authors' elaboration)

**Table 3: Data on Publications – Flinders University (2005-2009)**

Division	FIELDS	Num of publications	Total num of citations	Average num of citation	Median	Highest num of citations
Business School	HUMANITIES & SOCIAL SCIENCE	11	16	1.45	2	5
Law School	HUMANITIES & SOCIAL SCIENCE	29	24	0.83	3	8
Sc. English & Creative Writing	HUMANITIES & SOCIAL SCIENCE	0	0	0.00	0	0
Sc. of Archaeology	HUMANITIES & SOCIAL SCIENCE	34	37	1.09	2	12
Sc. of Australian Studies	HUMANITIES & SOCIAL SCIENCE	1	0	0.00	0	0

Sc. of Bio. Sciences	ENGINEERING, SCIENCE & RELATED	398	2297	5.77	4	108
Sc. of Chem & Phys Sciences	ENGINEERING, SCIENCE & RELATED	1	1	1.00	1	1
Sc. of Comp. Science, Eng. and Math	ENGINEERING, SCIENCE & RELATED	37	17	0.46	1	4
Sc. of Drama	HUMANITIES & SOCIAL SCIENCE	1	0	0.00	0	0
Sc. of Education	HUMANITIES & SOCIAL SCIENCE	100	248	2.48	3	22
Sc. of English	HUMANITIES & SOCIAL SCIENCE	0	0	0.00	0	0
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCE	6	3	0.50	1.5	2
Sc. of Int. Studies	HUMANITIES & SOCIAL SCIENCE	37	53	1.43	2	10
Sc. of Language Studies	HUMANITIES & SOCIAL SCIENCE	0	0	0.00		0
Sc. of Legal Studies	HUMANITIES & SOCIAL SCIENCE	1	0	0.00	0	0
Sc. of Medicine	HEALTH SCIENCES	301	2226	7.40	4.5	193
Sc. of Nursing and Midwifery	HEALTH SCIENCES	95	256	2.69	3	17
Sc. of Philosophy	HUMANITIES & SOCIAL SCIENCE	6	2	0.33	2	2
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCE	257	2104	8.19	5	66
Sc. of Screen & Media	HUMANITIES & SOCIAL SCIENCE	1	0	0.00	0	0
Sc. of Soc. & Policy Studies	HUMANITIES & SOCIAL SCIENCE	45	100	2.22	3	15
Sc. of the Environment	ENGINEERING, SCIENCE & RELATED	1	0	0.00	0	0
Sc. of Theology	HUMANITIES & SOCIAL SCIENCE	4	0	0.00	0	0
Sc. of Tourism	HUMANITIES & SOCIAL SCIENCE	2	2	1.00	0	2
Science Edu. in the 21st Century	ENGINEERING, SCIENCE & RELATED	1	7	7.00	7	7
<b>Flinders University</b>		<b>1369</b>	<b>7393</b>	<b>1.75</b>		<b>193</b>

*Source: Scopus Database (Authors' elaboration)*

**Table 4: Data on Publications per Year (2005-2009) – Flinders University**

Division	FIELDS	2005		2006		2007		2008		2009	
		Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.
Business School	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	3	1.33	5	0.80	3	2.67
Law School	HUMANITIES & SOCIAL SCIENCE	7	1.14	10	0.70	3	0.33	5	1.00	4	0.75
Sc. English & Creative Writing	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Sc. of Archaeology	HUMANITIES & SOCIAL SCIENCE	6	3.17	4	0.50	5	0.40	8	1.25	11	0.36
Sc. of Australian Studies	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	1	0.00
Sc. of Bio. Sciences	ENGINEERING, SCIENCE & RELATED	45	10.42	79	8.65	79	6.94	84	4.75	111	1.78
Sc. of Chem & Phys Sciences	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	0	0.00	1	1.00	0	0.00
Sc. of Comp. Science, Eng. and Math	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	0	0.00	12	0.25	25	0.56
Sc. of Drama	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	1	0.00
Sc. of Education	HUMANITIES & SOCIAL SCIENCE	19	2.74	28	3.07	28	1.82	13	3.00	12	1.67
Sc. of English	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCE	3	1.00	1	0.00	0	0.00	0	0.00	2	0.00
Sc. of Int. Studies	HUMANITIES & SOCIAL SCIENCE	4	3.00	8	1.88	12	1.92	11	0.18	2	0.50
Sc. of Language Studies	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Sc. of Legal Studies	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	1	0.00
Sc. of Medicine	HEALTH SCIENCES	49	14.53	46	10.35	64	7.55	81	5.11	61	2.31
Sc. of Nursing and Midwifery	HEALTH SCIENCES	10	5.30	16	6.13	14	2.57	29	1.72	26	0.73
Sc. of Philosophy	HUMANITIES & SOCIAL SCIENCE	2	1.00	1	0.00	0	0.00	1	0.00	2	0.00
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCE	44	14.91	62	10.37	47	11.06	59	3.86	45	1.27
Sc. of Screen & Media	HUMANITIES & SOCIAL SCIENCE	0	0.00	0	0.00	0	0.00	0	0.00	1	0.00
Sc. of Soc.& Policy Studies	HUMANITIES & SOCIAL SCIENCE	4	6.75	9	3.56	5	3.20	15	1.40	12	0.33
Sc. of the Environment	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	0	0.00	0	0.00	1	0.00
Sc. of Theology	HUMANITIES & SOCIAL SCIENCE	1	0.00	0	0.00	1	0.00	1	0.00	1	0.00
Sc. of Tourism	HUMANITIES & SOCIAL SCIENCE	0	0.00	1	2.00	0	0.00	0	0.00	1	0.00
Science Edu. in the 21st Century	ENGINEERING, SCIENCE & RELATED	0	0.00	0	0.00	0	0.00	1	7.00	0	0.00
<b>TOTAL HUMANITIES &amp; SOCIAL SCIENCES</b>		<b>90</b>	<b>1.87</b>	<b>124</b>	<b>1.23</b>	<b>104</b>	<b>1.11</b>	<b>118</b>	<b>0.64</b>	<b>99</b>	<b>0.42</b>

TOTAL HEALTH SCIENCE	59	9.92	62	8.24	78	5.06	110	3.42	87	1.52
TOTAL ENGINEERING, SCIENCE & RELATED	45	2.08	79	1.73	79	1.39	98	2.60	137	0.47
<b>TOTAL</b>	<b>194</b>	<b>2.56</b>	<b>265</b>	<b>1.89</b>	<b>261</b>	<b>1.48</b>	<b>326</b>	<b>1.25</b>	<b>323</b>	<b>0.52</b>

Source: Scopus Database (Authors' elaboration)

**Table 5: Data on Publications – University of South Australia (2005-2009)**

Division	FIELDS	Num of publications	Total num of citations	Average num of citation	Median	Highest num of citations
Adv. Manuf. and Mech. Eng.	ENGINEERING, SCIENCES & RELATED	46	85	1.85	2	21
Centre for Reg. Engagement	HUMANITIES & SOCIAL SCIENCES	7	14	2.00	2	9
David Unaipon College	HUMANITIES & SOCIAL SCIENCES	3	3	1.00	3	3
Int. Graduate Sc. of Business	HUMANITIES & SOCIAL SCIENCES	37	50	1.35	1.5	8
Sc. of Art, Arch. and Design	HUMANITIES & SOCIAL SCIENCES	6	1	0.17	1	1
Sc. of Comm., Int. Stud and Languages	HUMANITIES & SOCIAL SCIENCES	18	18	1.00	2	3
Sc. of Commerce	HUMANITIES & SOCIAL SCIENCES	76	172	2.26	3	12
Sc. of Comp. and Inf. Science	ENGINEERING, SCIENCES & RELATED	131	137	1.05	2	16
Sc. of Education	HUMANITIES & SOCIAL SCIENCES	46	86	1.87	2	36
Sc. of Elect. and Inf. Eng.	ENGINEERING, SCIENCES & RELATED	197	226	1.15	2	30
Sc. of Health Sciences	HEALTH SCIENCES	350	1981	5.66	4	103
Sc. of Law	HUMANITIES & SOCIAL SCIENCES	1	3	3.00	3	3
Sc. of Management	HUMANITIES & SOCIAL SCIENCES	80	273	3.41	3	20
Sc. of Marketing	HUMANITIES & SOCIAL SCIENCES	19	46	2.42	4	11
Sc. of Math. and Statistics	ENGINEERING, SCIENCES & RELATED	92	269	2.92	3	31
Sc. of Nat. and Built Environ.	ENGINEERING, SCIENCES & RELATED	95	255	2.68	3	20
Sc. of Nursing & Midwifery	HEALTH SCIENCES	3	3	1.00	3	3
Sc. of Psych., Soc. Work & Soc. Policy	HUMANITIES & SOCIAL SCIENCES	106	489	4.61	4	55
Sc. of Pharmacy & Med. Sciences	HEALTH SCIENCES	350	1411	5.64	5	165
<b>University of South Australia</b>		<b>1313</b>	<b>4111</b>	<b>2.37</b>		

Source: Scopus Database (Authors' elaboration)



**Table 6: Data on Publications per Year (2005-2009) – University of South Australia**

Division	FIELDS	2005		2006		2007		2008		2009	
		Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.
Adv. Manuf. and Mech. Eng.	ENGINEERING, SCIENCES & RELATED	5	0.40	2	11.50	7	1.43	13	1.85	19	1.37
Centre for Reg. Engagement	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	1	0.00	2	4.50	4	1.25
David Unaipon College	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	0	0.00	1	3.00	2	0.00
Int. Graduate Sc. of Business	HUMANITIES & SOCIAL SCIENCES	1	4.00	4	1.75	7	2.00	14	1.29	11	0.64
Sc. of Art, Arch. and Design	HUMANITIES & SOCIAL SCIENCES	1	1.00	1	0.00	1	0.00	2	0.00	1	0.00
Sc. of Comm., Int. Stud and Languages	HUMANITIES & SOCIAL SCIENCES	1	3.00	3	0.00	3	1.67	4	0.50	7	1.14
Sc. of Commerce	HUMANITIES & SOCIAL SCIENCES	6	4.67	12	2.42	16	3.38	23	2.35	19	0.37
Sc. of Comp. and Inf. Science	ENGINEERING, SCIENCES & RELATED	17	1.47	14	2.21	27	1.63	39	0.54	34	0.47
Sc. of Education	HUMANITIES & SOCIAL SCIENCES	6	10.33	6	0.83	7	0.29	9	1.00	18	0.44
Sc. of Elect. and Inf. Eng.	ENGINEERING, SCIENCES & RELATED	28	1.79	42	1.07	45	1.87	45	0.73	37	0.38
Sc. of Health Sciences	HEALTH SCIENCES	50	8.50	73	9.55	69	7.35	78	2.96	80	1.51
Sc. of Law	HUMANITIES & SOCIAL SCIENCES	0	0.00	0	0.00	1	3.00	0	0.00	0	0.00
Sc. of Management	HUMANITIES & SOCIAL SCIENCES	17	3.71	14	5.36	14	4.21	21	3.19	14	0.64
Sc. of Marketing	HUMANITIES & SOCIAL SCIENCES	6	3.83	2	2.00	2	3.00	3	2.00	6	1.17
Sc. of Math. and Statistics	ENGINEERING, SCIENCES & RELATED	10	5.40	16	5.50	17	1.94	10	0.90	39	2.18
Sc. of Nat. and Built Environ.	ENGINEERING, SCIENCES & RELATED	8	6.38	14	3.07	27	3.96	18	1.61	28	0.89
Sc. of Nursing & Midwifery	HEALTH SCIENCES	3	1.00	0	0.00	0	0.00	0	0.00	0	0.00
Sc. of Psych., Soc. Work & Soc. Policy	HUMANITIES & SOCIAL SCIENCES	14	7.429	25	5.6	15	7.67	26	4.5	26	0.5
Sc. of Pharmacy & Med. Sciences	HEALTH SCIENCES	20	9.55	51	10.51	71	5.89	50	3.70	58	1.40
<b>TOTAL HUMANITIES &amp; SOCIAL SCIENCES</b>		<b>52</b>	<b>3.45</b>	<b>67</b>	<b>1.63</b>	<b>67</b>	<b>2.29</b>	<b>105</b>	<b>2.03</b>	<b>108</b>	<b>0.56</b>
<b>TOTAL HEALTH SCIENCE</b>		<b>73</b>	<b>6.35</b>	<b>124</b>	<b>6.69</b>	<b>140</b>	<b>4.41</b>	<b>128</b>	<b>2.22</b>	<b>138</b>	<b>0.97</b>
<b>TOTAL ENGINEERING, SCIENCE &amp; RELATED</b>		<b>68</b>	<b>3.09</b>	<b>88</b>	<b>4.67</b>	<b>123</b>	<b>2.17</b>	<b>125</b>	<b>1.13</b>	<b>157</b>	<b>1.06</b>
<b>TOTAL</b>		<b>193</b>	<b>3.81</b>	<b>279</b>	<b>3.23</b>	<b>330</b>	<b>2.59</b>	<b>358</b>	<b>1.82</b>	<b>403</b>	<b>0.76</b>

Source: Scopus Database (Authors' elaboration)

**Table 7: Data on publications – Federal Research Centres (2005-2009)**

Centres	Num of paper	Total num of citations	Average num of citation	Highest num of citations	Median
CRC	18	65	3.61	14	2
CSIRO	738	6467	8.76	176	6
DSTO	154	296	1.92	34	3
SARDI	562	2647	4.71	66	4
<b>Federal Research Centres</b>	<b>1472</b>	<b>9475</b>	<b>4.75</b>		

Source: Scopus Database (Authors' elaboration)

**Table 8: Data on Publications per Year (2005-2009) – Federal Research Centres**

Centre	2005		2006		2007		2008		2009		TOTAL	
	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.	Num. Publ.	Av. Citat.
CRC	0	0.00	0	0.00	4	6.75	4	5.75	10	1.50	18	2.80
CSIRO	129	14.27	154	12.36	137	11.70	156	4.77	162	2.32	738	9.08
DSTO	26	2.27	30	1.73	29	3.72	48	1.27	21	0.76	154	1.95
SARDI	77	8.22	109	6.56	125	5.01	133	3.72	118	1.51	562	5.00

Source: Scopus Database (Authors' elaboration)

#### 4. Data on Patents according to Institution (2005-2009)

**Table 1: Data on Patents (2005-2009) – University of Adelaide**

University's Schools	FIELDS	2005	2006	2007	2008	2009	Total number of patents	European PO	IP Australia	US PTO
Australian Sc. of Petroleum	ENGINEERING, SCIENCE & RELATED						0			
Business School	HUMANITIES & SOCIAL SCIENCES						0			
Centre for Aut. Safety Research	ENGINEERING, SCIENCE & RELATED						0			
Elder Conserv. of Music	HUMANITIES & SOCIAL SCIENCES						0			
Entrepr., Commerc. and Inn. Centre	ENGINEERING, SCIENCE & RELATED						0			
Executive Ed. Unit	HUMANITIES & SOCIAL SCIENCES						0			
Law School	HUMANITIES & SOCIAL SCIENCES						0			
Med. Learning and Teach. Unit	HEALTH SCIENCES						0			
Sc. of Agr., Food and Wine	ENGINEERING, SCIENCE & RELATED	7	8	8	2	1	26	5	20	1
Sc. of Animal and Vet. Sciences	ENGINEERING, SCIENCE & RELATED		1	1	1		3		3	
Sc. of Arch, Lands. Arch. & Urban Design	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Chem. and Physics	ENGINEERING, SCIENCE & RELATED		6		2		8	3	5	
Sc. of Chem. Engineering	ENGINEERING, SCIENCE & RELATED						0			
Sc. of Civil, Envir. and Mining Eng.	ENGINEERING, SCIENCE & RELATED	1					1		1	
Sc. of Comp. Science	ENGINEERING, SCIENCE & RELATED			3	2		5	2	3	
Sc. of Dentistry	HEALTH SCIENCES						0			
Sc. of Earth and Envir. Sciences	ENGINEERING, SCIENCE & RELATED		2				2	2		
Sc. of Economics	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Education	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Electri. & Electro. Eng.	ENGINEERING, SCIENCE & RELATED			1			1			1
Sc. of History & Politics	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Math. Sciences	ENGINEERING, SCIENCE & RELATED						0			

Sc. of Mech.Engineering	ENGINEERING, SCIENCE & RELATED	1	2				3	1	1	1
Sc. of Med. Sciences	HEALTH SCIENCES	1		2	1		4	2	2	
Sc. of Medicine	HEALTH SCIENCES	2	2				4	2	2	
Sc. of Molec. and Biomed. Science	ENGINEERING, SCIENCE & RELATED	2	1	3	1		7	2	3	2
Sc. of Paediat.& Reprod. Health	HEALTH SCIENCES		6	3	1		10	4	6	
Sc. of Popul. Health&Clinical Practice	HEALTH SCIENCES						0			
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Social Sciences	HUMANITIES & SOCIAL SCIENCES						0			
<i>Unassigned patents</i>		13	11	12	10	6	52		52	
<b>University of Adelaide</b>		<b>27</b>	<b>39</b>	<b>33</b>	<b>20</b>	<b>7</b>	<b>126</b>	<b>23</b>	<b>98</b>	<b>5</b>

Source: European PO, IP Australia, USPO websites

**Table 2: Data on Patents (2005-2005) – Flinders University**

University's Schools	FIELDS	2005	2006	2007	2008	2009	Total number of patents	European PO	IP Australia	US PTO
Business School	HUMANITIES & SOCIAL SCIENCE						0			
Law School	HUMANITIES & SOCIAL SCIENCE						0			
Sc. English & Creative Writing	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Archaeology	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Australian Studies	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Bio. Sciences	ENGINEERING, SCIENCE & RELATED						0			
Sc. of Chem. Phys.& Earth Sciences	ENGINEERING, SCIENCE & RELATED						0			
Sc. of Comp. Science, Eng. and Math	ENGINEERING, SCIENCE & RELATED	1					1		1	
Sc. of Drama	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Education	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of English	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Humanities	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Int. Studies	HUMANITIES & SOCIAL SCIENCE						0			

Sc. of Language Studies	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Legal Studies	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Medicine	HEALTH SCIENCES	3	2	1			6	1	3	2
Sc. of Nursing and Midwifery	HEALTH SCIENCES						0			
Sc. of Philosophy	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Psychology	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Screen & Media	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Soc.& Policy Studies	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of the Environment	ENGINEERING, SCIENCE & RELATED						0			
Sc. of Theology	HUMANITIES & SOCIAL SCIENCE						0			
Sc. of Tourism	HUMANITIES & SOCIAL SCIENCE						0			
Science Edu. in the 21st Century	ENGINEERING, SCIENCE & RELATED						0			
<i>Unassigned patents</i>		1	1	2	1	1	6		5	1
<b>Flinders University</b>		<b>5</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>13</b>	<b>1</b>	<b>9</b>	<b>3</b>

Source: European PO, IP Australia, USPO websites

**Table 3: Data on Publications (2005-2009) – University of South Australia**

University's Schools	FIELDS	2005	2006	2007	2008	2009	Total number of patents	European PO	IP Australia	US PTO
Adv. Manuf. and Mech. Eng.	ENGINEERING, SCIENCES & RELATED	2	4	3	6		15	2	10	3
Centre for Reg. Engagement	HUMANITIES & SOCIAL SCIENCES						0			
David Unaipon College	HUMANITIES & SOCIAL SCIENCES						0			
Int. Graduate Sc. of Business	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Art, Arch. and Design	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Comm., Int. Stud and Languages	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Commerce	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Comp. and Inf. Science	ENGINEERING, SCIENCES & RELATED		2				2		2	
Sc. of Education	HUMANITIES & SOCIAL SCIENCES						0			

Sc. of Elect. and Inf. Eng.	ENGINEERING, SCIENCES & RELATED	9	5	5	10	9	38	6	26	6
Sc. of Health Sciences	HEALTH SCIENCES						0			
Sc. of Law	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Management	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Marketing	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Math. and Statistics	ENGINEERING, SCIENCES & RELATED						0			
Sc. of Nat. and Built Environ.	ENGINEERING, SCIENCES & RELATED	1	1	1	2		5		5	
Sc. of Nursing & Midwifery	HEALTH SCIENCES						0			
Sc. of Psych., Soc. Work & Soc. Policy	HUMANITIES & SOCIAL SCIENCES						0			
Sc. of Pharmacy & Med. Sciences	HEALTH SCIENCES	2	1			2	5		5	
Unassigned patents		3	5	2		4	14	1	12	1
<b>University of South Australia</b>		<b>17</b>	<b>18</b>	<b>11</b>	<b>18</b>	<b>15</b>	<b>79</b>	<b>9</b>	<b>60</b>	<b>10</b>

Source: European PO, IP Australia, USPO websites

**Table 4: Data on Patents (2005-2009) – Federal Research Centres**

Centres	2005	2006	2007	2008	2009	Total number of patents	European PO	IP Australia	US PTO
CSIRO	230	163	182	140	107	822	4	722	96
DSTO				1		1		1	
CRC	0	1	7	7	4	19	1	17	1
SARDI	0	0	0	0	0	0	0	0	0
<b>Public Research Centres</b>	<b>230</b>	<b>164</b>	<b>189</b>	<b>148</b>	<b>111</b>	<b>842</b>	<b>5</b>	<b>740</b>	<b>97</b>

Source: European PO, IP Australia, USPO websites



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- Australian Research Council: [www.arc.gov.au](http://www.arc.gov.au)
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Guide to R&D Tax Concession:

[www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Pages/GuidetotheRDTaxConcession.aspx](http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Pages/GuidetotheRDTaxConcession.aspx)

National Health and Medical Research Council: [www.nhmrc.gov.au](http://www.nhmrc.gov.au)

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