

BASIC DEFINITIONS AND CONVENTIONS

This section provides basic definitions and conventions relating to research and research management. These draw on international standards of practice and aim to develop a common understanding of research and research management-related terms as they pertain to higher education. Although none of these definitions are necessarily ‘cast in stone’, a more standard use and understanding of the key notions in research and research management will undoubtedly assist institutions in using this Guide. These definitions should be used to interpret the model for quality management of research described in Section 4 and to assess the effectiveness of quality management systems for research described in Section 5.

3.1. RESEARCH AND INNOVATION

According to the Oxford Dictionary, the term ‘research’ has French origins and appeared in the 16th century. It is rooted in the term ‘search’, invented in the 14th century and defined as ‘examine *thoroughly*’. Research meant an ‘act of searching *closely and carefully*’, or ‘intensive searching’. It was first applied to science in 1639 as ‘scientific inquiry’, but rarely used in that context before the end of the 19th century (Godin, 2001).

The OECD (Organisation for Economic Cooperation and Development) 2002 Manual (*Proposed Standard Practice for Surveys of Measurement of Research and Experimental Development*), known as the Frascati Manual, defines research as follows:

Research within higher education comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humankind, culture and society, and the use of this stock of knowledge to devise new applications. (OECD, 2002:29)

In countries like South Africa, research often has understanding social change as a specific focus and collective and individual development as a fundamental objective. A broad definition of research that is not narrowly scientific has to include all endeavours that add to society’s creative outputs, self-reflection and understanding.

The Frascati Manual further distinguishes between the following ‘types’ or ‘modes’ of research:

- Basic research
- Strategic research
- Applied research
- Experimental development.¹

3.1.1 Basic research

Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. The results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues (OECD, 2002:77).

3.1.2 Strategic research

Also known as oriented basic research, strategic research is research carried out with the expectation that it will produce a broad base of knowledge likely to form the background to the solution of recognised or expected current or future problems or offer possibilities for solving them (OECD, 2002:78).

3.1.3 Applied research

Applied research is also original investigation in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective. The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. The knowledge or information derived from applied research is often patented but may also be kept secret (OECD, 2002:78).

3.1.4 Experimental development

Experimental development is systematic work, drawing on existing knowledge gained from research and practical experience, that is directed to producing new materials, products and devices, installing new processes, systems and services, and substantially improving those already produced or installed. This category has little or no meaning for the humanities (OECD, 2002:79)

¹ These definitions can be applied equally to the Natural Sciences and Social Sciences and Humanities.

The following examples illustrate general differences between basic and applied research and experimental development in the natural sciences and engineering and in the social sciences:

A. Example from the natural sciences and engineering:

Studying a material's absorption of electromagnetic radiation to obtain information about its electron band structure is **basic research**. Studying this material's absorption of electromagnetic radiation under varying conditions (for instance, temperature, impurities, concentration, etc.) to discover its properties of radiation detection (sensitivity, rapidity, etc.) is **applied research**. Preparing a device using this material to obtain better detectors of radiation than those already existing is **experimental development** (OECD, 2002:79).

B. Example from the social sciences:

Analysing the environmental determinants of learning ability is **basic research**. Analysing the environmental determinants of learning ability for the purpose of evaluating education programmes designed to compensate for environmental handicaps is **applied research**. Developing means of determining which educational programme to use for particular classes of children is **experimental development** (OECD, 2002:80).

The Frascati definitions of basic and applied research are not the only accepted ones. Another influential approach to these distinctions is proposed by Donald Stokes in *Pasteur's Quadrant* (Stokes, 1997). Taking two key issues as his point of departure – the use of research and the basic quest for fundamental understanding – Stokes distinguishes between three categories: pure basic research, use-inspired basic research and pure applied research, as shown in this diagram:

		IS RESEARCH INSPIRED BY CONSIDERATIONS OF USE?	
		No	Yes
Is research inspired by a quest for fundamental understanding?	Yes	Pure basic research (Bohr)	Use-inspired basic research (Pasteur)
	No		Pure applied research (Edison)

The interesting addition that Stokes has made is to identify and emphasise 'use-inspired basic research' as a separate category of research.

3.1.5 Technological innovations

Technological innovations comprise new products, processes and social interventions and significant technological changes in these. An innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation) or used as part of an intervention for social development (social intervention). Innovations therefore involve a series of scientific, technological, organisational, financial and commercial activities which occur in, and are shaped by, social dynamics and contexts. This definition has been adapted from the OECD 1997 Manual, known as the Oslo Manual (OECD, 1997:20).

The Oslo Manual further distinguishes between technological **product** and **process** innovations:

A technological product innovation is the implementation/commercialisation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these. (OECD, 1997:24)

The Oslo Manual elaborates on each of these concepts:

A **technologically new product** is a product whose technological characteristics or intended uses differ significantly from those of previously produced products. Such innovations can involve radically new technologies, can be based on combining existing technologies in new uses, or can be derived from the use of new knowledge (OECD, 1997:138).

Examples: The first microprocessors and video cassette recorders were examples of technologically new products using radically new technologies. The first portable cassette player, which combines existing tape and mini-headphone techniques, was a technologically new product that combined existing technologies in a new use. (OECD, 1997:138)

A technologically improved product is an existing product whose performance has been significantly enhanced or upgraded. A simple product may be improved (in terms of better performance or lower cost) through the use of higher-performance components or materials, or a complex product which consists of a number of integrated technical subsystems may be improved by partial changes to one of the subsystems. (OECD, 1997:138)

Examples: The substitution of plastics for metals in kitchen equipment or furniture is an example of the use of higher performance components. The introduction of ABS braking or other subsystem improvements in cars is an example of partial changes to one of a number of integrated technical subsystems. (OECD, 1997:138)

Technological process innovation is the adoption of technologically new or significantly improved production methods, including methods of product delivery. These methods may involve changes in equipment, or production organisation, or a combination of these changes, and may be derived from the use of new knowledge. The methods may be intended to produce or deliver technologically new or improved products, which cannot be produced or delivered using conventional production methods, or essentially to increase the production or delivery efficiency of existing products (OECD, 1997:141).

Examples: The use of cellular phones to reroute drivers throughout the day allows clients greater flexibility in delivery destinations. Telephone banking allows clients to conduct many of their banking transactions from the comfort of their homes. (OECD, 1997:141)

3.2 POSTGRADUATE RESEARCH

Postgraduate research is research conducted for either a research master's or a doctoral degree. A 'research master's' degree is defined as any master's degree where an independent research thesis constitutes at least 50 percent of the credit for the degree.

According to the latest Higher Education Qualifications Framework under discussion (DoE, July 2004), master's and doctoral degrees occupy Levels 9 and 10 respectively of the National Qualifications Framework. **Appendix B** provides the level descriptors for levels 9 and 10. The level descriptors are the outermost layer of qualification specification and are broad qualitative statements against which more specific learning outcomes can be compared and located.

3.3 POSTGRADUATE SUPERVISION

To supervise literally means to 'oversee'. In the case of academic supervision, it means to oversee the successful completion of the postgraduate thesis. There is some consensus in the literature that the supervisory role implies a number of different responsibilities, giving the supervisor a variety of roles:

- To **advise** the student in the management of the postgraduate project (advisor);
- To **guide** the student through the research process (guide);
- To ensure that the required **academic quality** is achieved, so that the student's work will be of a fit standard to be awarded the degree (quality controller);
- To provide the required **emotional and psychological support** when needed (counsellor and mentor); and
- To ensure that all **administrative and logistical requirements** to obtain the qualification are met (administrator).

3.4 MANAGEMENT OF RESEARCH

While it is acknowledged that research should be protected as a creative and individualised pursuit within an institution, it is also important for an institution to ensure that the environment is conducive to this pursuit, i.e. there must be a true ‘research culture’.

Management of research includes all those activities and processes geared to creating an enabling environment for research to flourish, in an institution whose culture fosters imaginative, creative, innovative, high quality research. These activities and processes include research policy making, research planning, allocation of research resources (staff, funding, equipment), research support and development initiatives and the monitoring and evaluation of research quality.

3.5 RESEARCH FUNDING

The term ‘research funding’ covers all sources of funding for all types of research conducted by and within HEIs. It includes all forms of publicly funded research (agencies and government), donor-funded research (international and local donors), and publicly and privately contracted and consultancy types of research conducted by staff of the HEI.

3.6 RESEARCH SUPPORT AND DEVELOPMENT

Research support and development comprises specific activities or initiatives geared towards improving and enhancing research capacity, resources and outputs. This includes training postgraduate students and supervisors as well as supporting young and inexperienced researchers. In addition, research support and development initiatives should be particularly sensitive to overcoming the barriers black and women researchers faced in the past.

3.7 RESEARCH POLICIES AND PLANS

Research policies set out, in clear and precise language, the principles, rules, regulations and procedures that govern all aspects of research activities within the institution, and define the relevant relations with stakeholders and partners. The policies spell out a vision for research in the institution, including the identification of strategic areas and research priorities, and describe the mechanisms that will make it possible for this vision to be realised.

3.8 RESEARCH INFORMATION SYSTEM

A research information system is a computerised information system (electronic database)

that stores up to date and accurate information about the research and innovation activities, resources (research personnel, funding, equipment) and outputs of the HEI. Such a system should provide for easy retrieval of information and the production of appropriate research management reports that can support the planning, monitoring and implementation of the institution's research goals.

3.9 RESEARCH OUTPUTS

The term 'research outputs' is generally understood to mean the 'knowledge outputs' that result from academic or scientific research and which typically include new theories, models, empirical findings and data. These outputs are usually 'codified' in the form of journal articles, books, conference presentations and other forms of scientific or academic communication. The Department of Education in its *Policy and Procedures for Measurement of Research Output of Public Higher Education Institutions* defines research output as follows:

Research output is defined as textual output where research is understood as original, systematic investigation undertaken in order to gain new knowledge and understanding. Peer evaluation of the research is a fundamental prerequisite of all recognised output and is the mechanism of ensuring and thus enhancing quality. (DoE, 2003)

Appendix C provides a summary of the definitions of recognised research outputs (journals, books and proceedings) as listed in the Department of Education's *Policy and Procedures for Measurement of Research Output of Public Higher Education Institutions* (2003).

Within South African higher education, it has become standard practice to report on research outputs within the DoE's Classification of Educational Subject Matter (CESM) categories. **Appendix D** describes the CESM categories.

The definition of 'research output' can also be broadened to include other forms of knowledge outputs such as patents, artefacts, designs and other creative works.

3.9.1 Patents

Patents are documents, issued by a government office, that describe an invention and create a legal situation in which the patented invention can normally be exploited (made, used, sold, imported) only by or with the authorisation of the patentee. The protection of inventions is generally limited to 20 years from the filing date of the application for the grant of a patent (UNDP, 2001).

3.9.2 Artefacts, designs, creative works

These include non-textual outputs (images, performances, artefacts, designs) that result from original, systematic investigation undertaken in order to gain new knowledge and understanding and which lead to new or substantially improved insights.

3.10 RESEARCH ETHICS

Research ethics means the principles and practices that guide the ethical conduct of research. These should embody respect for the rights of others who are directly or indirectly affected by the research. The rights of others include rights of privacy and confidentiality, protection from harm, giving informed consent, access to information pre- and post-research and due acknowledgement. Ethical conduct in research also includes the avoidance of inflicting animal suffering of any kind and protection of the environment.

3.11 RESEARCH UTILISATION AND TECHNOLOGY TRANSFER²

The term ‘research utilisation’ can be understood either in a narrow or broad sense. In the narrow sense, it refers to the economic or commercial usefulness of research, i.e. how science is useful for economic growth or commercial aims. In the broad sense, it refers to any form of use that the results of scientific research are put to. So, in addition to economic or commercial usefulness, we can include social usefulness (use of research for society at large) and political usefulness (science in support of political decision making).

Technology transfer² is an important subcategory of the larger category set of knowledge transfer or activities and processes involving the use of knowledge. It can be defined thus:

Technology transfer is a principal avenue for the movement of research results from the University to private companies so that products can be developed and commercialized based upon this new knowledge. These results may take the form of inventions, discoveries, processes, techniques, devices, and substances, both physical and biological. (Stony Brook University website)

² The definitions of ‘technology transfer’ have been included here because of the growing demand placed on higher education institutions to measure research impact. However, from the definitions it is clear that measuring research utilisation and technology transfer is not a simple quantitative task. For further discussion and illustrations of how one can measure and evaluate these see the Carnegie study on Research Utilisation undertaken by CREST (www.sun.ac.za/crest/research/documentation-centre).

The following are some other definitions of technology transfer:

Technology transfer is the process by which research and other new technologies are transferred into useful processes, products, and programs. Another way of saying the same thing is: technology transfer is the process by which a better way of doing something is put into use as quickly as possible. (Hodgkins, 1989)

Technology transfer is a process by which existing technology is transferred or transformed to fulfil the user's needs. (Krull, 1990)

... all the activities leading to the appropriate adoption of a new product or procedure by any group of users. 'New' is used in a special sense as it means any improvement over existing technologies or processes, not necessarily a chronologically recent invention. [original emphasis] Technology transfer is not simply information dissemination; that is, it is not simply sending out information – whatever the form – and then passively awaiting its use. Technology transfer is a more active term. It implies interaction between technology sponsors and users and results in actual innovation. (Schmitt et al., 1985)