Open Access scholarly communication in South Africa: current status, significance, and the role for National Information Policy in the National System of Innovation

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously, in its entirety or in part, submitted it at any university for a degree.

Signature: …….. Date: ……..

Abstract

South African science shows a decline in its global competitiveness in that its scholarly publication rate has not kept pace with that of other countries, both developed and developing. This, together with a decline in publication rate especially among junior South African scholars, suggests a structural problem in the South African national system of innovation. A declining publication rate indicates a problem of knowledge diffusion for South Africa, and hints at a possible knowledge generation problem. This thesis limits itself to the dynamics of knowledge diffusion with specific reference to Open Access scholarly communication. Open Access scholarly communication is an overt intervention regarding knowledge diffusion. The marginalisation of science in and of developing countries, leading to a state of knowledge imperialism and knowledge dependence, is addressed, and it is argued that knowledge diffusion and generation are at the heart of long-term economic growth.

This thesis has been structured around two core sections, a theoretical framework based in the literature, and empirical study. The central concepts of scholarly communication and Open Access, national information policy (NIP), and national system of innovation (NSI) are elaborated upon in the theoretical framework (Chapters 2 and 3). The empirical part of this study (Chapters 4 and 5) in turn consist of two parts. Both parts used the survey method, however the first part made use of a questionnaire instrument, and the second part made use of a structured record review. Both empirical studies were used to assess levels of activity and extent of adoption of Open Access within a defined South African scholarly community, one discipline-based, the other institution-based.

The aims of this study were two-fold: to assess levels of awareness of and investment in Open Access modes of scholarly communication within defined scholarly communities; and to create a benchmark document of South Africa's involvement to date in various Open Access initiatives. The argument is made for the openness of scholarly systems, and furthermore that the disparate and uncoordinated nature of Open Access in South Africa needs a policy intervention. The policy intervention so identified would exist within an enabling policy environment and would be minimally disruptive to the South African science system. Said policy intervention would constitute a National Information Policy since it would address the storage, dissemination, and retrieval of scholarly research output.

This thesis recommends the amendment of the current statutory reporting mechanism - used by scholars to report and obtain publication rate subsidies – which would require that scholars make their research available via an Open Access mode of scholarly communication, and moreover, would require scholars to report on having done so.

Opsomming

Die wetenskap as praktyk in Suid-Afrika toon 'n afname in internasionale mededingendheid. Laasgenoemde is sigbaar in die tempo waarteen Suid-Afrikaanse vakpublikasies nie tred hou met dié van ander nasies nie, beide ontwikkelde en ontwikkelende lande. Hierdie afname, gepaardgaande met 'n afname in publikasiegetalle van veral junior navorsers, sou kon dui op 'n strukturele probleem in Suid-Afrika se nasionale innovasiestelsel. 'n Afname in die vakpublikasietempo dui daarop dat Suid Afrika 'n probleem het ten opsigte van die distribusie van kennis. Hierdie werkstuk is beperk tot die dinamiek van kennisdistribusie met spesifieke verwysing na 'Open Access' wetenskaplike kommunikasie. 'Open Access' wetenskaplike kommunikasie is 'n eksplisiete intervensie gemik op kennisdistribusie. Wetenskap binne en vanuit ontwikkelende lande word alhoemeer onbelangrik geag en kennis-imperialisme and kennis-afhanklikheid neem toe. Aan hierdie laasgenoemde aspekte word ook aandag geskenk. 'n Deel van die argument wat geopper word is dat kennisdistribusie en kennis-generering kern aspekte van lang-termyn ekonomiese groei is.

Hierdie werkstuk bestaan uit twee kern afdelings: 'n teoretiese raamwerk gebaseer op 'n literatuuroorsig, en 'n empiriese studie. Die sentrale konsepte van wetenskaplike kommunikasie en 'Open Access', nasionale inligtingsbeleid, en nasionale innovasiestelsels word beskryf in die teoretiese raamwerk (Hoofstukke 2 en 3). Die empiriese deel van hierdie studie (Hoofstukke 4 en 5) bestaan uit twee dele. Beide laasgenoemde dele maak gebruik van 'n opname as metodiek, maar die eerste deel het gebruik gemaak van 'n vraelys, en die tweede deel het gebruik gemaak van gestruktureerde studie van rekords (in die vorm van Webtuistes). Albei empiriese studies was gebruik om die vlak en mate van aktiwiteit rondom 'Open Access' binne 'n beperkte Suid-Afrikaanse wetenskaplike gemeenskap vas te stel. Hierdie gemeenskappe is gedefinieer óf volgens dissipline óf volgens instansie.

Die doel van hierdie werkstuk was veelvoudig: om die vlak van kennis van en betrokkenheid by 'Open Access' inisiatiewe vas te stel binne Suid-Afrika; sowel as om 'n basis-dokument te skep insake Suid-Afrika se betrokkenheid tot op hede by verskeie 'Open Access' inisiatiewe.

Die argument vir 'n oop wetenskaplike stelsel word gestel. Verder word geargumenteer dat die lukrake en ongekoördineerde manier waarop 'Open Access' tot dusver in Suid-Afrika bevorder is, daarop dui dat 'n intervensie op die vlak van beleid benodig word. Laasgenoemde beleid sou binne die bestaande beleidsomgewing geformuleer word, en sou relatief min ontwrigting meebring in die huidige Suid-Afrikaanse navorsingsopset. Die spesifieke beleid wat ter sprake is, is die nasionale inligtingsbeleid aangesien dit regulasies daarstel ten opsigte van die berging, distribusie, en herwinning van navorsingsuitsette.

Hierdie werkstuk stel voor 'n verandering van die huidige statutêre verslagdoeningsmeganisme – wat gebruik word deur wetenskaplikes om verslag te doen oor hul gepubliseerde navorsing om navorsingsubsidie te kry – wat sou vereis dat wetenskaplikes hul navorsingsuitsette beskikbaar stel via 'n 'Open Access' kanaal, en verder, dat navorsers verslag doen oor laasgenoemde.

Dedication

In memory of John M Richardson,
consummate educator and mentor,
who passed away prematurely 20 March 2003.
He believed in a 15 year old me
and gave me a chance at a better education in the then apartheid South Africa.

Acknowledgements

It has been a stellar year marked by my feeling for the very first time that I had become part of a scholarly community. This thesis stands on the shoulders of many giants. I would hope that it sets some benchmark for future studies on Open Access scholarly communication in South Africa, and that it marks an interstice (one of many, to be sure) of a long and fruitful process of the evolution of scholarly communication in South Africa.

Before thanking the persons who contributed in a concrete fashion to this thesis, with feedback, information, etc., I would firstly like to thank the two persons who contributed at an idea-level, as precursors, seven years ago, when I regarded myself more of a linguist than information scientist. They were the first persons with whom I had had online and offline conversations about the serials crisis, pre-prints, and ETDs (in effect conversations around 'Open Access', but the term had not been coined yet, then). Herbert Van de Sompel (BE + USA), good friend and colleague, I thank for listening, and for being there. Ann Okerson (USA) I thank for her different perspective which always makes me reconsider my position on a matter.

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[1] Semler, R. 2003. *The seven-day weekend*. London: Century (Random House imprint).

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Cape Town and Paarl, South Africa --- 10 January 2005

Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

ACM	Association for Computing Machinery
ACP	Advanced Cyberinfrastructure (sic) Program (USA)
AGORA	Access to Global Online Research in Agriculture
AJOL	African Journals Online
ALPSP	Association of Learned and Professional Society Publishers
ARL	Association of Research Libraries (USA)
BOAI	Budapest Open Access Initiative
CNRS	*Centre National de la Recherche Scientifique* (France)
CODATA	Committee on Data for Science and Technology
COMTASK	Task Group on Government Communications (South Africa)
CoRR	Computing Research Repository
CSSA	Computer Society of South Africa (South Africa)
DACST	Department of Arts, Culture, Science, and Technology (South Africa)
DARE	Dutch Academic Repository (Netherlands)
DISA	Digital Imaging South Africa (South African digital library)
DLIST	Digital Library of Information Science and Technology
DOAJ	Directory of Open Access Journals
DOC	Department of Communications (South Africa)
DoE	Department of Education (South Africa)
DoIS	Documents in Information Science
DST	Department of Science and Technology (South Africa)
E-LIS	E-prints in Library and Information Science
ETD	Electronic Theses and Dissertations
ESF	European Science Foundation (EU)
FAIR	Focus on Access to Information Resources (UK)
FEST	Foundation for Education, Science, and Technology (South Africa)
HEMIS	Higher Education Management Information System (South Africa)
HINARI	Health Inter-Network Access to Research Initiative
IBA	Independent Broadcasting Authority (South Africa)
IBSS	International Bibliography of the Social Sciences

ICASA	Independent Communications Authority of South Africa (formerly SATRA)
ICSTI	International Council for Scientific and Technical Information
ICSU	International Council for Science
ICT	Information and Communications Technology
IFLA	International Federation of Library Associations
IMF	International Monetary Fund
INASP	International Network for the Availability of Scientific Publications
IR	Institutional Repository
ISAD	Information Society and Development
ISI	Institute for Scientific Information
IT	Information Technology
JISC	Joint Information Systems Committee (UK)
LAN	Local Area Network
LIASA	Library and Information Association of South Africa
LIS	Library and Information Services
LSSA	Linguistic Society of Southern Africa
MPTB	Ministry of Posts, Telecommunications and Broadcasting (South Africa)
MPG	*Max Planck Gesellschaft* (Germany)
MRC	Medical Research Council (South Africa)
NACI	National Advisory Council on Innovation (South Africa)
NACLIS	National Council for Library and Information Services (South Africa)
NDLTD	Networked Digital Library of Theses and Dissertations
NDS	Novell Directory Service
NEPAD	New Partnership for Africa's Development (African continent)
NIF	National Innovation Fund (South Africa)
NIP	National Information Policy
NITF	National Information Technology Forum (South Africa)
NRF	National Research Foundation (South Africa)
NSF	National Science Foundation (USA)
NCSTRL	Networked Computer Science Technical Report Library
NSI	National System of Innovation

OAI	Open Archives Initiative
OAI-PMH	OAI Protocol for Metadata Harvesting
OECD	Organisation for Economic Co-operation and Development
OPD	Official Publications Depository (South Africa)
OSI	Open Society Institute
PERI	Programme for the Enhancement of Research Information
PKP	Public Knowledge Project
PLoS	Public Library of Science
PNC on ISAD	Presidential National Commission on the Information Society and Development
PRC	Presidential Review Commission (South Africa)
RAE	Research Assessment Exercise (UK)
RePEc	Research Papers in Economics
RcLIS	Research in computing and Library & Information Science
S&T	Science and Technology
SAALA	South African Applied Linguists Association
SACLA	South African Computer Lecturers' Association
SAICSIT	South African Institute for Computer Scientists and Information Technologists (South Africa)
SAITIS	South African Information Technology Industry Strategy Project
SAPSE	South African Post Secondary Education (South Africa)
SATRA	South African Telecommunications Regulatory Authority
SciELO	Scientific Electronic Library Online (Latin America)
SETA	Sector Education Training Authority (South Africa)
SHERPA	Securing a Hybrid Environment for Research, Preservation and Access (UK)
SPARC	Scholarly Publishing and Academic Resources Coalition (USA and Europe)
SPII	Support Programme for Industrial Innovation (South Africa)
STM	Scientific, Technical, and Medical
TENET	Tertiary Education Network (South Africa)
THRIP	Technology and Human Resources for Industry Programme (South Africa)
UNESCO	United Nations Educational, Scientific and Cultural Organisation

USA	Universal Service Agency (South Africa)
USPTO	United States Patent and Trademark Office (United States)
WSIS	World Summit on the Information Society

Section 1: Theoretical framework

Chapter 1

Introduction

South Africa has a declining scholarly publication rate when compared to other countries, both developed and developing. This may well be taken as an indicator of a declining global competitiveness of South African science as a whole, and hence a structural problem in the national system of innovation. A declining publication rate suggests a problem of knowledge diffusion for South Africa, and hints at a possible knowledge generation problem. This thesis is limited to the dynamics of knowledge diffusion with specific reference to Open Access scholarly communication. Open Access scholarly communication is an overt intervention regarding knowledge diffusion, with increased knowledge generation seen as a longer-term positive consequence. Where policy, and more particularly national information policy[2], is geared to guiding i.a. the development trajectory of a national system of innovation, the argument is made that national information policy - in the form of an Open Access mandate[3] - is required to encourage knowledge diffusion in South Africa and so stimulate the national system of innovation.

Writing about Open Access scholarly communication is akin to trying to track a fast-moving target, in that in this period of flux and transition, sentiments around Open Access veer between extremes of boldness and uncertainty. As with all scholarly endeavour, the challenge is to sort truth from fiction, hype from reality. Current discourse around changes in scholarly communication and scholarly publication may be better interpreted if placed within a context as described by the historian Louis Menand (2002: x):

> The critical massing of conditions that enables a particular way of life to come into being is almost impossible to detect while it is happening, and so is its deterioration. The world just rolls over, without anyone noticing exactly when, and a new set of circumstances is put in place. But the impulse to hold on to the past is very strong, and it is often hard to understand why things that worked once can't continue to work. A lot of energy and imagination are consumed trying to fit

[2] See the Definition of 'National Information Policy' used in this thesis.
[3] 'Mandate' here signifying a policy directive which requires engaging in Open Access forms of knowledge dissemination.

> old systems to new settings, though the pegs keep getting squarer and the holes keep getting rounder.

And so it seems with the adoption of Open Access scholarly communication in light of the ways scholarly communication expressed itself in the pre-Internet era. It is undeniable that the Internet and World Wide Web have wrought many changes, for life beyond scholarly communication, as well as for the process of scholarly communication. Our ways of work and communicating have been and are changing. The latter is an assumption which infuses this entire thesis. The Internet and World Wide Web (as well as other Information and communication technologies, such as wireless) are our new set of circumstances, and I imagine that our scholarly world is indeed rolling over, without our noticing exactly when. This thesis attempts to document an important aspect of this roll over within South Africa, and ponders the consequences for national information policy and the national system of innovation.

Knowledge generation and diffusion is at the heart of long-term economic growth. Scholarly communication, and more specifically scholarly publication[4], is an important manifestation of knowledge generation and diffusion. The commonly held reasoning behind Open Access scholarly communication is that greater access to the research literature, in effect greater knowledge diffusion, will lead to the advancement of science, and will be especially advantageous for developing countries, since developing country science continues to be marginalised due to prohibitive pricing of scholarly literature. The argument against the current reader-pays subscription-based publication model is that it in essence stifles knowledge diffusion due to prohibitive journal pricing. The knock-on effect of constrained knowledge diffusion is constrained knowledge generation, for how can one contribute to the literary canon and the advancement of a domain, if one cannot afford access to, and remain abreast of, the knowledge which has already been generated.

In effect, the aims with this thesis are two-fold: to assess awareness and levels of investment in Open Access modes of information dissemination, and to create a benchmark document of South Africa's current involvement in various Open Access initiatives. The first aim is overwhelmingly the crux of this thesis and is dealt with in the

[4] Scholarly publication refers to the published research output of the higher education sector as well as that of government and science councils. Though admittedly those within business (e.g. big pharmaceutical companies) also publish, it is the case that this thesis' remit is scholarly publication by the public sector.

document body. The second aim is done to agglomerate disparate initiatives into one document and to add them to the scholarly record, mostly in the form of the Appendices, but also interwoven throughout the thesis. Most certainly, some initiatives - such as Digital Imaging South Africa (DISA)[5] - have already been thoroughly documented, whereas others - such as the case of the arXiv mirror site in South Africa; or the number of institutions in South Africa with an institutional repository as at a certain date - may not have been. Creating such a benchmark document is driven, not by some misguided sense of self-importance, but rather the perceived need for a comprehensive scholarly record on Open Access scholarship in South Africa.

What follows is an elaboration on the thesis argument structure, followed by a brief definition of key terms, and thereafter, an explanation of the background to this study. All three of these sections below inform the structure, language, and reasoning of the remainder of this thesis.

Thesis argument structure

The thesis argument structure informs the logic and flow of the arguments presented here to support the main claim, namely, that Open Access scholarly communication in South Africa requires mandating through national information policy, which in turn will stimulate the national system of innovation. Descriptions of the main sections of this thesis, along with its hypotheses, are described below.

This thesis has been structured around two core sections, a theoretical framework based in the literature, and an empirical study. The theoretical framework (Chapters 2 and 3) elaborates upon the central concepts of scholarly communication and Open Access, national information policy (NIP), and national system of innovation (NSI). The empirical part of this study (Chapters 4 and 5) in turn consists of two parts. Both parts use the survey method, however the first part makes use of a questionnaire instrument, and the second part makes use of a structured record review. The questionnaire-based survey assesses national levels of awareness of international Open Access initiatives and repositories, and assesses levels of activity and the extent of adoption of Open Access scholarly communication practices. The scholarly community surveyed with the

[5] For which see Peters, D and Pickover, M. 2001. DISA Insights of an African Model for Digital Library Development. *D-Lib Magazine*. Nov 2001 Vol 7 no 11 (online) Available http://www.dlib.org/dlib/november01/peters/11peters.html

questionnaire-based instrument is based on discipline or research domain. As such, scholars and researchers within the Library-, Information-, Computer Sciences, and Information Systems disciplines are studied.

The structured record review assesses levels of activity and extent of adoption of Open Access in a scholarly community defined according to their institutional affiliation, in this instance, Stellenbosch University. As such, scholars and researchers across a range of disciplines within an institutional context, are studied.

The central questions posed in this thesis are:

Q1: Since Open Access scholarly communication finds expression through four core activities[6], do authors and researchers in South Africa engage in these four core activities, and hence engage unwittingly in Open Access scholarly communication?;

Q2: Does Open Access scholarly communication in South Africa require facilitation through national information policy instruments?;

Q3: Would such national information policy instruments have consequences for a national system of innovation?

Chapter 4 (Method) details the quantitative and qualitative parts of this study; which is then taken further by a discussion of the results in Chapter 5 (Results). Chapter 6 (Discussion and Conclusion) attempts to bring all of the strands from Chapters 1 to 5 together, drawing attention to the limits of the study, thereafter highlighting likely areas for further research, and ends in the conclusion for this thesis.

The argument structure creates a skeletal framework, fleshed out with the use of central concepts and terms. These central concepts and terms are briefly defined in the next section.

[6] These being publication in open access scholarly journals; distribution of research via institutional and/or disciplinary repositories; scholars making their research available via personal Web homepages; making the research output of postgraduates available via Electronic Theses and Dissertations repositories.

Definition of key terms

The purpose of this section is to provide the reader with a brief overview of key concepts used throughout this thesis. More detailed elaborations of these definitions are to be found in their associated chapters below.

Scholar

I will use the term scholar as defined by De Beer (2003: 119), who says that a scholar is:

> [A] person devoted to learning or fond of learning, or a learned person, a person with much knowledge, usually of a particular subject and of the links of any particular subject to other subjects, and especially one who gives careful attention to evidence, method, and good and sound argumentation, reasoning and thinking in a careful, disciplined and independent way.

I will extend De Beer's definition to incorporate the terms 'researcher' and 'academic'. Of course, not all academics are researchers, nor are all researchers, academics. It is notable that De Beer's use of 'scholar' is broad enough so that it can be equally applied to our notions of 'researcher' as well as 'teacher' or 'academic'.

Science

Except where the contrary is noted, I use the term "science" to refer to scholarly activities in the natural- as well as social sciences and humanities, in line with Cronin's (1984: 1) definition.[7]

Scholarly communication

Scholarly communication finds formal expression through journal and monograph publication, though it is not limited to the act of publication. The social processes which are associated with research and publication, such as informal communication (via telephone, traditional mail, e-mail, wikis, blogs), attendance at conferences, and formal peer-review are all forms of scholarly communication. A strong argument can be made for viewing teaching as an expression of scholarly communication, since the learning

[7] "…shorthand for the formalized and institutionalized process of systematic investigation, knowledge creation and research dissemination, both in relation to the natural ('hard') sciences and the social ('soft') sciences…[incorporating] :basic and applied; theoretical and problem-solving; academic and techno-commercial [research]" Cronin (1984: 1)

environment is the one in which the next generation of scholars are sensitised to the research domain. Taking the latter argument further, Fuller (2002: 217) makes reference to the role of "curriculum design" which prepares "…the conditions for the wider reception of the innovative and often controversial research done by the faculty." Fig. 1 below illustrates the various ways in which scholarship finds expression.

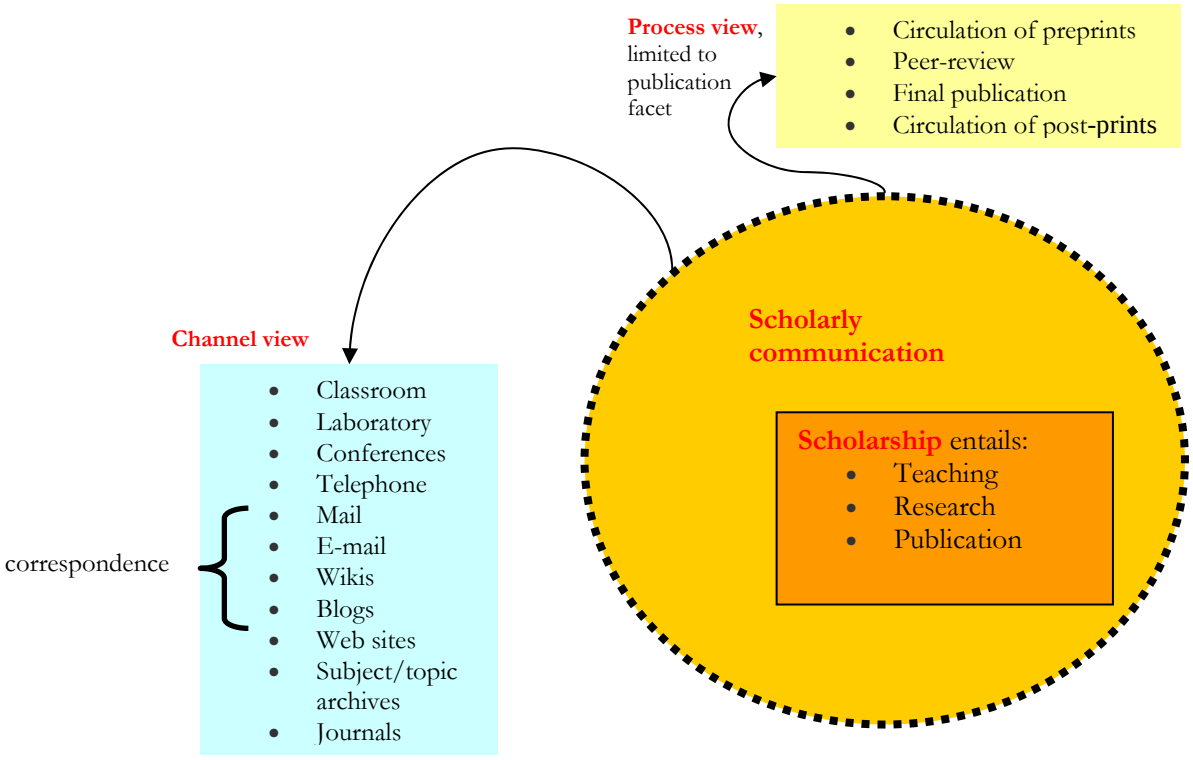

Fig. 1 Expressions/manifestations of scholarship

Open Access scholarly communication

Numerous definitions of Open Access scholarly communication may be found; the central tenet being that the reader does not pay for access to the research, and rather that the author may or may not pay for the 'making available' of such research. The key concept here is access; that research output is not expensive (i.e.. there is a minimal fiscal barrier) and that research output is accessible (i.e. access to the material is not restricted in terms of physical infrastructure nor restricted by authentication systems).

The Budapest Open Access Initiative, launched in February 2002 and spearheaded by the Soros Foundation's Open Society Institute, uses the following definition of Open Access:

> The literature that should be freely accessible online is that which scholars give to the world without expectation of payment. Primarily, this category encompasses their peer-reviewed journal articles, but it also includes any unreviewed preprints that they might wish to put online for comment or to alert colleagues to important research findings. There are many degrees and kinds of wider and easier access to this literature. By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited (Budapest Open Access Initiative, 2002).

The Budapest Declaration (BOAI) acknowledges that the literature referred to in their definition is not free to produce, but they add that "…experiments show that the overall costs of providing open access to this literature are far lower than the costs of traditional forms of dissemination."

I have cited a lengthy section of the BOAI definition since it makes the important reference to the non-proprietary ethos of scholarship, which I refer to later in discussions on the Republic of Science, and which seems to be the ethos underlying scholarly publication by the researchers surveyed by the questionnaire in this study. Secondly, the BOAI chooses to express itself on the role of copyright. The latter is briefly dealt with in the section titled 'Information regulation: the information commons' below. Furthermore, questionnaire respondents were surveyed on their behaviour regarding the cession of copyright when publishing, as well as what they thought publishers should allow with respect to self-archiving.

I find the need to amend the BOAI definition to accommodate a developing country context, where access to ICT infrastructure can be unreliable; or generally there exists a very pressing need; or access to such infrastructure is frequently expensive. Moreover, page fees (as per the traditional subscription-based model of publication) and article-processing

fees (as per the author-pays publication model used by some Open Access publishers) can be prohibitive to developing country researchers.

Hence, Open Access I define as the low-barrier diffusion of scholarly research. The term 'low-barrier' is usually used in the context of technology implemented to facilitate Open Access, and usually refers to software which can be easily implemented. I use the term 'low-barrier' solely in an economic sense so as to incorporate the notion that networked resources are not consistently nor absolutely free (the reader and scholarly author may incur cost by gaining access to a network connection; the scholarly author may incur cost through publication- or article processing fees). It should be recognised that the latter can be significant hurdles for scholars in countries which have low Internet and computer penetration, or scholars in counties subject to non-competitive monetary exchange rates; and that combinations of these circumstances are most likely to be found in developing countries.

Furthermore, I would like to emphasise with my definition the distribution of research, rather than publication, since Open Access can find expression through formal publication, as well as through the mere act of making research output available in a rather informal and decentralised manner.

Open Access itself thus finds expression primarily through four avenues:

1. Publication in Open Access journals;
2. Making research available in an institutional or disciplinary (a.k.a. subject-based or topic) digital archive/repository;
3. Making research available via Departmental or Personal homepages;
4. Making the research output of postgraduates available via Electronic Theses and Dissertations (ETD) digital repositories.

The options 1 through 4 above are ranked for ease of reference, rather than order of preference. It should be stated though that the options do differ in level of formality, where research publication (Option 1), whether peer-reviewed or not, is more formal than research dissemination (Options 2 - 4). Additionally, since many opponents of Open Access tend to conflate research dissemination with self-publication, I would like to emphasise that research 'dissemination' is not tantamount to 'self-publication'. Another

point of note is that in all of these instances of Open Access delineated above, the use of networked technologies is implied, if not stated.

Document types and repository types

During the publication process various document types can be found, these being 'pre-print', 'post-print', and 'e-print'. As indicated by Kling (2004: 598), the term 'pre-print' is sometimes confusingly used to refer to all unrefereed or draft versions of articles or manuscripts, regardless of whether they are destined for formal publication. He makes a strong case to restrict the use of the term 'pre-print' to only those articles which have been submitted for formal publication. Kling (2004: 600) defines the term 'pre-print' as referring to "…articles that have been accepted for a specific (publication) venue."[8]

The definition of 'pre-print' is not trivial, as the term forms the divide between the two most prominent ideologies when discussing Open Access. One school of thought proposes as a way forward that the journal publication model be overhauled. A second school of thought recommends that 'pre-prints' be made available freely by their authors via personal, departmental, or institutional repositories. Van de Sompel et al (2004) refer to these two main schools of thought as the "journal-reform school", and the "self-archiving school", respectively.

Cognisant of, though not wholly copying, Kling (2004: 598 - 600), the following definitions for document and repository types have been used in this study: These document and repository type definitions were also used as part of the questionnaire instrument; as preamble to the detailed questions. This was done so as to avoid confusion between 'pre-prints' and other forms of draft document surveyed.

- pre-print - version of an article which has been submitted for official publication, yet not yet accepted for publication;
- post-print – peer-reviewed version of article, accepted for publication and yet-to-be published, or already published;
- e-print – electronic version of a pre-print or post-print;

[8] The terms 'pre-print' and 'post-print' should be seen in context of the print publication paradigm. A pre-print is the pre-publication version of an article, the post-print in turn is the version of the article as it is to appear in the journal. Since both terms (pre-print and post-print) predate the advent of electronic publishing, the term 'e-print' was coined to refer to electronic versions of either of these two types of document.

- institutional repositories – a central storage server for the management and dissemination of digital research (and sometimes teaching-) materials created by the institution and its research staff, excluding Masters theses and Doctoral dissertations;
- ETDs – Acronym for Electronic Theses and Dissertations, signifying a central storage server for the management and dissemination of postgraduate digital research materials created by the institution's Masters and Doctoral students;
- Open access journal – journal which makes research articles freely available online immediately upon publication, or makes articles available for free six months after the original publication date.

National Information Policy

Rowlands (1996: 14), quoting Weingarten, defines information policy as "…the set of all public laws, regulations, and policies that encourage, discourage, or regulate the creation, use, storage, and communication of information." I use this definition of 'information policy'. I use the term 'information policy' to designate public policy which incorporates information-, science and technology-, as well as innovation policy, noting Rowlands' (1996:14) observation that these terms are often used synonymously. National information policy refers to those policies instituted by the State rather than firms or organisations.

National System of Innovation

After Galli and Teubal (1997: 343) 'national system of innovation' (NSI) is defined "…as the set of organizations, institutions, and linkages for the generation, diffusion, and application of scientific and technological knowledge operating in a specific country." The use of the term 'national system of innovation' has informed much of the Science and Technology policy dialogue in South Africa.

Core concepts as described above, much like the thesis argument structure, form the foundation of this research document. These structural elements however, are grounded in the varied reasons which prompted me to undertake this study in the first place. The background to this study is described in the next section.

Background to the study

Unlike the short-term aims and research questions explicated above, the background to the study attests to my long-established interest in the effects of the use of networked technologies on scholarly communication. It is evident that the research topic arose out of

genuine curiosity around, as well as personal experience in, the various facets of scholarly communication.

At an idea level, the genesis of this thesis dates back to my very early experiences of the Internet. I had obtained access to the Internet ca. 1997, and had marvelled at its diffuseness and its nature of just-in-time information access. An undergraduate Linguistics student at the time, I witnessed how the Web had transformed the way scholars in Linguistics organized themselves, with their using the Web and e-mail to provide information on the latest publications, job postings, and forthcoming conferences in Linguistics via fora such as LinguistList. Another discussion forum which piqued my curiosity was that of the Humanities Computing fraternity, which to the uninitiated, is a forum for those who use Computers within the Humanities, for example, for text encoding and analysis. In fact, in retrospect, I realise that these were the first E-mail discussion lists I had subscribed to.

Later, in 1999, the Linguistics Society of Southern Africa (LSSA) was informed that the government funding for publication of the *South African Journal of Linguistics* would be discontinued. Given my work in the library milieu, more specifically library automation, at the time, I was fully aware that such losses of funding and questions around the continued viability of scholarly journals published by small scholarly societies was not an isolated incident characteristic of a small discipline and research community, but was rather a problem which had beset a number of research communities in more recent times. As such, at the time I set out to establish whether adopting an electronic-only version of the journal would be feasible. Given the limited resources of the society, I advised that they lacked the necessary human and capital resources to embark on an e-journal path (De Beer, 2000). It was the case however that 18 months later the LSSA had merged their journal publication activities with that of the South African Applied Linguists Association (SAALA) and together they established a new journal, an amalgam of the two Linguistics journals which had gone before. As such simultaneous print and electronic publication became feasible and was effected. At the same time, it became quite natural for me to extend my experiences in Linguistics to other disciplines, and to ponder the ways in which this 'new model scholarship' found expression in other scholarly domains. Of course, I soon noticed that others, most notably librarians, and a few early-adopter type of scholars, were pondering similar questions.

Much later, in 2002, whilst employed as Web Server Administrator by the Information Technology Division of Stellenbosch University, I conceptualized and launched the Information Infrastructure Initiative, an affordable Web hosting facility for scholars and scholarly societies who were not directly affiliated with Stellenbosch University. There were a few enthusiastic responses from the scholarly community, but overall the response was middling.

In a certain sense, my experiences up until and including 2002 had gone the entire trajectory in that I had had exposure to various facets of the use of new technologies in scholarship. Having thus informally monitored the, what seems to be, scholarly (r)evolution since ~1997, the issue uppermost in my mind was the seeming lack of engagement in these new models of scholarship within South Africa. With a growing sense of frustration, firstly, due to the middling local interest in the 'Information Infrastructure Initiative' at Stellenbosch, and secondly, having heard from many that our current journal publication reward system[9] was the primary reason why we in South Africa could not 'go Open Access', I set out to discover, in a formal manner, what in fact scholars were doing with regard to Open Access. The empirical study within this thesis should serve as possible indicator of current scholarly practice. The limitations of the study notwithstanding, I think the responses and conclusions are illuminating.

Another facet of this thesis was initiated upon my reading about a study by Johann Mouton of the Centre for Research on Science and Technology, Stellenbosch University. One of his main conclusions, and the one most striking to me, was that the publication rate of young researchers in South Africa showed a marked decline, and that this worrying trend tends to indicate a structural problem in South Africa's national system of innovation (Boshoff and Mouton, 2003: 231). The question which arose in my mind was whether Open Access might alleviate this structural problem of low publication rate for young researchers within the national system of innovation. Another question which I pondered was whether national information policy was a likely bridge between Open Access and an ailing national system of innovation. In effect, if one set out to improve a system of innovation at a national level, it seemed logical to implement policy instruments at a national level also.

[9] Referred to as the SAPSE system; a comprehensive treatment of which is provided in Chapter 2: Scholarship and scholarly communication in South Africa.

In this thesis it will be shown that scholarly communication is at the core of a national system of innovation, and that Open Access scholarly communication can foster an improved and more vibrant national system of innovation. Furthermore, it will be argued that for a country with a small research community such as South Africa, it would be best to foster Open Access in a more coordinated way, and to rather have national information policy instruments which promote Open Access research diffusion. When viewed in a global context, South Africa is a small research community with relatively few research outputs (measured through publication rate and patenting rate). However, when viewed within an African context, South Africa is an intellectual powerhouse. That said, it can be argued that whatever argument pertains to South Africa regarding facilitating Open Access through national information policy, the same can be said for other countries on the African continent, which have even smaller research communities and even fewer numbers of research outputs than that found in South Africa.

This chapter, through its delineation of the research problem; its description of the structure through which the research problem is addressed, as well as the description of the wider context which prompted the initiation of this study, forms the framework for the remainder of this thesis. Scholarship and scholarly communication, and the advent of Open Access, is described in the Chapter which follows.

Chapter 2
Scholarly communication and Open Access

Beginning with a brief historical overview of scholarly communication, I go on to describe various theories and definitions of the Information Society. Theories of the Information Society provide a framework for understanding fundamental changes in scholarly communication, with these changes having gained momentum in the latter half of the 20th century. Open Access is elaborated upon as one current model of these aforesaid changes in scholarly communication. Open Access is a very real expression of a shift in emphasis in the developed world from network infrastructure roll-out, characteristic of early discourse on the Information/Knowledge Society, to an emphasis on content and services, or rather applications on and use of the network. The case of scholarly communication in developing countries is then described, which creates the context for a description, in the section thereafter, of scholarship in South Africa.

The origins of scholarly communication

Scholarly publication has its roots in the need for communication between scientists. Prior to the invention of the printing press, scientists communicated via the exchange of letters and via public debates akin to latter-day conferences. Of course, with the development of the printing press in the mid-1400's, the accessibility of fiction and non-fiction texts to the greater public was revolutionized (Alcorn, 1997:32). Dewar (2000) argues that scientific data collection was born with printing, as for the first time scientists were able to compare texts, rather than be limited to comparing verbal accounts about their predecessors and by their contemporaries. In fact, Dewar (2000) indicates further that the Scientific Revolution dates back to 1543 when Copernicus published *De Revolutionibus Orbium Coelestium*, a comparative analysis which was his response to the work of Ptolemy, Aristotle, and others.

About a century later, around 1640, members of The Invisible College, later renamed the Royal Society, gathered regularly for scholarly debate at the University of Oxford. Scholarly journals became a reality ca. 1665 with the establishment of the *Philosophical Transactions of the Royal Society of London* in England, and the *Journal des sçavans* in France. Dewar (2000) quoting Rosaldo, indicates that "...roughly during the first century after Gutenberg's invention, print did as much to perpetuate blatant errors as it did to spread enlightened

truth…. And never before had things been so confusing". The latter confusion seems to characterise the digital revolution also, as echoed by Lanier (1996: 170) when he says that:

> There will be so many channels to get it [factual information] from that some channels will have false information. Being able to provide people with a basis for believing in what they get over the network will become important. ... People will pay to know what is real.

The confusion which beset the scientific revolution seems all too similar to the confusion and concerns raised with the digital revolution. More specifically, Lanier's view points to current concerns around the authenticity and credibility of information found online. Open Access scholarly communication, when it expresses itself through the ease with which authors can post unrefereed articles online, has been criticised by some in that they claim that the works of scientists on the fringes of society and/or of questionable repute, are equally accessible in an Open Access model of scholarly communication. Proponents of Open Access however, tend to emphasise that calling for a move to Open Access scholarly communication does not automatically entail the discarding of peer-review and other quality control mechanisms (Suber, 2004).

Scholarly communication in the form of letters and conferences started so that scientists may enter into debate regarding their work. As with the advent of the printing press, the advent of the Internet has led to an information explosion, with readers and scholars grappling to come to terms with issues around the authenticity and credibility of information. The following section elaborates upon the concept 'Information Society', which in turn impacts the rather recent changes in scholarly communication.

Information Society as backdrop to changes in scholarly communication

Theories around the Information Society (which can also be referred to as the Knowledge Society, and which for the purposes of this thesis are terms I conflate) inform our understanding of the changes in scholarly communication in recent times. It is evident that there has been a shift away from infrastructure to application, content and services in the developed world when discussing the 'Information Society'. With infrastructure still of very real concern to those in the developing world, the question is whether they too have made a shift to a focus on application, content and services for existing networks.

World War II, and more so the events leading up to and following the launching of the Sputnik spacecraft in 1957, ushered in a new dawn of scientific research endeavour (Lynch, 2000: 62). The latter contributed to the revolution in information and communications technologies (ICT), and the establishment of what some have come to call the information society, a society dominated primarily by the production, transmission, and use of information.

Webster (2002: 23) disputes the notion that a society which has more information is therefore an information society. He argues rather that we have an information society "…not to the fact of there being more information, but to changes in the ways in which life now is conducted because of information." Numerous authors use the term 'information society' as a fait accompli and so do not provide a definition. Then there are other authors such as Webster (2002) and Van Audenhove (2003a) who attempt to firstly summarise the definitions used to date, and then secondly attempt to arrive at some own definition of the term. Webster (2002: 23) summarises the many and varied 'information society' definitions as centring on the measurement of five phenomena. Table 1 below summarises Webster's assessment, providing in the left hand column a list of the five phenomena with their characteristics in brief, and in the right hand column, associated noted authors for each school of thought.

Table 1 Information Society definitions, characteristics, and their associated authors

Phenomena	Associated noted authors
Technological innovation and diffusion (development and spread of ICT infrastructure entails a different form of social organisation)	Alvin Toffler, Bill Gates, Nicholas Negroponte, Michael Dertouzos;
Occupational change (the majority of society performs information work cf. manual or industrial labour)	Daniel Bell, Charles Leadbetter, Robert Reich, Peter Drucker, Manuel Castells.
Economic value (when gross national product consists largely of information products and services, and information work has better or increasing economic value, an information economy comes into being)	Fritz Machlup, Marc Porat, Charles Jonscher.
Information flows (establishment of information networks across great geographic areas influences conception of time and space)	Manuel Castells, Albert-László Barabási[10]
The expansion of symbols and signs (contemporary culture suffused with information e.g. 24 hour news, cellphones, computer games, and general media saturation)	Mark Poster

Source: After Webster, 2002: 22 – 26.

The focus on ICT infrastructure seems to be characteristic of information society initiatives at the end of the 20th century. Tuomi (2001) identifies three waves of the knowledge society (he uses the terms 'information society' and 'knowledge society' interchangeably), where the first two waves are infrastructure-centric. The first wave is characterised by claims of an ICT revolution (1970 – 1990) and a focus on network infrastructure and deregulation. The second wave, launched by the work of Al Gore in promoting a National Information Infrastructure (ca. 1992) in the United States, focused on the digital divide, and aspects such as "...competitiveness, economic growth, access, regulation, privacy, security, and intellectual property rights" (Tuomi, 2001:8). The third wave Tuomi (2001:8) refers to is

[10] The reference to Barabási is my own, and does not appear in Webster's (2002) text. For the interested reader: Barabási, A. 2003. *Linked: how everything is connected to everything else and what it means for business, science and everyday life*. Cambridge, Massachusetts: Plume.

characterised by the complementary development of technology policies and social policies, which together have complementary objectives.

The latter focus on infrastructure characterised the establishment a decade later of the Presidential National Commission on Information Society and Development (PNC on ISAD) in South Africa in 2001, so as to "…advise government on the optimal use of ICTs to accelerate the development of an information society. The result is a community that uses ICTs to accelerate the country's social and economic development" (PNC on ISAD, 2003a). More recent initiatives, in countries where infrastructure has become embedded and relatively stable, tend to emphasise the social role of networks (Tuomi, 2001: 8), services presented on the networks, and content- and knowledge generation (Spring et al, 2003; Marchionini, 2003).

The move to a focus on services and content on the network seems to be underscored in the Atkins Report commissioned by and submitted to the National Science Foundation (NSF) in the United States in January 2003, which investigated and promulgated the creation of an Advanced Cyberinfrastructure (sic) Program (ACP), so as to "…enable knowledge environments to revolutionize science and engineering education and research" (Atkins et al. 2003: 33). Atkins et al have "The most fundamental goal…" of empowering "…radical new ways of conducting science and engineering through the **applications** of information technology" (Emphasis in the original) (Spring et al, 2003: 3). The Atkins Report emphasises further three push factors which drive the need for an ACP, namely computation, content, and interaction. The pull factors for an ACP they identify as the vision and requirements originating at the frontiers of science and engineering research. A second study investigating the advanced cyberinfrastructure needs within the Humanities has been launched in 2004 by the NSF.

It seems the global agenda as set by the developed world has shifted to viewing ICT infrastructure as a means to an end. Given greater Internet and computer penetration in developed countries, it seems that content and services have become more of a central concern. In view of the latter, Branchofsky and Chudnov (2002) and Gadd (2003) opine that the focus within academic institutions has shifted from implementing the foundational technologies required for access to information, to thoughts around managing content,

both internally generated and externally acquired. The question arises whether the latter content-centric approach has in fact been adopted in South African universities.

Turning again to South Africa, it is interesting to note that the then Executive Deputy President, Thabo Mbeki, in an opening address to the Information Society and Development (ISAD) Conference on 13 May 1996 (PNC on ISAD, 2003b: 36), identifies three themes central to the conference and central to initiatives wanting to foster an information society. These themes are infrastructure, content, and finance. Considering my characterisation of the information society above, where infrastructure was paramount initially in the 1990's, and subsequently in 2000 and later, content and services became paramount, Mbeki's mentioning 'content' in 1996 seems rather prescient. However, regardless of the possible prescience of his address for the South African context, with the launching of the New Partnership for Africa's Development (NEPAD) in 2002 there seems to have been a concomitant shift in national priorities for South Africa to the African continent. The policy focus for South Africa to date seems to have shifted to infrastructure[11] roll-out in Africa away from a concentrated national emphasis on ICT infrastructure, and possibly away from wide-ranging discussion of content and services on, and use of, the network. [12]

Scholarship in the 20th and 21st C

Scholarship at the end of the 20th and advent of the 21st centuries is not immune to the evolution to an Information Society. Contemporaneous to the evolution to an Information Society, prices in scholarly literature soared, researchers publish more, librarians have felt the pinch, and most scholars seem to remain oblivious of an information access problem. Those who are acutely aware of an information access problem, librarians and scholars alike, have initiated the Open Access movement.

The current evolution of the scholarly communication system, which is both infrastructure- and content-driven, is untenable for some, and inevitable for others (Harnad, 1999; Hunter,

[11] Infrastructure mainly in the form of gas pipelines, the provision of running water, electricity provision, and transport, with seemingly less of an emphasis on ICT infrastructure. (NEPAD, 2003a, 2002)

[12] NEPAD is an initiative by African heads of state to uplift the living standard of and eradicate poverty in African nations. As part of its Action Plan, NEPAD has three sections on which it wants to focus. Section I (Preconditions) consists of a Political Governance Initiative, and an Economic and Corporate Governance Initiative. Section II (Sectoral priorities) consists of an Agriculture and Market Access Initiative, a Human Resource Development Initiative, an Infrastructure Initiative, and an Environment Initiative. Section III (Mobilising resources) entails the management of resource flows.

1998; Chodorow, 2000). Said evolution of the scholarly communication system has garnered much attention in the past decade, its having been driven by three factors, namely:

1. the 'serials crisis' - referring to the spiralling costs of scholarly literature in recent times (Cummings, et al. 1992: 83);
2. the growth in scholarly research output (Crane, 1972: 12; Pouris, 2003);
3. the advent and ubiquity of the Internet, in the context of the Information Society.

Electronic publication via the World Wide Web becomes an attractive alternative and countermeasure to spiralling literature costs and the ability to publish in multimedia formats also has its attraction (Odlyzko, 1997, 1999). Other authors advocate that universities publish their own research (Okerson, 1991) or that universities, at the very least, provide platforms to disseminate their research findings (Harnad, 1997 and 1999). Many authors, such as Fulda (2000) have come to regard the Internet as an "engine of scholarship" which acts as facilitator of scholarship, scholarship enhancer, promoter of the dissemination of scholarship, as well as a facilitator of feedback on scholarship.

Much of the attention to date surrounding the serials crisis has been from proponents within the academic- and research library arenas, given that library budgets bear the brunt of the increase in the price of serials or scholarly periodical literature. Not only have the cost of journals soared, but the price increases have affected the scholarly monograph (Steele, 2003).

In the traditional scholarly publishing system authors/researchers obtain funding from their institutions or funding bodies to do research. The results or findings are subsequently published by a publisher once copyright has been ceded by the author(s). In turn, university or research institutions' libraries buy back the published results in the form of scholarly journals. In effect, the research institution pays twice for the research: at the outset, and at the end of the information value chain. One has to remember and acknowledge, however, that the journal publisher does contribute value-added functions, such as coordinating peer-review and editing (Roosendahl, 2003). A simplified model of the research value chain is illustrated in Fig 2 below. The model is simplified in the sense that 'author' and 'reader' can be said to be the same person. Of course, if researcher X has produced a work Y, it is not that he or she needs to buy back that same work from the publisher. Rather, the reader/researcher is interested in the works of peers published in that journal. However, in

essence, since researcher's work Y is bundled as part of a journal issue, and given that that journal issue is purchased by the library, the researcher's institution is buying back their researcher's research output from the publisher.

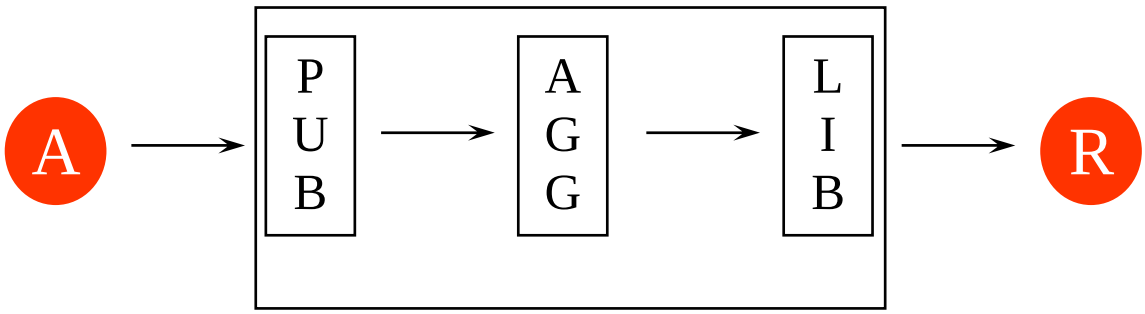

Fig. 2 Publication value chain (after Van de Sompel, 2002b)

Fig 2 Legend:

A = author; PUB = publisher; AGG = aggregator; LIB = library; R = reader

Returning to the point that libraries have felt the effects of soaring literature prices, it is the case that scholars have largely been shielded from these shock effects. Increasingly librarians have clamoured that the matter gain attention from their colleagues in academia. Some within academia have heeded the call, though Lorimer (2003: 66) is of the opinion that "[i]t appears that many scientists, and indeed other scholars, believe that the high cost of access to their research confers a higher status upon them…" Kaufman (Chodorow et al, 2000: 96) opines that "…the problems in scholarly publishing do not constitute a library problem but rather a problem for the entire scholarly community…" The July 2004 report of the United Kingdom (UK) House of Commons' Science and Technology Committee (S & T Committee) on an enquiry into the state of scientific publishing echoed a sentiment similar to that of Kaufman (UK House of Commons, 2004:102[13]). Hunter (2001), on a more pessimistic note, goes so far as to predict that four decades from now, we may look back and see that with regard to networked electronic publishing "…Universities were conspicuous largely by their *absence* of involvement. Unless something is done very soon" (Emphasis in the original). Fortunately 'something' is being done by scholars, librarians, and publishers alike (Okerson, 2003). That 'something' is 'Open Access'.

[13] Recommendation 41.

Open Access as an alternative model of scholarship and scholarly communication

New models of scholarly communication are evolving. The currently evolving model is referred to as 'Open Access'. It is not that Open Access is seen as the panacea for the crisis in scholarly communication, and it is as yet too early to tell whether it will be a panacea. Rather, the argument is made that exploration of new models of scholarship is needed, since the inherited scholarly publishing system is ailing. There seem to be no other competing new models at present which either oppose or complement Open Access, though Open Access itself can be rather nuanced in terms of the specific ways in which it manifests itself. That said, there seems to be at present the traditional (publication) model and Open Access. The two schools of thought within Open Access are the journal reform school, and the self-archiving school. Even within these, there are a number of variations regarding what such journal reform or self-archiving may entail. The seminal initiatives - at an international, trans-national, and national level – are described in this section. Respondents to the questionnaire forming part of this study were asked to indicate their degree of familiarity with many of the initiatives described below.

Open Access has variously been referred to as 'open access' (Budapest Open Access Initiative, 2002), 'self-archiving' (Harnad: 1999), and 'free online scholarship' (Suber: 2002). The primary term of reference at the time of writing has become 'Open Access', with the 'self-archiving' and 'free online scholarship' movements having largely been subsumed by the 'Open Access' movement.

Open Access scholarly communication is viewed as a mechanism to address escalating journal prices, and as a means of circumventing growing limited access to the increasing volume of research literature. Other reasons proffered for a move to 'Open Access' are that publicly funded research by rights should be more accessible to the tax paying public; that access to research by and in the developing world will be greatly improved; and that researchers at poorly funded institutional libraries will have increased access to the research literature (Lynch, 2003). More specifically, Lynch (2003) proposes that institutional repositories are needed to manage and preserve new digital scholarly materials such as simulations, data sets, visualizations, and models, which do not form part of the established scholarly publication chain.

Open Access scholarly communication is being spearheaded by bodies such as SPARC (Scholarly Publishing & Academic Resources Coalition)[14], PLoS (Public Library of Science)[15], BOAI (Budapest Open Access Initiative)[16], OAI (Open Archives Initiative)[17], and BioMed Central[18], aided and abetted by initiatives at expressing and managing digital rights ownership such as Creative Commons[19] and Project RoMEO[20].

SPARC, PLoS, and BOAI have the overt aim of exploring and promoting alternative models of scholarly communication. The OAI, however, started out as an initiative aimed at developing a technology so that e-print archives may interoperate, where producers (data providers) of these archives are able to form a network of trusted repositories through a protocol for harvesting metadata (Kiernan, 1999; Ginsparg et al, 1999). More recently however, having reached a relative level of stability in the avowed software, not to mention its ubiquitous implementation in areas beyond pre-print and e-print archives (Breeding, 2002: 24), the OAI has 'returned to its roots' and is once again focussing on new models of scholarship in promoting institutional repositories (Van de Sompel and Lagoze, 2002a).

International initiatives

Numerous national and international initiatives have been undertaken in order to promote the concept of 'Open Access' as well as to facilitate the implementation of Open Access systems. What follows is a description of each of the seminal initiatives referred to in the previous section, followed by a description of national initiatives undertaken by various governments. South Africa's involvement in these is noted where applicable. All of the international initiatives and some of the national initiatives described below were listed in the questionnaire instrument, when assessing degree of familiarity with Open Access initiatives. International initiatives by non-governmental institutions can foster the adoption of Open Access through its active promotion in South Africa. Moreover, international funding agencies which mandate Open Access and who fund research in developing countries, could also lead to a change of behaviour in i.a. South African researchers.

[14] http://www.arl.org/sparc/ and http://www.sparceurope.org
[15] http://www.plos.org
[16] http://www.soros.org/openaccess/
[17] http://www.openarchives.org
[18] http://www.biomedcentral.com
[19] http://www.creativecommons.org
20 http://www.lboro.ac.uk/departments/ls/disresearch/romeo/

Scholarly Publishing and Academic Resources Coalition

Though the Scholarly Publishing and Academic Resources Coalition (SPARC) was established in 1998 by the Association of Research Libraries (ARL) in the United States, its efforts with respect to the promotion of Open Access has in effect become global. SPARC is "…an alliance of universities, research libraries, and organizations' that seeks to serve 'as a catalyst for action, helping to create systems that expand information dissemination and use in a networked digital environment …" (Dekeyser, 2003). SPARC is membership-based, and in the interest of its members it compiles and disseminates informative written guidebooks and advocacy materials for those involved in the scholarly communication chain. These guidebooks and related materials are educational, and aim to raise awareness of issues, particularly around the serials crisis. At an administrative and executive level, SPARC has offices in the USA and Europe.

Public Library of Science

The Public Library of Science (PLoS) made its presence felt in 2001 with an open letter to publishers of biomedical journals, published in the respected publication *Science*. The open letter expressed concerns on behalf all biomedical researchers about restricted access to scientific and medical literature. The same researchers, by undersigning the open letter, undertook to boycott scholarly publishers and their journals if they did not make published articles available for free six months after publication. What the boycott would entail was not publishing in any restricted-access journals, not writing reviews for them, and not subscribing to them. Scientists and researchers (30 000 in total) from 170 countries signed the manifesto electronically by submitting their details via the World Wide Web. In total, 141 researchers resident in South Africa signed the PLoS open letter, and of these, 33 were affiliated with Stellenbosch University (Gass, 2004). Since then, PLoS has adopted a new route and has discontinued its campaign which centred around the open letter, probably since many researchers and scientists found the terms of the open letter difficult to enforce. PLoS' new way forward was to establish two Open Access journals, one in Biology, the other in Medicine, both of which use the author-pays funding model. If authors do decide to boycott a journal, they now have an Open Access alternative in which to publish. PLoS realised that giving researchers an Open Access venue in which to publish would go some way to furthering the Open Access cause, and also to concretely demonstrate that Open Access journals can be viable and can come to compete with established high impact factor

journals[21]. In contrast to the traditional subscriber-pays model, with the author-pays model, authors pay to publish in these journals and readers have untrammelled access to the full text without the need to pay subscription fees, as per the BOAI definition of Open Access.

Budapest Open Access Initiative

The Budapest Open Access Initiative (BOAI) was launched in February 2002, with a $3 million infusion of funding from the Open Society Institute (OSI). As part of its Information Program, the OSI advocates for access to the research literature through funding pilot projects, meetings, and the compilation of informative literature and reports on studies which promote the Open Access cause. The OSI has an interest in Open Access as it believes greater access to knowledge will foster more open democratic societies. As recently as April 2004, the OSI funded institutional memberships to PLoS for countries in the developing world. As such, authors in the qualifying countries' institutions would be able to publish in the PLoS journals with sponsorship from the OSI. Furthermore, the OSI funded the first Open Access scholarly communication conference in South Africa in July 2004. The latter is described in detail later in this chapter. Scholars and researchers are able to sign the BOAI statement on their Web site. However, ascertaining country affiliation of the signatories is not possible when viewing a listing of signatories' names.

Open Archives Initiative

The origins of the Open Archives Initiative (OAI) were elaborated upon above. To situate it along a timeline with the previously-mentioned initiatives, OAI had its inaugural meeting in October 1999 and predates both the BOAI and the PLoS. Unlike these later initiatives which tend to emphasise the ethos and promote the culture behind Open Access, the OAI meeting participants chose to place an overt emphasis on technology development. They chose to focus on developing the technology or technologies which would support alternative methods of research dissemination (Ginsparg et al 1999), and did not adopt the 'us' (scholars and librarians) vs. 'them' (publishers) perspective characteristic of numerous discussions around Open Access. The OAI was thus not an overt rallying cry akin to the BOAI and PLoS initiatives. The OAI developed a Protocol for Metadata Harvesting (the OAI-PMH), which permits OAI-compliant digital archives to interoperate through the exchange of Dublin Core and other metadata formats. It is not a protocol for the retrieval

[21] The concept of high impact factor journals is comprehensively addressed in this chapter, in the section on scholarship and scholarly communication in South Africa.

of full-text, though the latter is being experimented with[22]. Rather, the OAI-PMH facilitates federated searching of digital archives by means of the harvested metadata being used to populate a central 'service provider' server. A search of the central server by a typical end-user would direct users to the original repository housing the full-text article. The latter sounds simple but proves to be quite revolutionary. Whereas before, digital archives existed in isolation, the OAI-PMH facilitated that a network of digital archives be delineated. What the OAI-PMH gave rise to, was the elaboration and formation of an e-prints community across disciplines. To date, three institutions[23] in South Africa have OAI-compliant digital repositories.

BioMed Central

BioMed Central is an independent publishing venture in the biomedical sciences which uses the author-pays publishing model (authors in developing countries are exempted), and also recovers costs through institutional membership charges. It was established in 1999, and as such is the earliest publishing venture in this regard, predating PLoS. At the time of writing, BioMed Central publishes over 100 journals, as well as Faculty of 1000, a literature evaluation service. BioMed Central also makes its software, which handles online article submission and peer-review, available for use by others wishing to start an Open Access journal. Also at the time of writing, BioMed Central has three institutional members located in South Africa, namely the Medical Research Council (MRC), the University of Stellenbosch, and the University of the Western Cape. A tally of institutional members worldwide is provided in Appendix K.

Position statements and declarations regarding Open Access

I would here draw a distinction between international initiatives undertaken by interested individuals and non-governmental organisations as described thus far, and those international initiatives undertaken by research funding bodies. The latter seem to be in a class of their own when one considers that they tend to be trans-national and to sometimes

[22] For which, see Van de Sompel, H, Nelson, M.L, Lagoze, C and Warner, S. 2004. Resource harvesting within the OAI-PMH framework. *D-Lib magazine*. Vol 10 num 12 (online) Available http://www.dlib.org/dlib/december04/vandesompel/12vandesompel.html Retrieved 17 December 2004.

[23] These being:
Rand Afrikaans University Electronic Theses and Dissertations;
University of Cape Town Computer Science Research Document Archive;
University of Pretoria Electronic Theses and Dissertations.
Source: http://archives.eprints.org/index.php?action=home&country=za
See also Appendix L for a global tally of institutional repositories as at December 2004.

be discipline-specific. These latter types of initiatives are primarily of a sort driven by professional societies or funding bodies which tend to fund research within certain disciplines.

Examples of the latter are the Wellcome Trust position statement on Open Access[24] (with a focus on human and animal health research). Sometimes there are specific initiatives which arise in particular countries and particular research domains, but which become trans-national in nature when researchers and scientific societies from other countries endorse these position statements. The Bethesda Statement on Open Access[25] (Health Sciences research in the United States; released June 2003) is one such example, and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities[26] (covering Sciences and humanities research; regarded as a German initiative spearheaded by the Max Planck Society, but with international signatories such as France's *Centre National de la Recherche Scientifique* (CNRS[27]); released October 2003). These statements of national and international support should be seen for their full worth, since these are statements endorsing Open Access which are being signed by senior ranking government research administrators, and policy-makers. Frequently university administrators at the level of presidents, rectors, and vice-chancellors are also involved.

The Wellcome, Bethesda, and Berlin Declarations are regarded as landmark statements of support for Open Access. I have also chosen to describe them extensively here since the familiarity of survey respondents with these statements was tested in the questionnaire instrument in this study. Other statements listed in the aforesaid survey were, the ALPSP[28] (Association of Learned and Professional Society Publishers) statement, the International Federation of Library Associations and Institutions (IFLA)[29] statement on Open Access to Scholarly Literature and Research Documentation; and the Washington D.C. Principles for Free Access to Science (a.k.a. the DC principles)[30]. The Wellcome-, Bethesda-, Berlin-, ALPSP-, IFLA statements, and D.C. Principles were listed in the survey when gauging

[24] http://www.wellcome.ac.uk/en/1/awtvispolpub.html
[25] http://www.earlham.edu/~peters/fos/bethesda.htm
[26] http://www.mpg.de/pdf/openaccess/BerlinDeclaration_en.pdf
[27] The CNRS is the "…largest European institution dedicated to fundamental research" (Larédo and Mustar (2000)) and employs more than 26, 000 researchers (Larédo and Mustar (2001a).
[28] http://www.alpsp.org/news/openaccpositionstatementoct03.pdf
[29] http://www.ifla.org/V/cdoc/open-access04.html
[30] http://www.dcprinciples.org/

familiarity with Open Access, since they were the most recent declarations when the survey had been conducted.

These latter declarations are not all emphatic supporters of Open Access. The ALPSP statement (released in August 2003) is rather tentative, emphasising the need for experimentation with various journal publication models. The IFLA statement was indeed a show of support of Open Access, released in December 2003. Debates around the crisis in scholarly communication have their origins in the library community, and it is almost an anomaly to note that the IFLA, as a global political heavy-weight in the library arena, took two years (taking the BOAI February 2002 declaration as benchmark) to finally issue a statement in support of Open Access. The DC principles were signed by 48 non-profit publishers (representing 380 journals and 600,000+ members), who are affiliated with or run by professional or scholarly societies. What seems to have been the aim of these non-profit publishers was not so much a statement of support of Open Access, but rather a statement highlighting their plight as publishers who do not have celestial profit margins, and who already, in some shape or form, provide free access to old issues of their publications as well as free access to readers in developing countries. The view then of these non-profit publishers is that they are not like the big STM publishing houses who are often decried for their exorbitant serials prices. The Library and Information Association of South Africa (LIASA) is a member of IFLA, and is therefore tacitly a supporter of the IFLA statement.

A number of initiatives have been undertaken by publishers to provide free or discounted access to readers and researchers in developing countries. Of these, the Health Inter-Network Access to Research Initiative (HINARI); the Access to Global Online Research in Agriculture (AGORA); the International Network for the Availability of Scientific Publications (INASP) and its Programme for the Enhancement of Research Information (PERI) are of the most frequently cited such initiatives. A description of these is provided later in this chapter.

As is evident, a number of landmark initiatives have been undertaken in support of Open Access, with South Africa participating to varying degrees, but generally at a low political level. What follows is a description of state-led and national initiatives abroad, arising at a high level of political influence and intervention.

National initiatives worldwide

National initiatives refer to those Open Access policy directives and activities undertaken by nation states, and not to those undertaken exclusively within South Africa. State-led and national initiatives abroad can be instructive for similar policy initiatives in South Africa. National initiatives are mainly of two types: those fomented by government decree, and those driven by science councils and/or university administrators.

Before highlighting specific initiatives, more generally it is thought that governments must be seen to drive forays into Open Access.
Bachrach et al (1998) assert that :

> Because the electronic world offers many potential improvements to enhance traditional publication, scientists, administrators, and federal science policymakers must reconsider both how the results of publicly funded research are best disseminated and how that dissemination is best supported.

West (Chodorow et al, 2000: 96) echoes Bachrach et al. when he says that "(t)he solution to the scholarly publishing challenge requires a national and even international approach rather than a local one." National initiatives have arisen in the United Kingdom, United States, the Netherlands, Germany, Italy, Scotland, and Australia. Trans-nationally, the European Union has also issued a policy briefing on Open Access for discussion.

<u>UK House of Commons Science and Technology Committee</u>

At the governmental level, the United Kingdom (UK) House of Commons' Science and Technology Committee (S & T Committee) was tasked with en enquiry into the state of scientific publishing. The committee was appointed by "…the House of Commons to examine the expenditure, administration, and policy of the Office of Science and Technology and its associated public bodies" (UK House of Commons, 2004). The report of July 2004 made 82 recommendations, of which the following summary can be made:

- Change is needed on the library side (increased library budgets) as well as publisher side (greater transparency on journal publication costs);

- That "…UK Government fund the establishment of an inter–linked network of institutional repositories on which all research articles originating in the UK should be deposited and can be read for free" (UK House of Commons, 2004: 97);
- That a rigorous process of independent peer-review be fomented regardless of the dissemination method used;
- More experimentation with alternative publishing models such as the author-pays model;
- That the UK Scientific, Medical, and Technical (STM) fraternity exists within a global context, and that in this regard, the UK should "act as a proponent for change on the international stage and lead by example" (UK House of Commons, 2004: 97).

More specifically, the report indicates a number of opinions with respect to the necessity for government policy mandating Open Access, and the likely positive effects for developing countries of Open Access. In fact, of the 82 recommendations made in the final report, 20[31] were explicit recommendations for government intervention and action, and three[32] recommendations expressed the likely benefits of Open Access for developing countries (UK House of Commons, 2004: 98-107).

In response and as recently as November 2004, the UK Parliament rejected many of the recommendations of the S & T Committee, saying that it "'is not aware that there are major problems in accessing scientific information,' and that the publishing industry is both 'healthy and competitive'" (Engber, 2004). Many saw the government response as one of bowing to pressure from the publishing industry.

United States House Appropriations Committee

Whilst the UK made its enquiry, the United States House Appropriations Committee launched a similar initiative. The basic tenet underlying such government initiatives is that since government spends a substantial amount of funds supporting research endeavour, researchers and the general public should have close-to if not entirely untrammelled access to publicly funded research output.

[31] Recommendations 2, 18, 29-31, 44, 48-50, 53, 55-57, 59-60, 63 -64, 71-72, 77.
[32] Recommendations 14-15, 63

European Science Foundation

The European Science Foundation (ESF) (European Science Foundation, 2003) circulated a discussion document in 2003 within its community. Though the document is explicitly regarded as a discussion piece and not a policy nor position paper, it was important to note that the ESF has 'Open Access' on its radar.

Specific Western European government initiatives

Further to the ESF piece, a number of European Union countries have expressed support of Open Access, mainly through the initiation of projects to set up national networks of institutional repositories. The SHERPA (Securing a Hybrid Environment for Research, Preservation and Access)[33] and FAIR (Focus on Access to Information Resources)[34] projects of the Joint Information Systems Committee (JISC[35]) in the United Kingdom are examples of the latter More particularly, JISC will launch a funding programme in early 2005 to grant £2.5 million per year for two or three years to fund digital (including institutional) repositories. In the Netherlands the SURF foundation instituted the Digital Academic Repository (DARE[36]) network of institutional repositories, with system implementations effected in 2003. The Max Planck Gesellschaft (MPG) in Germany initiated its eDoc[37] project, an institutional repository for researchers of the MPG. More generally, Open Access is supported by the Rectors of German universities through a number of projects[38], as well as through the signing of the Berlin Declaration on Open Access. In October 2004 the Scottish Science Information Strategy Working Group launched the Scottish Declaration of Open Access[39]. In November 2004 in Messina, Sicily[40] representatives from 32 Italian research institutions (31 universities and 1 research centre) signed the Berlin Declaration on Open Access.

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33 http://www.sherpa.ac.uk/
34 http://www.jisc.ac.uk/programme_fair.html
35 http://www.jisc.ac.uk
36 http://www.darenet.nl
37 http://edoc.mpg.de/
38 Recommendation of funding for institutional repository network http://www.hrk.de/e/812.htm ; Support of PhysNet http://Physnet.uni-oldenburg.de/PhysNet/ and, MathNet http://www.math-net.de ; Project GAP - German Academic Publishers http://www.gap-c.de ; DINI - German Initiative for Network Information http://www.dini.de
39 http://scurl.ac.uk/WG/SSISWGOA/declaration.htm
40 There are 77 universities in Italy. The signing is being referred to as the Messina Declaration. The workshop was facilitated by the Council of Rectors of Italian Universities. See also http://www.aepic.it/conf/index.php?cf=1

Australia

Earlier, in May 2004, and beyond the borders of the European Union, the Vice-Chancellors from the Group of Eight Australian universities[41] released a statement (Group of Eight, 2004) in support of Open Access, explicitly supporting:

- ongoing development of open access initiatives in Group of Eight universities,
- digital publishing practices that underpin the timely, cost-effective dissemination of the highest quality scholarly information with a commitment to good practice, and
- further examination of criteria for promotion in new publishing models.

To date high-level policy actors on the African continent - such as the New Partnership for Africa's Development (NEPAD) - and within South Africa - such as the South African government, the South African Universities Vice-Chancellors Association (SAUVCA), or the Committee of Technikon Principals - have not come out in support of any of the Open Access declarations and statements. What follows is an indication of high-level policy endorsements from South Africa, mostly at the level of access to and exchange of data, or which hint at the need for Open Access.

Policy endorsements from South Africa: an overview

Policy endorsements from high-level, usually government-level actors, for initiatives which are close cognates to the Open Access initiatives described thus far, have been few and far between. Invariably, the focus has overtly been on access to data. A few initiatives mention access to information, but usually limited to particular domains and not access for scientists generally.

The Committee for Scientific and Technological Policy of the Organisation for Economic Co-operation and Development (OECD) held a meeting in January 2004, attended by government representatives from 34 countries[42], South Africa included. At this meeting, the OECD 'Declaration on Access to Research Data from Public Funding' was signed.

[41] Australian National University; University of New South Wales; University of Adelaide; University of Queensland; University of Melbourne; University of Sydney; Monash University; University of Western Australia. See also http://www.go8.edu.au/

[42] The signatories to both declarations are: Australia, Austria, Belgium, Canada, China, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Russian Federation, the Slovak Republic, the Republic of South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. See also http://www.oecd.org/documentprint/0,2744,en_2649_34487_25998799_1_1_1_1,00.html

Less feted, but also signed at the meeting in question, was the 'Declaration on International Science and Technology Co-Operation for Sustainable Development'. The focus on access to research data in the associated declaration and the co-operation declared on the Science and Technology front, are promising avenues for fostering Open Access in South Africa. I will return to this point in the Discussions chapter.

The Commonwealth Parliamentary Association[43] held a workshop titled 'Access to Information' in July 2004, attended by i.a. a representative of the South African Parliament. The context and outcomes of the meeting was very much in line with the provisions made in South Africa's Promotion of Access to Information Act (Act no. 2) passed in 2000, where access to information held by public bodies is provided for. A liberal reading of such legislation, as is done by Britz (2004: 200), would regard it as encouragement for the provision of research output from publicly-funded bodies. In my view, the latter is a rather too liberal reading of the legislation. I would argue that such legislation is more focussed on providing transparency of and in governments so as to foster a vibrant democracy. The latter view of 'diffusing information for democracy' is echoed by Mostert (2004). A similar view to Mostert's is expressed by Poulin (2004) in the context of access to legislative documents. However, Poulin specifically mentions the utility of Open Access in developing countries in this, the latter, regard.

South Africa also made its presence felt at the World Summit on the Information Society held in Geneva in December 2003. Here, the 'Declaration of Principles'[44] and 'Plan of Action'[45] make reference to access to scientific information and knowledge. The 'Declaration of Principles' explicitly states under B.3.28 that "We strive to promote universal access with equal opportunities for all to scientific knowledge and the creation and dissemination of scientific and technical information, including open access initiatives for scientific publishing" (WSIS, 2004a: 4), and the 'Plan of Action' under clauses C3.10.h and C3.10.i state (WSIS, 2004b: 4):

> h) Support the creation and development of a digital public library and archive services, adapted to the Information Society, including reviewing national library

[43] http://www.cpahq.org
[44] http://www.itu.int/wsis/documents/doc_single-en-1161.asp
[45] http://www.itu.int/wsis/documents/doc_single-en-1160.asp

> strategies and legislation, developing a global understanding of the need for "hybrid libraries", and fostering worldwide cooperation between libraries.
>
> i) Encourage initiatives to facilitate access, including free and affordable access to open access journals and books, and open archives for scientific information.

The WSIS was not the only such global forum where the sharing of scientific knowledge and information was declared important. In 1999 the United Nations Educational, Scientific and Cultural Organisation (UNESCO) held a 'World Conference on Science' attended by high-level representatives from various countries. The South African delegation was headed by the then Minister of Arts, Culture, Science, and Technology, Dr Ben Ngubane. A 'Declaration on Science and the Use of Scientific Knowledge' was endorsed by the Conference which emphasised i.a. the need for the sharing of scientific information and knowledge (UNESCO, 2000). The question which arises is to what extent these declarations, both of the OECD and the WSIS, are acted upon. Thus far, South African government initiatives in this regard have not been forthcoming. In fact, Dickson (2005: 9) opines that the direct focus on poverty alleviation in developing country policy initiatives has relegated science to the periphery. He adds, commenting on the 1999 World Conference on Science, "Although many [developing countries] sent their science ministers to the Budapest meeting, few felt the topic of sufficient importance to deserve the attention of more politically significant figures such as finance ministers." He argues further for the integration of science and technology at all policy levels, to counteract the "...relative lack of political interest in science and technology within developing countries themselves."

There are 32 national branches of the international scientific society, the International Council for Science (ICSU), in South Africa. The 2003 annual reports of these branches authored by their South African national chairs were made available in September 2004. Two of the 32 branches explicitly mention Open Access, namely CODATA (Committee on Data for Science and Technology) and ICSTI (International Council for Scientific and Technical Information). To provide a sense of the range of scientific disciplines which reported to the South African ICSU National Board, a list of these national branches may be found in Appendix J. The question with regard to implementation of these declarations, remains.

Of note, before concluding this section, is the South African Research Information Service (SARIS) project which aims to set up an agency dedicated i.a. to the management and facilitation of access to global research for South African scholars. The latter includes access to subscription-based and Open Access research output. The project is funded by the Ford Foundation and managed by the Council for Scientific and Industrial Research (CSIR) in South Africa. This latter project is described in Chapter 3, under 'National information policy in South Africa'.

Before describing specific Open Access repository implementations in the next section, I would like to mention here the Open Access scholarly communication conference held in Pretoria, South Africa in July 2004[46]. It was the first conference in South Africa dedicated to 'Open Access scholarly communication' and was funded by the Open Society Institute (OSI) and the South African Site Licensing Initiative (SASLI). The aim[47] of the conference, broadly speaking, was to discuss a way forward for Open Access in South Africa, and in fact the latter was dealt with on day 2 of the conference, when participants conducted a roundtable discussion. Those in the library and information services sector, as well as all research managers at higher education institutions had been invited to the conference, yet assessing actual attendees (~120 in toto) indicated that those in the library arena predominated. Conspicuous, mainly by their absence, were research managers. In fact, there was one research manager in attendance. Furthermore, the Chief Executive Officer of TENET was also present. One of the immediate outcomes of this conference is to schedule a workshop on institutional repositories with a particular emphasis on skills development in the latter regard[48].

In a similar vein to the Open Access conference described above, but predating it, an ETD workshop was held in October 2003 in South Africa, as part of an UNESCO Pilot Project on the African continent. Wits University formed part of this study, and was the implementation site for an UNESCO-sponsored ETD respository[49].

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[46] The conference Web site http://www.sabinet.co.za/oai/.

[47] The specific aims on the conference Web site http://isis.sabinet.co.za/dspace/handle/123456789/38 are given as:
To focus on the different perspectives and issues related to Open Access Journals and institutional repositories; to enhance and support research output and the system of scholarly communication in higher education institutions and research institutes in South Africa; broaden the engagement of libraries, higher education institutions, government and researchers in scholarly communication issues.

[48] I am on the team planning said workshop; this knowledge is first hand.

[49] The final pilot project report is available at http://146.141.35.251/ETD-db/pilotproject_finalreport.doc

This section concludes the treatment of specific policy initiatives at the international, trans-national, and national levels. More particularly, South Africa's involvement has been described on a number of fronts, with a brief digression into the first Open Access scholarly communication conference held in South Africa. What follows is a brief section on specific Open Access repository implementations.

Specific Open Access repository implementations: brief overview

The specific repository implementations described in this section are limited to those listed in the questionnaire instrument assessing awareness of Open Access. The repositories were chosen for inclusion in the survey either because they are of the oldest repository implementations (with the *ex-ante* expectation that they should be relatively familiar to the questionnaire respondents) or because they were specific subject-based repositories within the Computer-, Library-, and Information Sciences. One information retrieval tool used frequently by Computer Scientists was also listed in the survey instrument. I describe these repositories below. The responses to the questionnaire instrument regarding these repositories are evaluated in Chapter 5 (Results).

Two of the longest running implementations of subject-based e-print repositories are arXiv[50], for the Physics, Mathematics, Non-linear sciences, Computer Science, and Quantitative Biology disciplines, and RePEc[51], for the Economics scholarly community, both of which were listed in the survey instrument. As a matter of interest, there is a mirror site for arXiv in South Africa[52], which resolves to a Web address physically located at Wits University.. Browsing the news postings at arXiv.org, it is indicated in a message dated August 2000 that the South African mirror site is hosted by the Department of Physics, University of the Witwatersrand, Johannesburg[53]. However, personal experience would indicate that the link has not worked for at least a year. I have experience dating back to the year 2000 in using this South African mirror site, having read pre-prints on Computational Linguistics. Apparently, the South African mirror site has had infrequent problems attributable to hardware failure, and more recently due to power outages (Warner, 2005). It should be noted that power outages have generally plagued the region in which the mirror site is located during the fourth quarter of 2004, and as such its failure then was not due to the immediate hosting environment. It is argued later in this thesis that the lack of

[50] http://arxiv.org
[51] Research Papers in Economics; http://repec.org
[52] http://za.arXiv.org/
[53] http://www.arxiv.org/new/#helpsearch

electricity is a major impediment to the diffusion of information and communication technologies across the African continent, and as is evident, even in South Africa such electricity breakdowns do occur. Nevertheless, the existence of the South African arXiv mirror site demonstrates one of the earliest forays into Open Access in South Africa[54].

The earliest subject-based e-print repositories for the Computer Sciences were established in the United States, and were named the Computer Science Technical Report project (CS-TR) and the Wide Area Technical Report Service (WATERS). In 1995, the Networked Computer Science Technical Report Library (NCSTRL[55], pronounced 'ancestral') was created, based on the technologies tested in the CS-TR and WATERS projects (Halpern and Lagoze, 1999). In 1998, a Computing Research Repository (CoRR) was created in a collaborative project of the Association for Computing Machinery (ACM), a prominent professional society for Computer Scientists and related disciplines. Though now regarded as an historic archive rather than an active repository, NCSTRL does house as many as 27,000 documents (Carr et al, 2000).

A related digital library service in the Computer Sciences is Citeseer (a.k.a. ResearchIndex). Citeseer indexes the contents of the personal homepages of Computer Scientists. As such, the full-text of articles is not housed in a central server and associated mirror sites, but is rather linked to from the Citeseer service.

The Networked Digital Library of Theses and Dissertations (NDLTD[56]) is at one and the same time an early manifestation of and ETD repository started at Virginia Tech in the United States, which launched the organisation itself (NDLTD) in the mid-1990s dedicated to the promotion, adoption, dissemination, and preservation of ETDs. It promotes the latter through an annual ETD conference, the earliest of these being in 1998. At the time of writing it has 217 members consisting of 189 member universities (including 7 consortia), and 28 institutions, with six of these in South Africa[57]. It was reported earlier

[54] As a matter of interest, there is no RePEc mirror in South Africa. However, the South African Journal of Economics does have an online presence www.saje.co.za, hosting the journal as well as working papers. However, the journal articles are only available as part of an annual subscription (i.e. single articles cannot be purchased) and there are only two working papers available at the time of writing.
[55] http://www.ncstrl.org
[56] http://www.ndltd.org
[57] These being the University of Johannesburg http://etd.uj.ac.za; University of Pretoria http://upetd.up.ac.za ; University of the Free State http://lourie.uovs.ac.za/ETD-db/; University of South Africa http://etd.unisa.ac.za ; Rhodes University http://www.ru.ac.za/library/theses/; Rand Afrikaans

that South Africa has three OAI-compliant institutional repository members registered in the international registry[58]. Obviously, and as per the definitions used for ETD and IR in this thesis, one may have the one type of digital repository without the other, and vice versa. The Rand Afrikaans University becoming part of the University of Johannesburg in 2005, it is unclear why three of the – in effect – five South African institutional members of NDLTD have not registered with the international registry of institutional repositories.

Efforts within the Library- and Information Sciences have been the Documents in Information Science (DoIS[59]) and the E-LIS[60] projects. DoIS is a bibliographic service for Library and Information Science (LIS) literature, and E-LIS is the e-prints repository housing research articles in a number of languages. An e-prints repository for LIS literature restricted to the English language exists, named Digital Library of Information Science and Technology (DLIST[61]). A more or less hybrid repository effort, covering the Computing Sciences and Library/Information Sciences, is represented by RcLIS (Research in computing and Library & Information Science), which will act as a portal serving full-text of articles retrieved via a retrieval service named Konz (Krichel, 2004).

Of the sites and services described thus far in this section, the following were listed on the questionnaire instrument: Citeseer a.k.a. ResearchIndex; NCSTRL; ArXiv; RcLIS; NDLTD; E-LIS; RePEc; and DoIS. The degree of familiarity of the questionnaire respondents with these sites and services is dealt with in Chapter 5.

African Open Access journals

What follows is a brief overview of journals produced across Africa and/or dealing with themes specific (though not necessarily limited) to Africa. This section is included to form part of the benchmark aim of this thesis. The journals elaborated upon below are based on searches performed on the Directory of Open Access Journals (DOAJ)[62]. Note further that

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University http://etd.rau.ac.za. The Rand Afrikaans University became part of the University of Johannesburg in 2005, even though they are indicated as separate and distinct members by the NDLTD.

[58] Rand Afrikaans University Electronic Theses and Dissertations;
University of Cape Town Computer Science Research Document Archive;
University of Pretoria Electronic Theses and Dissertations.
Source: http://archives.eprints.org/index.php?action=home&country=za
See also Appendix L

[59] http:dois.mimas.ac.uk

[60] http://eprints.rclis.org/

[61] http://dlist.sir.arizona.edu/

[62] http://www.doaj.org

the level of awareness of the DOAJ was not tested for as part of the questionnaire-based survey conducted for this thesis.

Conducting searches on the DOAJ on the terms 'africa' and 'african' produce ten and 17 hits, respectively. Eliminating duplications for both result sets produces a journal list containing 20 journals (of a total of 1424 journals indexed by the DOAJ up to mid-January 2005) dealing with African research themes. In effect, 1.4% of journals indexed by the DOAJ are African in origin or research theme.

Of these aforementioned 20 journals[63], four journals are South African in origin or affiliation. The four South African journals are the 'Sahara Journal of the Social Aspects of HIV/AIDS' published by the South African Medical Association Health and Medical Publishing Group; the 'Smithiana Bulletin' published by the South African Institute for Aquatic Biodiversity; the 'South African Journal of Animal Science' published by the South African Society for Animal Science; and the 'South African Journal of Information Management' published jointly by InterWord Communications and the Department of Information Studies of the Rand Afrikaans University[64] in South Africa. Furthermore, of these four South African journals, two are accredited by the South African Department of Education and thus appears on its list of accredited journals. The journals are the 'South African Journal of Information Management' (indexed on the SA-specific SAPSE list) and the 'South African Journal of Animal Science' (indexed by the ISI). The SAPSE system is described in this chapter, in the section below titled 'Scholarship and scholarly communication in South Africa'.

In anticipation of the next section of this thesis, it should be borne in mind that this section reveals only those journals which are African in origin or affiliation, and that searches for other developing countries or regions have not been done.

In effect, what I have described in this section on 'Open Access as an alternative model of scholarship and scholarly communication' is an overview of Open Access initiatives which had been tested for in the survey instrument, are seminal and so should be well known by anyone familiar with Open Access, and mostly constitute a picture of the shift in focus to

[63] The details of these 20 journals, as per the DOAJ, are provided in Appendix M below.
[64] The Rand Afrikaans University became part of the University of Johannesburg as of 2005, as part of an institutional merger process.

content and services as explained in the Section on the 'Information Society' earlier in this Chapter. It can be seen that South Africa's participation at the level of explicit Open Access policy has been tentative, and at the level of project implementation has been disparate and rather cautious.

Scholarship and scholarly communication in developing countries

This section on scholarship in developing countries needs to be situated against a backdrop of technological and industrial development. Here we revisit my earlier conjecture whether Africa, when compared to the developed world, has indeed made a transition from debates concentrating on infrastructure to debates where content and services have become central. Participation of developing countries in networked research dissemination initiatives are being constrained by porous infrastructure or are being neglected in favour of initiatives favouring general social and economic upliftment. This is at the level of policy intervention. At the level of scientists themselves, it seems many, much like their counterparts in the developed world, are not aware of the information access problem described earlier in this chapter.

Increasing marginalisation

Numerous development indicators (World Development Report, World Competitiveness Yearbook, and Technology Achievement Index) paint a relatively bleak picture of social, economic, and technological development in developing countries. Castells (1998: 70 - 128) describes the economic, political, and social decline in sub-Saharan Africa (excluding South Africa and Botswana) during the rise of the informational/global economy. He attributes the marginalization of Africa to three factors (Castells, 1998: 90):

1. Unreliable institutional environment
2. Lack of production and communication infrastructure
3. Erroneous economic policies

He describes further Africa's 'technological apartheid' (Castells, 1998: 92) due to, not only low computer and Internet penetration, but also due to the lack of a fundamental precursor to computerised networks, namely electricity. Findings from a survey conducted by Ondari-Okemwa, a Kenyan information scientist, on access to knowledge in sub-Saharan Africa, underscore the need for a reliable electricity supply. His survey reveals that "some

2.5 percent of the respondents said that electricity supply in their countries was very reliable, 25.5 percent said it was reliable, 65 percent said it was unreliable and 7 percent said it was very unreliable" (Ondari-Okemwa, 2004: 366).

Castells adds (1998: 95):

> Technological dependency and technological underdevelopment, in a period of accelerated technological change in the rest of the world, make it literally impossible for Africa to compete internationally either in manufacturing or in advanced services.

Castells' statements here add credence to my earlier conjecture that the shift from (network) infrastructure to content and services (on the network) is bypassing Africa. Of course, since Castells' analysis above excluded South Africa and Botswana, the question still remains as to the status quo in South Africa.[65]

In a later study, Castells (2001) reflects particularly on the effects of the Internet on business and society, and speaks of an economy which runs at Internet speed, and of how the Internet:

> [I]s the technological tool and organizational form that distributes information power, knowledge generation, and networking capacity in all realms of activity. Thus, developing countries are caught in a tangled web. On the one hand, being disconnected, or superficially connected, to the Internet is tantamount to marginalization in the global, networked system. Development without the Internet would be the equivalent of industrialization without electricity in the industrial era (Castells, 2001: 269).

The import of Castells' argument is that of course, infrastructure is important, which tends to undergird the African Union's NEPAD initiative and it's continued focus on infrastructure roll-out. Ondari-Okemwa (2004: 371) also emphasises the need for infrastructure in sub-Saharan Africa. Van Audenhove et al (2003: 84) however claim that infrastructure roll-out is a Western agenda propagated by the likes of the World Summit on

[65] The development trajectory of Botswana is beyond the scope of this thesis.

the Information Society (WSIS), the Organisation for Economic Co-operation and Development (OECD), and the International Monetary Fund (IMF), and is chiefly grounded in technological determinism, where the expectation is that the elaboration of ICT infrastructure will automatically lead to economic and social development. Note however that these authors use infrastructure in different senses. NEPAD uses 'infrastructure' to refer to electricity, transport, institutions, and ICT. Ondari-Okemwa uses the term to refer to electricity and ICT infrastructure. Van Audenhove et al use the term 'infrastructure' solely in the sense of ICT infrastructure.

Yet, we seem to be confronted with a zero-sum scenario, in that it is said that we cannot advance the one (content and services) without first having provided universal service with the other (infrastructure). The question which arises is why can we not advance content and service delivery on extant networks, whilst also making advances in infrastructure roll-out?

The marginalization Castells refers to has consequences for Africa's contribution to global scholarship. It seems fitting to quote Altbach and Tefera (1998: viii) who assert that:

> Africa will be affected by the technological revolution and will have to adjust to it. Developments in the West will, in general, mean that Africa will fall further behind in the knowledge race. Africa does not have the funds, the infrastructure, or the size for its research community and universities to participate fully in current developments. The revolution in knowledge distribution is, in general, bypassing Africa (My emphasis added).

One may hope that the situation has not been as dire as Altbach and Tefera claim, yet Stillwell (2003) seems to endorse their view. Her experiences attest to the lack of access to information in the form of research publications in African countries other than South Africa. Story (2002, 48), quoting Darch, indicates further the unsustainability of libraries in Africa, with empty shelves and dated monograph collections. Davis and Carden (1998: 20) say "[i]solation resulting from inadequate communication infrastructure is the critical bottleneck for many researchers in developing countries..."

It is said that the knowledge gap is widening, and that a state of knowledge imperialism will take hold, where researchers in developing countries, through lack of access to reliable

research information, will have to receive foreign aid of a different sort (Arunachalam, 1999: 470). The latter seems to have manifested itself, post this 1999 prediction by Arunachalam, with initiatives such as HINARI, and AGORA. He adds that developing countries will be further marginalised, with an increasing inability to "…contribute to, and take advantage of, knowledge in the sciences" (Arunachalam, 1999: 465). Furthermore, the exposure of journals from developing countries to the wider scientific community is severely constrained, where only 13% of the 140,000 periodical titles indexed in 'Ulrich's Directory of Scientific Serials' are from developing countries (Arunachalam, 1999: 476), and where "China and India in Asia, South Africa and Nigeria in Africa, and Brazil, Argentina and Mexico in Latin America dominate the scene" (Arunachalam, 1999: 476). The latter attests to disparities between developing countries themselves with respect to the relative degree of exposure of their research output. That said, a more recent indication is that the proportion of publications from non-Western countries indexed in the ISI Science Citation Index (SCI) has increased (Swan, 2004), as illustrated in Table 2 below, and that beyond the ISI SCI, scientific activity in developing countries has grown (Jacobs, 2001).

Table 2 Growth of non-Western scientific output in Science Citation Index

Year	Total number of database records in SCI	Percentage publications from North America and Western Europe (% of total no. of records)	Total real number of publications from North America and W Europe	Total real number of publications from non-Western countries
1983	672,417	75%	504,313	168,104
1993	754,305	70%	528,014	226,291
2003	1,111,397	50%	555,699	555,698

Source: After Swan, 2004.

Lor and Britz (2003) in considering the information flows from south to north, conflate the terms open archiving and self-archiving, and promulgate these as a means whereby African scholars may disseminate their findings cost-effectively, as well gain access to global scholarly discourse and output. Later, Britz (2004: 200) highlights the role that Open Access can play in fomenting social justice around information provision, when viewed in the context of information poverty. The International Council for Scientific and Technical Information (ICSTI, 2003) cautions that the needs of developing countries implicitly may

differ from those of developed countries in an age of Open Access, and they ask that stakeholders remain cognisant of the same.

Marginalisation on the technology front so easily leads to marginalisation on the science front, a situation characteristic of many scholars in developing countries. In the pre-Internet era of scientific communication, scholars in developing countries (and by extension their laboratories and libraries) were marginalised due to geographical isolation; due to the developing country-specificity of their research; or as in the case of South Africa for many years, due to sanctions. Open Access is regarded as a means whereby developing country scholars may increase their contribution and exposure to the scholarly cannon. In this regard, a number of Open Access initiatives with developing countries as their focus have been started. Some of these are described in the next section.

Initiatives with a developing-country focus

Earlier in this chapter I briefly described the initiatives of publishers to provide free or reduced cost access to scientific literature in developing countries. The notable initiatives here are HINARI, AGORA, and INASP-PERI. Other frequently mentioned initiatives with an overt focus on developing countries are the Public Knowledge Project, Bioline, African Journals Online (AJOL), and the SciELO/BIREME initiative.[66] What follows is a brief description of these aforementioned initiatives. It should be noted that none of these projects were listed in the questionnaire instrument when assessing awareness of Open Access. These initiatives demonstrate that access to content in developing countries is of concern to scholars, librarians, and publishers in developing- and developed countries.

Echoing the ethos of the Open Society Institute, the Public Knowledge Project[67] (PKP), a Canadian initiative, concerns itself with greater public access to research output so as to foster more vibrant and open democracies. It thus has the general aim of improving relations between science and society. At the same time, it concerns itself with issues surrounding Open Access. The PKP has been particularly active in highlighting the plight of researchers in the developing world. More to this, the Public Knowledge Project has also developed the Open Journal System, software which can be used to create and manage

[66] A comprehensive list of publishing initiatives aiding developing nations, can be found at http://www.library.yale.edu/~llicense/develop.shtml
[67] http://pkp.ubc.ca

an online journal and to organise conferences. Bioline[68] is a not-for-profit publishing initiative aimed at lessening the divide between North-South research, and more pointedly hosts a number of bioscience journals from developing countries, South Africa included. African Journals Online (AJOL)[69], an initiative of the International Network for the Availability of Scientific Publications (INASP)[70] provides exposure to as many as 175 African research journals in 2004 (it launched with 10 journals in 1998). Covering a broad range of disciplines, AJOL makes tables of contents and abstracts freely available. Full-text of articles is handled via traditional document delivery methods, where only users outside of developing countries are charged for these document delivery transactions. The SciELO (Scientific Electronic Library Online)[71] initiative makes available a range of research output from Latin America, either as abstracts and/or full-text.

Scholarship and scholarly communication in South Africa

Brief history

The history of scholarship and scholarly publishing in South Africa has largely gone undocumented[72]. Whereas Grey (2000: 163 – 188) writes about "Academic publishing in South Africa" in the volume entitled "The politics of publishing in South Africa", she devotes most of the chapter to a description of the South African tertiary textbook market, historically and where to it might evolve, rather than scholarly publishing of monographs and journals. However, in a brief section which does address the latter, she mentions the demise of the scholarly monograph due to small print runs and the high prices of these, adding that "…the under-funded universities are reluctant to put any subsidies into making African research available" (Grey, 2000: 182). She predicts that the future for African scholarly publishing might well be electronic, and that South Africa could play a pioneering role in this regard if it is prepared to seize the opportunity.

I should add that Grey's contribution to this volume is written from the perspective of the publishing community. As such, when she writes of the first university press founded in ca.

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[68] http://www.bioline.org.br/
[69] http://www.inasp.info/ajol/
[70] http://www.inasp.org.uk
[71] http://www.scielo.br
[72] Plug, C. 1996. South African science in the year 1896. South African Journal of Science. Vol 92: 1 (January 1996) provides a chronology of science in South Africa covering the period 1596 to 1896, with particular focus on developments in 1896. However, he cites no sources and as such, I wonder about the accuracy of the article. My stating the latter is not a contradiction of my having stated that the history of science has largely gone undocumented. Rather, I would expect Plug to have at least provided detail of primary sources, if these were what he had used to compile the article.

1925, established to publish a journal and monographs on African Studies, she writes from the perspective of the 'activity of publishing' rather than the 'scholarly endeavour'. First of all, the fact that the university press had been established at that time to publish this particular journal should not be read as that journal being the first ever scholarly journal to be produced in South Africa. Furthermore, her analysis is wanting since she focuses on the domain of African Studies and how this has evolved over time. The latter implies that South African, or for that matter, African scholars, could only make meaningful contributions to science if their scholarship were limited to African Studies. What this loses sight of is that an African scientist publishing on Physics, or say, Chemistry, will not have this African slant. And so it can be said for a number of disciplines beyond the social sciences. In effect, we are nowhere nearer to any knowledge about what the first scholarly journal in South Africa had been, meaning here one produced on African soil. For sure this history is complicated by the fact that South Africa has numerous colonial influences, and as such, would have been exposed to, and in all likelihood adopted and participated in, scholarly practices from the former colonial countries such as Britain and the Netherlands.

Plug (2004) relates some of the history of South African science in an article chronicling the major scientific developments in 1904 (See also Plug, 1996). In the 2004 article he makes mention of the "South African Quarterly Journal" publishing an article in 1830 titled 'Remarks on the geology of South Africa'.

Moving on to more recent history, Mouton and Dowling (2001: 48) describe the isolation South African scientists experienced during the 1970s and 1980s, due to their being ostracised by the international academic community. The latter scientific isolation formed part of general international bans on contact with South Africans due to apartheid legislation and practices of the time. "This meant a lack of scientific contact, banning from scientific conferences, rejection of scientific publications and a general lack of international scientific collaboration" (Mouton and Dowling, 2001: 48).

More recent history I can relate from personal experience. Up until 1999, as many as 21 scholarly journals were government sponsored. An example here is that of the Linguistic Society of Southern Africa, which published its journal, the *South African Journal of Linguistics*, jointly with the 'Foundation for Science, Education, and Technology' (FEST), with financial assistance from the Department of Arts, Science, Culture and Technology

(DACST). The printing press responsible was the government-funded Bureau for Scientific Publications. The year 1999 was a watershed in that 16 of the 21 sponsored journals would lose their continued funding and scholars were forced to consider alternative means for survival. A full treatment of the latter winnowing process can be found in Pouris and Richter (2000). Particularly, the options facing the Linguistics Society of South Africa was to merge the journal with that of another society, and co-publish in this manner; or take the journal to a purely electronic/online instantiation (made possible through a saving on printing and posting costs); or discontinue the journal. It must be said that the latter option was hardly mentioned as an option.

At about the same time that the FEST delivered this shake-up, a key player in the information market in South Africa was gearing up for the electronic hosting of scholarly content. SABINET, a bibliographic service provider in South Africa, developed its e-Publications[73] platform for the making available of South African research. SABINET limits its role to the mark-up of content for electronic availability and the making available of this e-content, and does not regard itself as a publisher. All the journals made available in the e-Publications platform, have print equivalents printed by other printing presses. As such, the focus of the scholarly societies still seems to be one of 'print first, electronic second'. Prior to e-Publications being launched in early-2002, I was requested to test the usability of the system's interface in late-2001. At present close to 200 journals are made available via subscription to the e-Publications platform. Another player in this scholarly publications market in 2000 was NISC. The difference between the SABINET and NISC model is that NISC does regard itself as a publisher, and as such, produces both the print and electronic copies of journals. To date NISC publishes a small number of South African scholarly journals.

The SAPSE system

Higher education institutions[74] in South Africa receive funding from the state Department of Education (DoE), previously based on a funding formula which considers the number of students enrolled, the number of degrees awarded, and the publication output[75]. This funding management information system was referred to as the South African Post

[73] http://journals.sabinet.co.za/WebZ/Authorize?sessionid=0&next=ej/ej_search.html&bad=error/authofail.html

[74] Formerly, universities and technikons. As of 2004 many institutions are being merged, and technikons are being renamed 'universities of technology'.

[75] Science councils do not receive this state subsidy for publication output.

Secondary Education (SAPSE) system. The 2004 and 2005 academic years see the migration to a new management system, referred to as the Higher Education Management Information System (HEMIS). With the HEMIS system funding will be based on publication rate and the postgraduate graduation rate.

Generally when faculty refer to the 'SAPSE system', they are invariably referring to the system whereby those in academia receive subsidies from government for each publication produced per annum which has been published in a DoE accredited journal. The system is similar to that used in Australia and Spain (Butler, 2004). The Department of Education (DoE) maintains a list of scholarly publications which it accredits.

This list of accredited journals, referred to as the SAPSE list, has three points of origin:

1. journals listed in the Citation Indexes of the Institute for Scientific Information (ISI);
2. a list[76]comprising local scholarly journals (those not already indexed by the ISI) and international scholarly journals (not indexed by the ISI but which are frequently used by South African scholars) which have been accredited by the DoE upon having met the criteria for inclusion in the overall SAPSE list; and;
3. the list of journals maintained by the International Bibliography of the Social Sciences (IBSS)[77].

The SAPSE list provided in December 2003 listed 197[78] South African journals accredited by the DoE, with about 30 South African journals indexed by the ISI. Thus far, and results from the survey will show that, SAPSE funding has been a major barrier to the adoption or evolution of Open Access journals in South Africa.

Debates around funding linked to publication counts is beyond the scope of this thesis, though it is expected that results for South Africa would be similar to those stated by Butler (2004) where it was found that there was a marked increase in output in low impact

[76] I will refer to this list as the South African journals list, meaning journals either published by South African scholarly societies, or journals published outside of South Africa and not indexed by the ISI, but which have become popular among South African scholars within a defined discipline.
[77] http://www.lse.ac.uk/collections/IBSS/Default.htm Established in 1951, and published by the London School of Economics and Political Science since 1989. The IBSS is funded by the Economic and Social Research Council (ESRC), the Joint Information Systems Committee (JISC) and The London School of Economics and Political Science (LSE), all within the United Kingdom.
[78] See Appendix N for the Stellenbosch news bulletin "New Policy for Accredited Journals from 2004".

journals in Australia due to publication-linked funding. Similarly, South African scholarly journals (save for those indexed by the ISI) can be regarded as low impact journals[79]. Since the DoE assessment of scholarly authors is quantitative, the relative quality of the publication in which their work appears is almost irrelevant, since they receive funding for having published in a DoE accredited journal regardless of its impact factor. I hasten to add that a low impact factor does not denote a journal of poor quality. It is the case that some journals deal with highly specialised areas of investigation which by definition would have a small number of contributing authors. Journals in languages other than English also suffer from a low impact factor, or sometimes journals dealing with issues specific to a particular country or region (e.g. a developing country) might also have a low impact factor as a result. In sum, it can be said that journals which deal with areas at the margins of the Western Science agenda tend to have low impact factors. Pouris and Richter (2000) indicate the reasons authors gave for publishing in South African journals, as follows:

- Assessment of the journal as the best for the particular paper;
- A link with a series of papers or to contribute to a special issue or focus;
- The regional significance of the work or intended audience;
- A wish to contribute to local scholarship or to support local journals;
- SAPSE accreditation;
- Rapid publication time;
- Judgement that the paper was not good enough for an international publication.

As is evident from the above, the choice of a local journal above an international one is driven by a number of factors.

Scientific productivity in South Africa

Pouris reports in 1995 that in a global context, South Africa produces 0.5% of the world's scientific publications and 0.1% of the world's patents, with researchers numbering 0.5% of the world's researchers. However, when situated within and viewed on the African continent, South Africa produces as much as 50% of the continent's publications when measured in the Institute for Scientific Information's (ISI) citation indexes, and that South

[79] The impact factor of a journal is calculated by the ISI and forms part of the selection criteria for inclusion in their indexes. It is based on the number of citations for a given journal. It is argued that journals with high impact factor, in effect highly cited journals, tend to represent the central core of the research for a discipline/domain, and are generally highly regarded by peers. However, numerous deficiencies with respect to impact factor are and have been argued i.a. by Braun (2004). A comprehensive introductory treatment can be found in Borgman and Furner (2002).

Africa produces 98% of African patents awarded by the United States Patent and Trademark Office (USPTO). I would here add that the ISI's citation indexes are generally perceived to favour the natural sciences, and to not adequately represent the social sciences, especially humanities (Mouton (2004); Mouton and Dowling (2001: 66). Considering the latter, it might be that South Africa's proportion of publications produced is higher.

That said, Mouton and Dowling (2001: 53) cite Pouris' bibliometric[80] analyses covering the periods 1988 to 1996. They indicate:

> His analyses clearly show how South African scientific output had a gradual growth between 1980 and 1987… Over that same time, South Africa's output as a proportion of world output, increased from 0.4% to nearly 0.7%. However, after peaking in 1987, overall output has remained pretty much the same at an average of 3300 publications per year until 1994. In terms of world output, this in effect has meant a drop in proportion of world share from 0.7% in 1987 to 0.4% in 1994.

A more recent bibliometric study by Pouris (2003) covering the period 1995 – 2000, indicates an increase in the absolute number of publications for South Africa. He concludes however that when aggregate South African research publication output is situated within a global context, South Africa is in fact losing ground and that "(t)he overall picture of South African science, as measured by the ISI data, is one of deterioration and decline" (Pouris, 2003: 426). An exception to this general decline is the Social Sciences and Humanities in South Africa, which showed an increase in world proportional research publication output between 1995 and 2000 (Pouris, 2003: 427). The latter is significant when viewed in light of the empirical structured record review undertaken as part of the study for this thesis. The structured record review is described in Chapters 4 and 5. Pouris (1996) attributes the publication growth in the Social Sciences and Humanities as a probable "...side-effect of the enlargement of social sciences faculties at South African universities". Pouris argues further (2003: 428) for the implementation of adequate policy measures to bolster South Africa's research impact and publication record if it wants to be regarded as an African intellectual and educational hub.

[80] Bibliometrics is a quantitative approach which refers to the tallying of citation counts to research articles. It is a method with which to monitor scientific production.

Again, it should be borne in mind that Pouris' analyses focussed on publications in the ISI indexes, and that a fair number of South African journals are not indexed by the ISI. Mouton and Dowling (2001: 48) indicate that 205[81] South African scientific journals are accredited by the South African Department of Education (and so authors publishing in these journals may claim article publication subsidies from the State); and that only 30 of these journals are indexed by the ISI. In 2004 this situation as described by Mouton and Dowling has remained relatively unchanged.

An elaboration on the above from the perspective of article counts. In 1984 the number of South African articles indexed by the ISI was 2423; in 1987 that figure rose to 3469 publications; which rose even further in 2000 to 3592 publications. When compared to world output, South Africa produced 0.5% in 1981; 0.67% in 1987; and declined to 0.49% in 2000 (Pouris, 2003: 425-426). In real terms, South Africa's research output has grown, but when compared to world output, South Africa's research output has decreased.

Considering trends within the South African scholarly arena, Stellenbosch University's Centre for Research on Science and Technology reports (Boshoff and Mouton, 2003: 231) that South Africa's scientific workforce is ageing and that some 49% of South African scholars publishing during 2000 were older than 50 years of age. Further, that few young academics are either attracted into the system, or do not have the time or incentive to publish, or a combination of these two factors.

Given the aforementioned structural problems, it seems cogent to consider whether Open Access initiatives may work some way towards alleviating the situation. Further, since the problems are identified at the national (cf. regional, or sectoral) system of innovation, it seems obvious to ask whether concomitant national information policy is required to address the issue. This facet is taken further in the next chapter.

[81] The discrepancy between the total number of journals on the South African journals list is noted. Earlier in this section I indicated that there are 197 journals on the South African list provided in December 2003. Mouton and Dowling's figure of 175 (i.e. 205 minus 30) dates back to 2001. The discrepancy can be attributed to the continued revision of the SAPSE South African journals list. Said revision of the list began in 2001. The figure of 197 journals is from the list provided on the Stellenbosch University Web site. (See also Appendix N).

Beginning with a brief historical overview of scholarly communication, I have gone on to describe various theories and definitions of the Information Society. Theories of the Information Society form the foundation for fundamental changes in scholarly communication, having provided momentum to these changes in the latter half of the 20th century. Open Access was elaborated upon as one current model of these aforesaid changes in scholarly communication. Open Access is a very real expression of a shift in emphasis in the developed world from network infrastructure roll-out, characteristic of early discourse on the Information/Knowledge Society, to an emphasis on content and services. The case of scholarly communication in developing countries was described, followed by a description of scholarship in South Africa.

Chapter 3
National Information Policy and the National System of Innovation

The aim of this chapter will be to first demonstrate the varied definitions of information policy, and describe the national information policy process to date in South Africa. Thereafter the National System of Innovation framework is introduced. The central role of universities in the National System of Innovation is described, which suggests that any legislation which changes scholarly communication practices, will have consequences for the National System of Innovation.

Building on chapter 2, Fuller (2002: 173) sets the tone for Chapter 3 when he says:

> [H]istorically the only reliable way to prevent the introduction of a new technology from redrawing and sharpening already existing class divisions in society has been government regulation."

National Information Policy

Information policy as public policy

"Policy" refers to a statement or set of statements in which goals are set, and a programme is developed, by decision-makers in response to conditions in a particular society (Kotzé, 1999: 4). The study of public policy is defined as "…studies of what governments do" (Jackson and Jackson, 1997: 28) and "…analyzes and evaluates policies in areas such as defense, health, education, and resource development"(Jackson and Jackson, 1997: 29). As Dye (1998: 2-3) indicates "Public policy is whatever governments choose to do or not to do."

Though policies can be developed in the private sector, it is mainly public sector and government-driven policies which give expression to and aim to address a society's needs. Information policy, as a subset of public policy, finds expression in all manner of public policy documents. Public policy sources range from election manifestos; discussion documents such as Green and White Papers; legislation; national budgets; policy statements such as speeches and articles; international and interstate agreements; and the actions of decision-makers (Kotzé, 1999: 32). Information policy may also be sourced in the aforesaid

documents. Surveying the literature one may broadly conclude that 'Information policy' refers those policies which set standards for or limits to the storage, use, and exchange of information goods or -services. Still surveying the literature, and using the latter broad definition, one may find a range of references to policies using varied and varying nomenclature. Some such examples are 'information and communications policy' (Cogburn, 2003); 'information policy' (Rowlands, 1996; Browne, 1997a, 1997b; Weingarten, 1996; Dick, 1998; Benkler, 1998); 'policies for an information society' (Moore, 1998); 'information society policy' (Melody, 1995; Van Audenhove et al., 1999); 'information and communications technology policy' (Van Audenhove, 2001).

Telecommunications policy may also be added as a subset of information policy, where the focus is on improving and/or regulating access to telecommunications, in what is often referred to as 'universal service'. Universal service, in effect high teledensity, is usually circumscribed as having a fixed telephone line within a certain radius from each citizen. Taking telecommunications policy to the next level of services (up from infrastructure), we find that universal service would promote access to government and health information, commonly referred to as 'ICT for development'. The latter aim is not to be confused with giving scientists greater access to information resources. In order to effect the latter, we need information policy.

Defining information policy

Rowlands (1996) and Browne (1997a, 1997b) provide a lengthy unpacking of the term 'information policy', their central claims being that the disciplinary boundaries of the term are vague, and that those within the discipline of information studies seem to have a clearer idea of the sense and limits of the term than those outside of information studies. That said, maybe a number of specific definitions will add clarity, or provide a general sense of the remit of the term.

Benkler (1998, 3) opines: "Information policy consists of a set of commitments a society adopts about how information ought to be produced, processed, stored, exchanged, and regulated."

Furthermore, Moore (1999: 703), identifies a number of stakeholders in an information society (see Fig. 3 below), and possibly it is best to then limit any definition of 'information

policy' to any policy which somehow addresses issues for these stakeholders concerned. Moore, writing from a library-centric point of view, graphically emphasises the role of 'libraries and information service' through Fig. 3, as denoted by the relatively larger circle encompassing 'libraries and information service'. I would like to emphasise though that for the purposes of this study, the circle sizes of these Venn diagrams in Fig. 3 are immaterial.

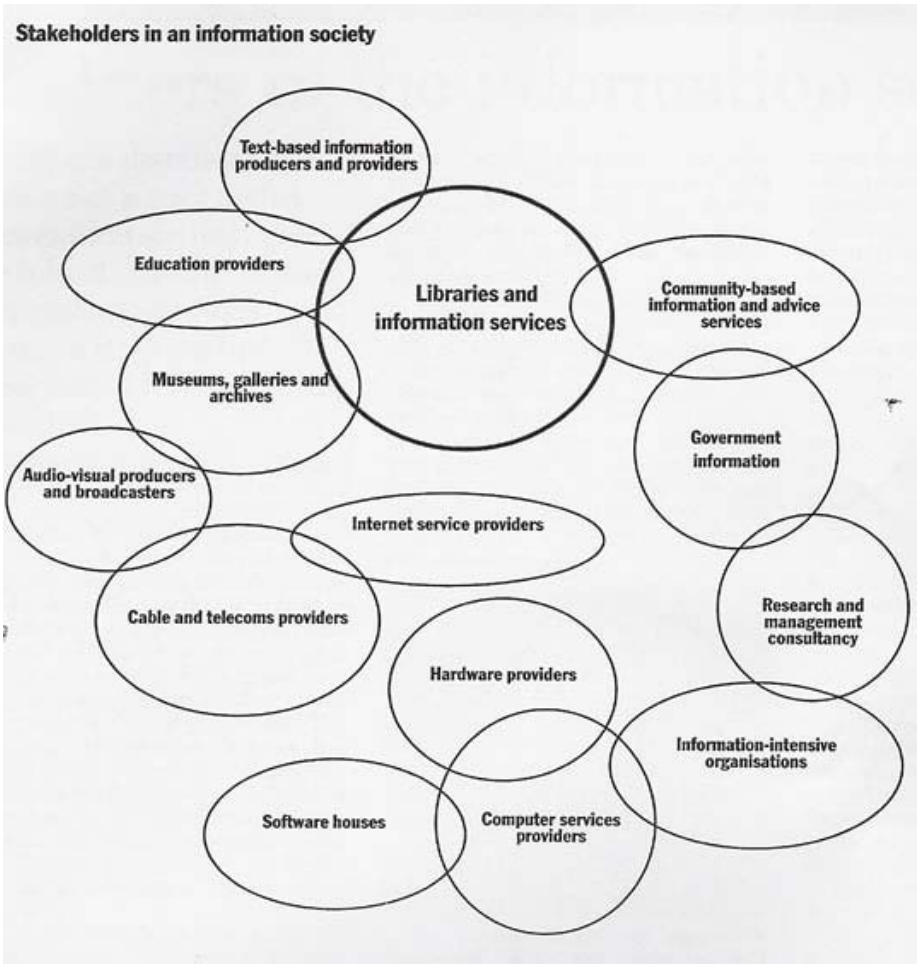

Fig. 3 Stakeholders in an Information Society (Moore, 1999: 703)

Compare Moore's stakeholder framework illustrated above, with Rehman's definition (Rehman, 1996: 186) as illustrated in Fig. 4 below. Rehman identifies "influencing spheres" which need to be considered when defining the term 'information policy' and more specifically 'national information policy'. He attempts to define the scope of information policy. As can be seen from Fig 4, policies regarding communication, education, science, industry, economics, trade, health, environment, agriculture, and culture, inform

information policy. Rehman argues for the latter specifically with regard to national information policy.

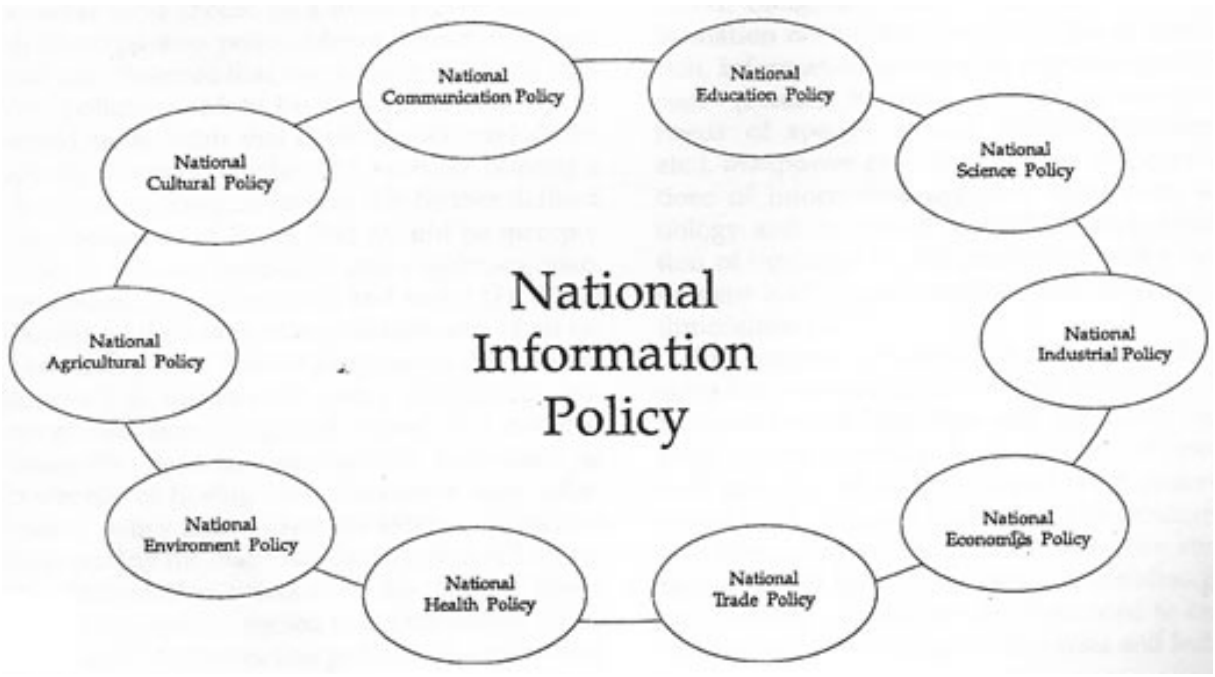

Fig. 4 Scope of Information Policy (Rehman, 1996: 186)

Moore and Rehman's definitions taken together, it is to be expected that many information-related issues will be articulated in diverse areas of policy, covering for instance, science and technology policies; and in what is sometimes referred to as innovation policy (Davis, 1995: 82); and even economic policy, as all are so closely interlinked and interdependent. In fact, Davis (1995: 87) uses the terms 'science policy', 'science and technology policy', and 'innovation policy' interchangeably.

It is thus no surprise that Rowlands (1996: 14), quoting Weingarten, defines information policy as "…the set of all public laws, regulations, and policies that encourage, discourage, or regulate the creation, use, storage, and communication of information." Furthermore, Rowlands (1996: 14) speaks of "information *policies*" (my emphasis) and that they "…tend to address specific issues and, at times, to be fragmented, overlapping and contradictory." Hodge (2001) adds that "Information policies are developed and enacted at all geopolitical levels – local, national, regional and international. All levels impact the way that people disseminate, collect, use and redistribute information."

A number of authors have defined levels or hierarchies at which information policy may be drafted and implemented. Of note here is Muir and Oppenheim's (2001) *Report on Developments World-Wide on National Information Policy*. The authors make a distinction between technology-centred policies and information-centred policies. As such, they exclude from their analysis policies focussing on telecommunications development, ICT sector development, and policies focussing on teaching technology skills. Rather, they held within their purview information-centred policies concentrating on aspects of e-government; content creation and delivery; heritage and legacy preservation; quality of information; universal access; e-commerce; legal deposit; intellectual property rights; freedom of information; data protection and privacy; and information literacy. I will return to this point later, but mention here that parallels can be drawn between Muir and Oppenheim's technology vs. information distinction, and what I later term the distinction between infrastructure, versus content and services which run on the infrastructure (i.e. use of the infrastructure).

In addition to that of Muir and Oppenheim, other information policy hierarchies are that of Rowlands (1996: 15), and Weingarten (1996: 45). Whereas Rowlands (1996: 15) draws a distinction based on whether a policy provides a social or economic backdrop; can be applied to the entire information sector; or whether it can only be applied within a particular information sector, Weingarten (1996: 45) draws a distinction between formal policies (i.e. government defined) and informal policies (i.e. society or organisationally-defined). The hierarchies of Rowlands and Weingarten are illustrated below in Tables 3 and 4 respectively.

Table 3 Rowlands' Information Policy Hierarchy

Level of hierarchy / type of policy	Characteristic(s)	Example(s)
Infrastructural policy	Applies across society; affects information sector directly or indirectly; provides social and economic context.	Tax or employment law; freedom of establishment; education policy
Horizontal information policies	Has specific application; impacts across the whole of information sector	Statutory provision of public library services; zero-rated VAT on books; data protection law.
Vertical information policies	Has specific application to particular information sector	Geographic information community

Source: After Rowlands, 1996: 15

Table 4 Weingarten's Hierarchy of Information Policy

Formal Policies	Example Information Policies
1. Constitution	First Amendment, intellectual property
2. Legislation	Privacy act, Copyright law, Freedom of Information Act
3. Regulation	Federal and state telecommunications regulation
4. Common law	Libel, slander
Informal Policies	**Example Information Policies**
5. Standards and guidelines	Fair information principles for private personnel records
6. Organizational rules	E-mail confidentiality in private firms, security policies
7. Mores and norms	Don't read other people's e-mail. Don't lie. Don't swear.

Source: Weingarten, 1996: 45

The elaboration of various definitions of information policy, and national information policy in particular, aimed to provide the reader with a conceptual overview of the domain. To conclude this section, I would like to emphasise that the definition used in this study

limits itself to formal policies (as per Weingarten), acknowledges the overlap of information policy with science-, technology-, and innovation policy (as per Davis), and remains cognisant of the scope of information policy (as per Rehman).

National information policy in South Africa

The approach taken in information policy development in South Africa is characterised as "…seldom coordinated, both in 1994 and subsequently…"(James, 2001: Ch3 - Section 2) and that "…to date the policy processes are still very fragmented"(James, 2001: Ch3 - Section 4). In many respects, the approach to information policy development in South Africa has been bottom-up, with a number of different public- and private sector bodies formulating policies.

The South African process is described by James (2001) as having evolved through four periods, namely, transition (1989 - 1994); transformation (1994 - 1997); implementation (1997 - 2000); and an evaluation and policy reformulation period (2000 - present). Van Audenhove (2003b: 139) adopts the categorisation of James for the period spanning 1995 to 2002. He notes in an article published as recently as 2003 that South Africa's information policy implementation was seriously flawed, especially with respect to telecommunications policy. He notes further (2003b: 133) that "…South Africa is aware of the enormous imbalances in the flows of information." and that "South Africa sees itself…as a possible forerunner for the rest of the continent in producing and exporting African content." The latter however refers to cultural products e.g. entertainment.

A host of policy documents have been produced, addressing a range of information-related areas. Broadly speaking, and echoing Muir and Oppenheim (2001), these policy instruments have mostly addressed technology issues rather than purely information provision issues. A comprehensive list of these policy instruments can be found in Appendix I. The purely information provision types of policy instruments are:

- National Council for Library and Information Services Act (NACLIS) (Act 6 of 2001);
- Promotion of Access to Information Act (Act 2 of 2000);
- National Library of South Africa Act (Act 92 of 1998).
- Legal Deposit Act (Act 54 of 1997);
- National Archives of South Africa Act (Act 43 of 1996);

In line with the definition I used for national information policy, it will be evident that there are considerable overlaps between information policy documents and science/technology/innovation policy documents.

In an official communication from the Ministry of Posts, Telecommunications and Broadcasting in South Africa, it was reported that selling a minority stake in Telkom, the national telecommunications monopoly, was based on a "…vision to improve the quality of life of all our people, make South Africa a knowledge-based society, and help create an information economy" (MPTB, 1997 as quoted in James, 2001:Ch.3 - Section 4).
The NITF (National Information Technology Forum) position paper (1996), the COMTASK report (1995), as well as the White Paper on Science and Technology (1995/6), all address South Africa's incorporation into the Information Society and the concomitant need for information policy. And again in 2002, the Presidential National Commission on the Information Society and Development (PNC on ISAD) has been established to address this issue.

During 1994 to 1998 in South Africa, the information policy process was high on national agendas and many initiatives were launched as a result. Subsequent to the aforementioned timeframe, coinciding with a change in President in South Africa, the national focus has shifted from overt technological development to socio-economic development for South Africa. The latter shift may be in line with a general trend as indicated by SAITIS (2000: 33). With the advent of the New Partnership for Africa's Development (NEPAD) initiative, a pan-African initiative aimed at improving governance and socio-economic conditions across Africa, and which falls under the auspices of the African Union, the focus across the African continent has shifted to, among others, infrastructure rollout, as attested to by the NEPAD Infrastructure Strategic Action Plan (NEPAD, 2002). NEPAD also has a strategic framework with regard to Science and Technology (NEPAD, 2003b).

Legal Deposit Legislation (the Legal Deposit Act of 1997 - Act 54) in South Africa makes provision for the establishment of Official Publications Depositories (OPDs) which, in addition to the role already played by the National Library of South Africa, allows for the deposit of publications at additional so-designated institutions. A strict interpretation of the law would indicate that the depositories would house 'official publications', for which read,

'government publications'. Furthermore, the Act does make provision for the law requiring legal deposit to extend to all public institutions, which if liberally interpreted, could include universities within its remit. The legislation is important since it can be seen as an enabling factor in the creation of nationally-driven digital repositories. An additional point of note is that the ethos underlying the legislation is for the public to obtain easy access to documents produced by publicly-funded institutions. Provision is made within the legislation for the creation of at least one OPD per province (there are nine provinces in South Africa). Thus far, and very recently, one OPD has been designated as such. Lor (2003) indicates that due to reshuffling of government departments, designation of OPDs has been slow to occur. However, on 17 March 2004 (Notice 1131 of 2004, published in the 25 June 2004 Government Gazette) the first OPD was indicated, namely the Constitutional Court Library.

The South African Research Information Service (SARIS) project, funded by the Ford Foundation and administered by the Council for Scientific and Industrial Research (CSIR) in South Africa, was initiated in 2004 with series of consultative workshops at various higher education institutions throughout South Africa. The aim of SARIS is to centrally coordinate initiatives which promote access to research in South Africa, and proposes the establishment of an agency which would promote the latter. The areas which would gain attention are (SARIS, 2004:15):

- Component 1: e-Science facilitation centre
- Component 2: Content provision (research literature/publications)
    - 2(a) An enhanced National Site Licensing Initiative (SASLI+)
    - 2(b) SA Open Access Infrastructure (SOAPI)
- Component 3: A Digital Curation and Preservation Resource Centre
- Component 4: Management of sustainable e-print repositories
- Component 5: Register of SA Research Outputs
- Component 6: Innovation Projects Centre
- Component 7: Web-based Support System (SARP)

Since the areas indicated above are from a discussion document, it is possible that they might change as discussions around the document evolve. My initial assessment however is that far too much emphasis is placed on the creation of a one-stop-shop system and the management of commercially acquired information, and that the discussion document disregards the differing research practices of the various research cultures e.g. the emphasis

on e-Science (akin to the ACP project of the United States) loses sight of the fact that not all research is driven by intensive analysis of vast quantities of data. That said, the sheer scope of the SARIS project is laudable, though I consider it too ambitious in its current formulation, when compared to my proposal for mandating Open Access as discussed in Chapter 6 below.

Information regulation: the information commons

Information policy and information law seem to be 'two sides of the same coin'. As such, debates around Open Access scholarly communication are not the sole preserve of information scientists. When discussing Open Access scholarly communication, it is difficult to ignore or disregard debates around the notion of Commons frequently encountered in the Law literature. A commons is traditionally communal land or a resource which citizens may freely make use of, and has its origins in the communal tracts of land used by farmers to graze cattle and grow food (Kranich, 2004: 10). These communal lands increasingly became proprietary property, and as a result became governed by associated laws regulating ownership of private goods. I shall here briefly mention arguments relating to the maintenance, if not resurrection, of what is referred to as the information commons.

Kranich (2004: 11) refers to two types of legal regimes which govern commons, namely open access (a.k.a. 'no property') regimes and common property regimes. The use of the term open access here should not be confused with the use of 'Open Access' as defined in scholarly communication debates. Though it is true that some Open Access initiatives make use of the open access legal regime, not all of them do. Simply put, 'Open Access' does not automatically entail 'open access'. Kranich (2004: 11) circumscribes an open access legal regime as one where "…nobody has the legal right to exclude anyone else from using the resource…" Common property regimes are of the sort which govern the use of, for instance, public transportation, public services, and the like. The latter are all public goods. A public good is a good or service where the increased consumption by one person does not decrease the quantity of the good or service available for others[82], and furthermore, no one can be prevented from consumption of the good or service in question.[83,84] Benkler (2003: 7) adds that information as a public good is "…necessary for efficient and innovative information production systems…"

[82] Non-rivalry
[83] Non-excludability

An initiative aimed at promoting the concept of information commons, is that spearheaded by Lawrence Lessig, namely the Creative Commons, established in 2002. The initial reasoning behind the initiative was to permit authors to express the degree to which their works might be used by others through the attachment of a 'commons deed'. Prior to the existence of such 'commons deeds', authors and creators of artistic works had two options when wanting express rights ownership over a creative work. Works were either automatically copyrighted with 'all rights reserved' regardless of whether copyright had been explicitly indicated or not. The opposite extreme of this copyright regime was to designate a work as being part of the public domain. These two opposing poles of rights expression made no allowances for more nuance of use, and as such, the Creative Commons was initiated. What the latter permits is for authors/creators to designate whether their work might be used with or without attribution by others; whether royalties could be earned from any derivative works or should only be used for non-commercial purposes; and whether any such derivative work should only be made available under similar licensing terms. These commons deeds are composed at three levels of comprehension, as it were, one copy of a deed is written in 'plain English', the second format is the equivalent legally correct document, and the third instantiation is a machine-readable format.

Besides these initial primary objectives, Creative Commons has effected a number of project offshoots, such as an internationalisation effort. What the latter entails is the translation of the legal document (based on and in the system of Jurisprudence of the United States) into country-specific formats which will stand up in courts of countries[85] outside of the United States. At the time of writing South Africa does not yet have a country-specific 'Commons deed', but does have an official presence in the global Creative Commons effort.[86]

Another Creative Commons license to note is what is referred to as the Developing Nations[87] license which, when used, indicates permission to users in the developing world

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[84] Non-rivalry and non-excludability are terms encountered in the Economics literature. (Taylor, 2001: 343)

[85] Countries with country-specific commons deeds (December 2004): Austria, Belgium, Brazil, Canada, Germany, Spain, Finland, France, Japan, Netherlands, Taiwan.

[86] http://za.creativecommons.org

[87] http://creativecommons.org/license/devnations/

to make royalty-free use of the work in question, whereas full copyright is retained by the author/creator in respect of users in the developed world.

National System of Innovation

Innovation, at a technological and organisational level, is generally regarded as a key driver of economic growth in industrial economies (Solow, 2003: 1). According to Smits (2002: 875) innovation theories to date have had two approaches, namely one which focuses on processes of innovation, and one which focuses on systems of innovation. The process model tends toward micro-level analysis of firms and organisations, whereas the systems model tends toward macro-level analyses, be it at sectoral, regional, national, or international levels. The systems-level approach acknowledges the role of various actors in innovation, and of how these interact and possibly influence one another. What the latter amounts to is an acceptance that no one actor in innovation is the sole innovator, but rather that interactions between economic actors are also important, and that in effect, the innovation policy environment is a complex one[88]. Furthermore, the quality of research originating in the public sector[89] is seen as a key strength in any country's system of innovation (Larédo and Mustar, 2001b: 501 - 502).

In the sections which follow, I define the term 'innovation', and then elaborate on the economic theory infusing innovation theory. Thereafter, innovation theory and innovation policy are described, before a definition of National System of Innovation is provided. Then the National System of Innovation in South Africa is elaborated upon, and the chapter concludes with a section on the openness of scholarly systems as propounded by innovation theorists. What is clear is that universities are critical to innovation systems.

Innovation defined

Many authors differ on their definitions of 'innovation', as well as on their views of the contexts in which innovation occurs. Some regard innovation as a purely technical endeavour (Nelson and Rosenberg (1993), as cited by Edquist (1997: 9). The famed economist Schumpeter (as quoted by Edquist, 1997:9) thought that innovation can be seen as the setting up of new functions of production with regard to products or organisations. In turn, and decades later after Schumpeter, Nelson and Rosenberg (1993, as cited by

[88] See De la Mothe (2003) regarding the complex nature of the policy-making environment

[89] Public sector research refers to that conducted within research universities as well as government laboratories, after Larédo and Mustar, 2001b: 508.

Edquist (1997: 9)) thought that operationalising new product designs or new manufacturing processes within a firm was worthy of being called innovation, regardless of whether such new products or processes are novel in any way whatsoever to the world (Edquist , 1997:10). By 'novel' here I mean to indicate that the product or process is entirely new and had not been used before in any place. Of course, what Nelson and Rosenberg are arguing for is that a product or process can be new to a firm, even though the product or process is not new to other companies beyond the firm, and that this 'newness to the firm' is tantamount to innovation.

It would be useful here to introduce Suarez-Villa's distinction between invention and innovation. Suarez-Villa (2000:8), in defining a new world economic order which he terms technocapitalism, defines invention as the "discovery of new processes, tools, or ideas" (2000:8), and innovation he regards as involving "…the application and development of an invention for utilitarian purposes" (2000:8). In effect, according to Suarez-Villa, invention has to do with novel discoveries, whereas innovation is more a matter of diffusing inventions to sectors or places beyond its immediate sector or place of origin. In this regard, Nelson and Rosenberg's definition of innovation, its being so broadly defined, seems close to Suarez-Villa's definition of innovation, yet Nelson and Rosenberg (Edquist, 1997:9) implicitly exclude a concept of invention as propounded by Suarez-Villa. In fact, Suarez-Villa's invention versus innovation distinction seems to echo that of Schumpeter. According to Lievrouw (2002: 193), Schumpeter had the following to say about invention and innovation, "… invention corresponds to the generation of a new concept, while innovation involves its communication or transfer beyond the originator(s)." In contrast, Edquist (1997: 10) describing the definition of Nelson and Rosenberg (1993) indicates no such terminological distinction between invention and innovation, indicating "…their innovation concept includes not only the first introduction of a technology but also its diffusion."

The technology-centric view of innovation seems quite stringent and limiting. A more accommodating view would indicate that innovation can occur at the level of a technological product or process, as well as at the level of the organisation with respect to institutional change.

Edquist (2004 forthcoming: 182) sums up the situation quite nicely when he defines innovation as:

> [P]roduct innovations as well as process innovations. Product innovations are new—or better—material goods as well as new intangible services. Process innovations are new ways of producing goods and services. They may be technological or organizational.

A taxonomy of innovations, as per Edquist (2001), is illustrated in Fig. 5 below.

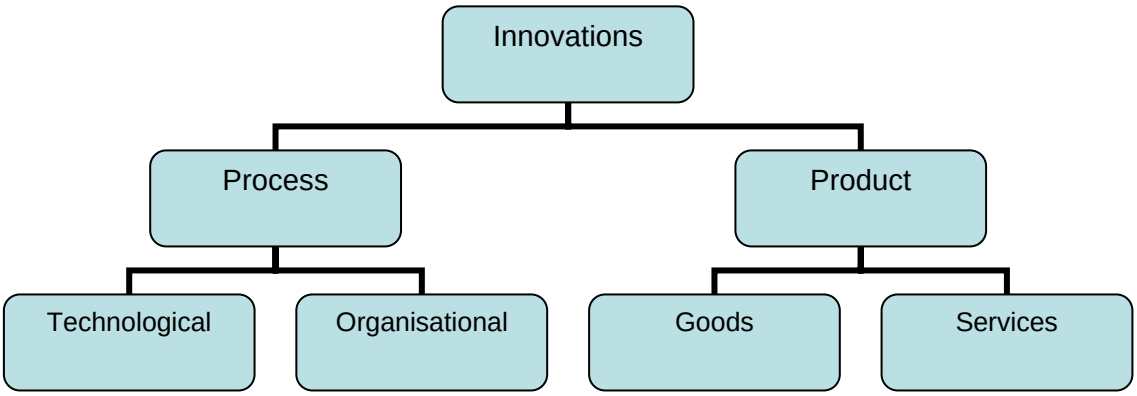

Fig. 5 Taxonomy of innovations (Edquist, 2001)

An even more expansive view of innovation is given by Edquist (2001), when he describes innovation and education as two separate yet associated learning processes. He claims that education entails individual learning which results in human capital. In turn, innovation entails organisational learning which results in the accumulation of structural capital.

Another point of note is the departure from a linear model of innovation, which dictates that innovation starts out as scientific research made manifest through investment in research and development, which results in technology development. In turn the resultant product or process is funded, packaged, and marketed, in essence commercialised. Linear models of innovation have been replaced by evolutionary network models (Etzkowitz and Leydesdorff, 1997: 3-4) such as the system of innovation approach.

Associated economic theory

Innovation theory is grounded in neo-classical and evolutionary economic theory. At first, taking its cue from neo-classical economics, a linear model of innovation was defined, which assumes rational behaviour on the part of economic actors, and where each actor has a definite role which does not overlap with the role of other actors in the innovation cycle. In the latter view, innovation occurred with all the characteristics of a closed system, even though of course the 'systemic' nature of innovation had not been defined as such. Given the increasing role of technology (products and processes) in innovation, theories based on neo-classical economics proved to be inadequate (Saviotti, 1997: 180) hence the adoption of evolutionary theories

With the introduction of the systems approach, grounded in evolutionary economics, the complex nature of innovation with its many actors is acknowledged, where these actors influence one another to varying degrees. Furthermore, the systems of innovation approach embraces the concept of continuous learning by economic agents, a concept inherited from evolutionary economics (Andersen et al. 2002: 188-189). In essence, an innovation system has all the characteristics of an open system.

Soete defines the 'new economy' as "…an economy much more dominated by global influences and by the speed often in real time of information and communication across distance" (Soete, 2001: 22). Where discussions around globalization traditionally centre around trade and foreign direct investment, Soete identifies a new dimension of globalization, characterized by the global impact of new information and communication technologies where value is generated through "…information content, distribution, and consumer interaction…" (Soete, 2001:23) rather than solely material production. What he argues for is a 'new' globalization characterized by international transactions and relations which do not readily reveal themselves in balance of payments statements, are largely intangible, and "…, based primarily on the internationalization of information and knowledge" (Soete, 2001:26).

Alcorn (1997: 79) describes the commonly accepted determinants of economic growth, these being: population demographics; state of the arts (referring to the availability, and use of technology for the production of goods and services); growth of knowledge; available

resources (natural and other); and rate of capitalization ("rate at which society is willing to capitalize or invest in productive capacity" (Alcorn 1997:79)).

Alcorn (1997: 79) circumscribes the 'growth of knowledge' determinant as:

> The degree to which knowledge increases in the society among individuals and the highest level of knowledge obtained by the society as a whole, how generally knowledge is dispersed through education, how specific it is to content (the nature of knowledge), and how easily exchanged and communicated that knowledge is, are important factors in what constitutes the intellectual base of a society and the rate at which new knowledge can be assimilated and put to use.

He goes on to say that the 'growth of knowledge' determinant is generally accepted as the most significant source of long-term economic growth (Alcorn, 1997: 80). Conceição et al (2000: 11) affirm the latter, and regard knowledge as a key for economic development. They add that "(t)he lack of resources and infrastructure to deal with knowledge diffusion, storage, and use in underdeveloped regions is pervasive" (Conceição et al, 2000: 11).

Innovation theory

Conceptually, innovation theory has its origins in the work of the economist Joseph Schumpeter in the 1940s which held that temporary monopolistic control of an invention is the incentive for entrepreneurial innovation. Much later in 1957 Robert Solow (Taylor, 2001:496) delineated the growth accounting formula within the context of neo-classical economic growth theory. Solow's formula was used to measure the growth rate of productivity based on the relative contributions of capital and technology. Prior to Solow's work, productivity was measured solely in terms of capital. Measuring growth in terms of capital has its roots in the works of Taylor. The role of technology had not been factored into the measurement of productivity growth up until 1957. The latter does not signify that the idea of factoring in technology had not occurred to scholars predating Solow. In fact, Friedrich List in 1841 propounded the idea of technology *and* skills as essential factors in economic growth (Freeman, 2002: 192).

Later conceptual developments pertinent to this thesis were made in the 1990s by Romer, then Porter, and subsequently Nelson. According to Furman et al (2002: 900) the

contributions of Romer, Porter, and Nelson are important since they define country-specific factors which "…determine the flow of innovation." Romer defined an ideas-driven endogenous growth theory which posits that research and development activity (and hence the ensuing economic growth) is sensitive to the knowledge stock available to researchers. He defined a national ideas production function, as illustrated by the equation in Fig. 6 below:

$$\dot{A}_t = \delta H_{A,t}^{\lambda} A_t^{\phi}$$

Rate of new ideas production = no. of ideas workers x stock of ideas available to researchers

Fig. 6 Romer's growth model – national ideas production function (Furman et al 2002:902)

Simply put, Romer's theory establishes a direct link between economic growth and the importance of access to research output, i.e. 'the stock of ideas available to researchers'. David (2003b) argues for an 'open science' which he says is "well suited to the goal of maximising the rate of growth of the stock of reliable knowledge."

Porter defined a national industrial cluster-based theory of competitive advantage, and Nelson defined the national innovation systems approach. The national system of innovation approach is seminal for its acknowledgement of the role of national policy and the active role played by government (Furman et al, 2002: 903). Archibugi and Michie (1997: 134) hold that, beyond acknowledgement of government's role, the literature on national systems of innovation in fact advocate for the greater role of government in fostering innovation. Etzkowitz and Leydesdorff (1997) introduced the triple-helix model of university, industry, and government relations or linkages, representing respectively the knowledge-, economic-, and political sectors. The triple-helix accounts for the increasingly important role of universities - the knowledge sector thus - in enhancing innovation and economic development. The latter is in contrast to earlier theories where industry-government linkages were emphasised above that of the university (Etzkowitz et al, 2000: 314). In expanding on the characteristics of the triple-helix and at the same time describing the evolution to the entrepreneurial university, four processes are identified as redefining the production, exchange, and use of knowledge. In the context of this thesis, one of the processes to note is the "…influence of one institutional sphere upon another in bringing about transformation…" (Etzkowitz et al, 2000: 315). By way of example, Etzkowitz et al

refer to the implementation of legislation which transfers[90] intellectual property rights for federally funded research to universities and other public sector laboratories. Here the political influences the academic. Such transfer of intellectual property rights was enacted as the Bayh-Dole Act (1980) in the United States. It is significant since a similar type of provision was and is foreseen for university research in South Africa. Though not yet launched as an official policy initiative, much debate has raged within academia and South African industry regarding such a provision (Haase, 2004: 16-17). It is generally argued that the transfer of intellectual property rights for government-funded research to universities would lead to more academics capitalising on their research through commercialisation (Medical Research Council, 2001). The latter has been the positive effect of the Bayh-Dole Act for the United States. Similar provisions have been enacted in Sweden[91] and Japan (Etzkowitz et al, 2000: 315). It is envisioned that such alternative funding, a third stream, could be used to attract senior staff and upgrade research facilities. It is feared however that the private sector in South Africa may decrease collaborative research projects with universities if Bayh-Dole type of legislation is enacted. I will return to this point in the Discussions chapter.

Furman et al (2002: 900) speak of innovation infrastructure[92], innovation clusters, and the links between these as the basic building blocks for a country's 'national innovative capacity'. Other authors distinguish in turn between institutions (rules of the game), organizations (players), and the links between these. Furman et al (2002: 930) go on to state that public policy has an important role in shaping a country's national innovative capacity.

Innovation policy

Lundvall and Archibugi (2001: 11) opine that the traditional remit of innovation policy has been to delineate a public knowledge infrastructure and to define links between the knowledge infrastructure and firms. It may be said here that this traditional remit seems characteristic of a linear view of the innovation process, and cannot be adequate for a systems approach to innovation.

[90] Frequently referred to as 'technology transfer' i.e "…the transfer of research results from universities to the commercial marketplace for the public benefit…" (Haase, 2004: 17).
[91] See Goldfarb and Henrekson (2003) for a comparative analysis of the US and Swedish systems.
[92] "Among other things, the common innovation infrastructure includes a country's overall science and technology policy environment, the mechanisms in place for supporting basic research and higher education, and the cumulative "stock" of technological knowledge upon which new ideas are developed and commercialized" (Furman et al., 2002: 900).

In contrast to Lundvall and Archibugi's definition of innovation policy, the definition used by De la Mothe seems more appropriate within a systems of innovation context. De la Mothe (2003: 199) describes innovation policy as "...concerned with stimulating, guiding, and monitoring knowledge-based activities within a political jurisdiction – typically, a nation, or a region." He adds that the goals of innovation policy are often economic, but that these goals are frequently couched in social welfare terms, such as a goal of 'the advancement of knowledge'. I would argue that public policy, being the preserve of governments, is more often than not phrased and couched in such social welfare terms. This, the latter, should be seen as a natural component of such policy, given that policy is drafted to improve the lot of a nation, more particularly a political constituency, and so should be and is phrased in terms which delineate the benefit(s) to society. Also, innovation is seen as a vehicle to increase the global competitiveness of a nation, which in turn has indirect positive consequences for social welfare.

Smith (1997: 86 – 106) goes on to describe the importance of public policy in developing and maintaining physical infrastructures (roads, electricity, telecommunications) and knowledge infrastructures (universities, research laboratories, libraries, databases, etc) which have effects on the economic performance of innovation systems. He argues for knowledge as a stock and flow, where public policy is formulated to increase the flow of knowledge, augmenting the stock thereof, adding that the maintenance ("…storage, access, availability, dissemination,…")(Smith, 1997: 101) of such knowledge stock is a neglected part of science and technology policy. He adds that the "…scale and openness of such (knowledge) systems is an important issue in public policy, with potentially large effects on innovation performance" (Smith, 1997: 102). Furthermore, citing a 1974 study by Gibbons and Johnston[93], Smith concludes the section by echoing their findings that "…basic scientific results - stored in libraries or in university departments…" are key contributors to industrial innovation (Smith, 1997: 102).

Science and Innovation policy in South Africa

There are many overlaps between what is regarded as information policy, and what is then referred to as science-, technology-, and innovation policy. In fact, noted authors on information policy, generally, such as Rehman (1996), and particularly in South Africa, such as James (2001) and Van Audenhove (2003b) include science-, technology- and innovation

[93] Gibbons, M and Johnston, R. 1974. The roles of science in technological innovation. *Research policy*, 3(3), 220 - 242

policy as part of their analyses. Van Audenhove's stance should be seen in light of the fact that he was analysing sources of policy which promoted the 'information society'.

To date the sources of science and innovation policy in South Africa have been:

- White Paper on Science and Technology (1995 - 1996);
- National Research and Technology Audit (1997);
- Science, Engineering and Technology Institutions Review (1997);
- National Advisory Council on Innovation Act (Act 55 of 1997);
- DACST[94] Foresight Study (1998 - 1999);
- National Research Foundation Act (Act 23 of 1998);
- National Research and Technology Foresight study (2000);
- National Research and Development Strategy (2002).

However, initiatives around stimulating innovation have not been limited to policy documents. There are also state funded science initiatives such as the establishment of a National Advisory Council on Innovation (NACI)[95] (established by Act 55 of 1997), and the creation of the National Innovation Fund (NIF)[96], formerly residing within the Department of Arts, Culture, Science, and Technology (DACST), and latterly within the Department of Science and Technology (DST)[97]. The Innovation Fund behaves much like a venture capital company. Similar to the DST's Innovation Fund, the Department of Trade and Industry administers the Support Programme for Industrial Innovation (SPII). Furthermore, there is the Technology and Human Resources for Industry Programme (THRIP) residing within the Department of Trade and Industry which attempts to address the skills shortage in the fields of science, engineering, and technology.

Another body to note is the Southern African Research and Innovation Management Association (SARIMA), which seems quite influential in the higher education sector. One of its projects is to Map the National System of Innovation in South Africa, a second project is to create an Institutional Research Information System (IRIS). The IRIS however is aimed at managers of research, rather than the researcher i.e. the IRIS will store

[94] Department of Arts, Culture, Science, and Technology (DACST).
[95] http://www.naci.org.za
[96] http://www.innovationfund.ac.za
[97] The DACST existed from 1994 until mid-2002. After 2002, two departments were created, namely, Arts and Culture, and Science and Technology, respectively, and in 2004 two corresponding separate ministries were created.

bibliographic data, and other management data for the purposes of statutory reporting, rather than store full-text for researcher access.

The South African government is considering introducing legislation which would transfer rights ownership (intellectual property and copyright) of the results of publicly-funded research to universities. The latter move is regarded as one which would generate an additional income stream for universities. A similar legislative measure, referred to as the Bayh-Dole Act, had been introduced in the United States in 1980. The impact of the Bayh-Dole Act, and moves within South Africa in this regard, are dealt with earlier in this chapter as well as Chapter 6 below.

National System of Innovation defined

Some authors (Freeman (1987), Lundvall (1992) as cited by Edquist (1997)) define 'national system of innovation' in a phrasal sense, whereas others, including Edquist, define the whole by attempting to define its constituent parts namely 'innovation', 'national', and 'system' respectively. More than this, systems of innovation can also be defined spatially according to continent, nation or sub-nationally (Freeman, 2002) or according to industry sector (Malerba, 2002). Freeman's spatial definition can be augmented by regional or trans-national views of innovation systems.

For the purposes of this study, I use the definition of Galli and Teubal (1997: 343) for 'national system of innovation' (NSI), which is defined "…as the set of organizations, institutions, and linkages for the generation, diffusion, and application of scientific and technological knowledge operating in a specific country."

Of note is Galli and Teubal's claim that organisations and institutions define the incentive structure of "…S&T and innovation/diffusion activities…" (p346) for a country, and furthermore, that "Government policy is a major enabling factor in the generation of linkage mechanisms and incentives" (p347).

Types and examples of the various organisations, institutions, and linkages in an NSI are enumerated in Table 5 below (after Galli and Teubal, 1997: 346 – 347).

Table 5 Organisations, institutions, and linkages in an NSI

Organisations	Institutions	Linkages
Political (ministries or national councils for S & T)	Formal constraints (patent laws, formal criteria for allocating resources to science, peer review procedures, technical standards and norms)	Market transactions
Bureaucratic (public agencies and offices implementing innovation policy)	Informal constraints (norms of behaviour, conventions, codes of conduct)	Unilateral flows of funds, skills, and knowledge (embodied and disembodied)
Regulatory (for standards, norms, and certification)	Enforcement characteristics of these abovementioned constraints	Interactions (user-supplier networks)
Social (academies and professional associations)		
Educational (universities and schools)		
Knowledge-oriented sans economic goals (government laboratories in the area of defense or health)		
Non-profit organisations with economic goals (technical centre or experimental stations of an industrial association)		
Profit-oriented firms (R&D companies, joint ventures, consortia)		
Bridging bodies which connect the S&T realm with needs of firms (innovation centres, chambers of commerce or industrial associations, industrial liaison units of universities)		

Source: After Galli and Teubal, 1997: 346 -347.

Larédo and Mustar (2000) indicate that the national systems of innovation literature emphasises the "…central role for higher education in the new knowledge economy." Mouton and Dowling (2001:41) regard the higher education sector as "a significant partner in the NSI".

As for the role of policy with respect to a national system of innovation, Edquist (2004: 191) is of the opinion that SIs cannot be coaxed into being solely through policy. He adds that systems of innovation cannot be consciously planned or designed, and are in fact more evolutionary in nature, akin to innovation processes. He concludes that "[c]entralized control over SIs is impossible and innovation policy can only influence the spontaneous development of SIs to a limited extent." That said, Edquist (1997: 2) argues for the particular usefulness of the systems of innovation approach in research and in policy analysis.

Central to the concept of a national system of innovation is "…the fundamental assumption that what is going on in terms of innovation differs between nations. This means both that countries are specialized in terms of technological fields and that the mode of innovation has national specificities" (Andersen and Lundvall, 1997: 254). What this tends to indicate is that the types of innovation occurring between nations differs, and that improved access to literature does not imply that countries will develop similar innovation strategies or approaches. The skills base of a country, for instance, would still influence the types of innovative activity engaged in.

National System of Innovation in South Africa

Many argue that a national system of innovation approach is inappropriate in the face of globalisation, yet the nation state is the level at which the competitiveness of a country is measured, and furthermore, it is the level at which government's may implement policy to attempt to direct innovation. Moreover, Kahn (2004: 24) adds that innovation in South Africa still operates with a national focus, due to its lack of international and cross-border linkages.

The systems approach to innovation permeates discourse on innovation in post-apartheid South Africa. More particularly, the South African government set the tone in the use of

the National System of Innovation (NSI) as framework for analysis in the White Paper on Science and Technology of 1996, which in effect constituted the country's Science and Technology policy between 1996 and 2002. As of 2002 a National Research and Development Strategy was formulated by the Department of Science and Technology, with its becoming the latest Science and Technology policy.

Mani (2001) indicates that South Africa is one of the few developing countries to explicitly use the NSI as policy framework, but adds, when describing the use of the NSI approach in the White Paper, that "…this subscription to seemingly sophisticated terms and concepts is more in form than content" (Mani, 2001: 51) and that "…the term 'NSI' is described in rather a textbook fashion…" (Mani, 2001: 24). Be that as it may, reading any recent literature by South African science policy analysts, the National System of Innovation approach seems a fait accompli.

Kahn describes the South African national system of innovation as robust, and consisting of:

> [A] large private sector, a set of state owned enterprises, eight major science research councils[98],… thirty six higher education institutions, all embedded in a functioning legal and regulatory system relatively well supported by state-owned utilities, standards and testing laboratories. In addition there are a range of other government laboratories and research institutes as well as research sections in museums (Kahn, 2004: 6).

The most recent South African National Survey of Research and Experimental Development (R&D) of 2001/2 (DST, 2004) reveals this robustness of the NSI on the part of R&D. Blankley and Kahn (2004: 9) attribute the robustness of R&D to the National Research and Development Strategy of 2002.

Said robustness of the NSI based on R&D activity can be gleaned from Tables 6 and 7 below. The contribution of fields to research and development in South Africa is illustrated in Table 6 below, and thereafter, the relative contribution per sector to R&D is illustrated

[98] Agriculture Research Council - ARC, Council for Geoscience- CGS, Council for Scientific and Industrial Research-CSIR, Human Sciences Research Council-HSRC, National Research Foundation–NRF, formerly the Foundation for Research Development, Council for Mineral Technology - Mintek, Medical Research Council – MRC, and the South African Bureau of Standards – SABS.

in Table 7 below. Tables 6 and 7 represent different views of national R&D activity within South Africa.

Table 6 Expenditure on R&D according to research field

Field of research	Percentage expenditure on R&D
Natural sciences	20.7
Engineering sciences	20.2
Applied sciences and technology	15.2
Information and communication technologies	13.7
Social sciences and humanities	10.7
Medical and health sciences	10.2
Agricultural sciences	9.3

Source: DST, 2004

Table 7 Sectoral contribution to R&D

Sector	Percentage of R&D undertaken
Business	54
Higher Education	25.3
Government (incl. Science Councils)	21.1
Non-profit sector	7.3

Source: Blankley and Kahn (2004: 10)

Blankley and Kahn (2004: 11) conclude that R&D and innovation in South Africa will in all likelihood continue to grow - from the 2001/02 figure of 0.76% of gross domestic product being spent on R&D, originally measured at 0.69% in 1997/98 - due to the current favourable economic and investment climate.

Openness of scholarly systems and the National System of Innovation

A number of scholars have written about the openness of scholarly systems. Foray (1997) writes within the context of a national system of innovation, Arunachalam (2004) writes about Open Access within a science and technology policy context, and David (2003a) writes from the perspective of research management.

Foray regards knowledge distribution and knowledge openness as "…a critical characteristic of any system of innovation" (1997: 64). He posits further that it is economically efficient to facilitate wider distribution of existing knowledge and to increase inexpensive access to latest research findings, since knowledge generation is cumulative in

nature, and so is dependent on research which has gone before. He regards knowledge as both an output of the innovation process, as well as an input of the knowledge generation process (1997: 65).

Foray uses the term 'open access', but since his publication predates the establishment of the 'Open Access' movement by some four years, it is safe to say that he did not have the 'Open Access' ethos nor movement in mind at the time of his writing. Nevertheless, he makes an argument for the increased dissemination and availability of research output, when he claims that (1997: 66):

> Open access that distributes knowledge widely and rapidly
>
> - Facilitates independent replication of findings;
> - Promotes swift generalization of results;
> - Avoids excessive duplication of research;
> - Increases the probability of creating useful new products, processes, and ideas arising from novel and unanticipated combinations because new knowledge is available to many researchers;
> - Thus raises the social value of knowledge by lowering the chance that it will reside with persons and groups who lack the resources and ability to exploit it.

Foray goes on to say that knowledge openness is neither a natural process nor convention. On the contrary, knowledge restriction rather than openness is often fostered due to market forces e.g. so as to facilitate private sector investment in research. As such, measures which hinder knowledge openness are implemented, such as, intellectual property rights, or low incentives to codify knowledge (since codification leads to diffusion). He adds that "…[w]hile a convention of secrecy and access restriction can diffuse spontaneously, a convention of openness and cooperation has to be constructed" (1997: 79).

Unlike Foray who believes that openness is not endemic to scientific enquiry, David (2003a) argues that there are two forces at work when it comes to the openness or lack thereof of research practice. David argues that openness can be fostered due to the registration reward bestowed upon scientists upon first making their findings known.

Registration in this sense indicates that a finding is associated (in effect 'registered' within the academic community) with a particular researcher, who in turn is regarded as the originator/inventor of the idea. The latter, according to David (2003a: 172) characterises and has always characterised the work of scientists within the 'Republic of Science'[99]. He (2003: 172) contrasts the openness of the 'Republic of Science', with the proprietary nature of the 'Realm of Technology'. Both approaches, according to David, are important for new knowledge (knowledge generation) and existing knowledge. He argues that the 'Republic of Science' increases knowledge stock, and that the 'Realm of Technology' facilitates maximal exploitation of economic rents[100] on existing knowledge. Hellström (2003: 394) echoes David (2003a: 172) when he describes the increasing importance of science in technology development, and vice versa. Bruno Latour refers to the latter as 'technoscience' (Faulkner, 2002: 143).

That said, many conceptions of innovation are technology-centric even though innovation extends beyond technology-inventions. As such, the proprietary ethos which infuses the 'Realm of Technology' is automatically applied and adopted within the context of the Republic of Science also. The latter may be proffered as a possible reason for the increased tendency toward restrictive access to research literature. In effect, with the growth of importance of technology in and for society, technology's proprietary ethos has infused scholarship and academia generally.

Of further consideration is whether the system of economic rents David (2003a) speaks of, forms part of the Open Access ethos or not. The latter depends on to whom that system of economic rents applies. The financial gain for authors may be through patents, though admittedly not all research results in patents. Regarding publication, authors generally do not gain in a direct manner financially through publication (the financial gain is indirect, since increased publication generally leads to promotion and tenure). Generally speaking, the economic rents for an article are exploited by the publisher. For the journal reform school of Open Access in its current incarnation, the exploitation of economic rents by the

[99] The term 'Republic of Science' was coined by Michael Polanyi. See Polanyi, M. 1962. The republic of science: its political and economic theory. *Minerva,* 1(1):54 -73. reprinted in Shils, E. 1968. *Criteria for scientific development: public policy and national goals*. Cambridge, Massachusetts: MIT Press.

[100] An economic rent is the price of a good or service which has a fixed supply, and where the price is not dependent on nor sensitive to the supply of the good (Taylor, 2001: 374). The concept of economic rents is applicable to scholarly literature, since an increased supply of scholarly articles since the beginning of the latter half of the 20th century has not led to a decrease in the price of such literature (contrary to strict economic theory where increased supply leads to a decrease in price of a commodity).

publisher is anathema. I would argue here that the author-pays model, though publisher-driven, cannot be regarded as another instantiation of economic rents imposed by the publisher. I make this argument on the basis that with the author-pays model, the payment is once-off, whereas with the reader-pays model (the traditional journal subscription model used to date), payments are repeated and cumulative.

David (2003a: 172) makes an argument for the continued existence of such a rents system (which runs counter to the journal reform school of the Open Access movement), and goes on to argue for the continued importance of the openness of the 'Republic of Science' (which is akin to the Open Access movement's ethos). He does emphasise that the 'Republic of Science' and 'Realm of Technology' are separate, yet complementary, and that the challenge for science and technology policy is to keep these two systems "…linked and in symbiotic balance…" (David, 2003a: 172).

National Information Policy and the National System of Innovation has been covered in this chapter. In conclusion it can be said that National Information Policy, as defined and used in this thesis, limits itself to formal policies (as per Weingarten, 1996), acknowledges the overlap of information policy with science-, technology-, and innovation policy (as per Davis, 1995), and remains cognisant of the scope of information policy (as per Rehman, 1996). Notions around information as a public good permeate discourse on the information commons, and the importance of an open national innovation system, especially with respect to scholarship, is highlighted, presenting the inherent dichotomy between the entrepreneurial university and Polanyi's 'Republic of Science'. Furthermore, the systems approach to innovation allows for the complex interaction between all contributors to innovation, at the organizational, and process level. We see therefore that universities, and by extension public sector research, are central to a national system of innovation, and are regarded as components of sustained economic growth. Romer's growth theory demonstrates, in purely economic terms, the effects of knowledge diffusion (access to knowledge) on the growth of new ideas (innovation) in a society.

Section 2: Empirical analysis

Chapter 4

Methodology

This chapter provides an explication of the study's objectives, the research methods chosen, as well as a detailed description of each step of the quantitative research process undertaken.

Having informally observed developments around networked electronic publishing, more specifically in the context of academic scholarship, these past seven years, it is that I have arrived at a subjective set of insights. In order to better explore these insights, whilst avoiding the risk of imposing my view, it seemed prudent to use a research method where a more exploratory stance is encouraged. With the latter in mind, I have used the survey method to conduct two quantitative studies. The instruments used were a self-administered questionnaire, and structured record review. What follows is a detailed description of, first the self-administered questionnaire, followed by a description of the structured record review.

Self-administered questionnaire

I decided to survey a research community in order to:

- assess levels of awareness of Open Access initiatives, as well as
- to ascertain the degree of participation in using Open Access methods of information dissemination by the defined sample population.

Study population defined

Though Open Access is a matter for scholarly communication, and as such pertains equally to all academic disciplines, this study had to be curtailed by studying a defined population. Physicists[101] and Economists[102] have played an early decisive role in demonstrating the viability of pre-print servers. However, in this study, subjects were chosen within the broad

[101] In the form of arXiv.org, established 1994 at the Los Alamos National Laboratory, USA, and initially serving the High-Energy Physics community. (Ginsparg, 1997)
[102] In the form of the RePEc (Research Papers in Economics) archive established in 1997 (Krichel, 1997)

disciplines of Computer-, Library-, and Information Sciences, and Information Systems, and aimed particularly at those who are required to present and/or publish their research.

The Computer-, Library-, and Information Sciences, and Information Systems disciplines were focused on since many developments in the digital library arena are and have been spearheaded by Librarians and Computer Scientists working in collaboration. With the latter in mind, it seemed logical to extend the sample to scholarly places where Librarians and Computer Scientists are trained: variously Computer-, Library-, and Information Science, and Information Systems academic departments at universities and technikons in South Africa. Furthermore, recent years have seen the curricula for the Library- and Information Sciences becoming more technology-oriented, and so more akin to traditional programmes in the Computer Sciences and Information Systems disciplines. The Department of Information Science at the University of Stellenbosch has an undergraduate programme in Socio-Informatics, teaching courses traditionally the preserve of the Computer Sciences and Information Systems disciplines. The latter applies to Information Science programmes at the University of Pretoria also.

Since the emphasis of the survey was on scholarship, and noting that research in the defined fields is not only conducted within academia nor even solely in the departments previously mentioned, provision was made for likely participation from Information Technology (IT) practitioners within industry; those in IT administrative support units within higher education institutions; and researchers situated at non-governmental organizations conducting research within these defined domains.

Recruitment of subjects

Potential participants were identified on an individual and group basis. Individuals were identified by means of Web homepages of academic departments, and group identification took the form of subscribers to electronic discussion lists. A list of potential individual participants was compiled from the contact and/or staff information gleaned from the Web homepages for the population sample. All Computer-, Library-, and Information Sciences, and Information Systems academic departments were identified.

Furthermore, Library Directors at higher education institutions within South Africa were asked to circulate the initial invitation message to their Library staff; and IT Directors at

higher education institutions were targeted via a Tertiary Education Network (TENET)[103] mailing list. The latter list however comprised of individuals other than just the IT Directors.

Other electronic mailing lists were also identified for the broad disciplines enumerated. These mailing lists were LIASAonline (mailing list for the Library and Information Association of South Africa), SABINEWS (mailing list of a South African library vendor), SAICSIT (South African Institute for Computer Scientists and Information Technologists), and the CSSA.(Computer Society of South Africa). The students of the MPhil in Information and Knowledge Management programme at Stellenbosch University were also invited to participate, as well as presenters at the annual conference of the South African Computer Lecturers' Association (SACLA). As is evident, this was a convenience sample. Antonius (2003: 116) indicates that convenience samples are indicative of the range of opinions for a population, but not the proportions in which those opinions are found.

Using the Web to identify subjects and to ascertain their contact particulars presumes that contact information is up-to-date. All in all 300 individuals were identified. The latter figure excludes the group, mailing list-based participants. That said, it is a recognized problem of doing research via e-mail and the Web that messages can be easily forwarded to recipients not forming part of the identified population. Moreover, that the number of active subscribers to mailing lists can be difficult to estimate given the number of mailing addresses which become defunct, not to mention that individuals' e-mail addresses may not function due to technical problems during the period when the study is undertaken.

Procedures and measures

The self-administered questionnaire was published via the World Wide Web (See Appendix A). No paper or electronic copies in formats other than HTML were circulated. All participants were advised of the URL of the questionnaire. Foo and Hepworth (2000: 53-54) emphasise the cost-effectiveness and speed with which Web-based surveys may be conducted, which permits the quick electronic processing of data which is already in electronic format. They state further the drawbacks to performing surveys electronically, such as "…lack of anonymity, lack of common application platforms, lack of computer

[103] The body responsible for the management of the network infrastructure and bandwidth for the tertiary institutions in South Africa.

literacy skills of participants, and incomplete and erroneous returns that require special processing."

The survey design was descriptive/observational (Fink, 2003a: 46), looking at the behaviour of extant groups, these being the scholars and researchers defined above. Furthermore the survey was cross-sectional in that it assessed the behaviours for the sample at a given point in time, in this particular instance, their behaviours up until the end of May 2004.

In order to achieve the stated aims of the survey, some of the survey questions were drafted from scratch, and other questions were derived from surveys on Open Access which had been conducted previously. The surveys sourced in the latter regard were that of Simpson (2004), Pelizzari (2004), and Björk and Turk (2000). Though it is often said that previously used survey questions should be re-used since in effect they have been 'tested' when having been used in previous studies, Fink's (2003b: 16) caveat should be noted, when she claims that study populations differ and that their comprehension of and responses to questions may as a result also differ. Furthermore, it should also be borne in mind that the purposes of surveys differ, and in this regard also, questions may not always be adopted pell-mell from previous studies. It cannot be assumed that survey instruments can be implemented globally unless they have been expressly designed for such global purposes. Harkness et al.(2003) provide a detailed explication of the factors to consider when conducting global or cross-cultural surveys.

At the outset it was decided to disseminate the survey instrument electronically due to the limited timeframe I faced. The questionnaire was initially drafted and constructed for dissemination as an MS-Word document via e-mail. However, a service was found with which to effortlessly publish the questionnaire online on the World-Wide Web. It had been recommended that I pilot the questionnaire with as few as one person, to as many as ten persons. In its (the latter's) stead, I identified 6 testers, and cascaded the questionnaire from tester 1 to tester 2, to tester n. The latter is a rather simplified representation of the testing conducted. The detail follows below. In the end, the questionnaire went through five iterations or drafts with 6 testers, where testing took the form of either pilot tests, or cognitive pre-testing. Both types of tests were used to hone the content and organization of the survey questions.

Fink (2003b: 107) defines the cognitive pretest as:

> [A] chance to take the draft of your survey to potential respondents and ask them individually to review each question: What does the question mean to the respondent? Is there a better way of asking it? What do the response choices mean? Given a choice between two types of response formats, which is better?

A number of pretests may be conducted prior to pilot testing a questionnaire. The first cognitive pretest concentrating on both question validity and content validity was conducted with someone who has expertise in Statistical analysis. Thereafter a cognitive pretest concentrating on content validity was conducted with a Library Director and Manager of a Subject/Discipline archive as well as a trained Documentalist/Librarian. Feedback from these tests resulted in version two of the questionnaire. A cognitive pre-test for question validity was conducted with a psychologist, which resulted in questionnaire version three. Though it can be argued that my pretesters were not strictly from my survey population, in that they were either not South African, or were not solely from the Computer-, Library-, and Information Sciences, Information Systems disciplines, it is the case that I considered it best to consult subject experts on Statistics - with a focus on question validity for subsequent data analysis and interpretation - and experts on Open Access – with a focus on content validity - prior to doing pilot tests. Pilot tests were indeed conducted with two Information scientists (both trained Librarians; one a junior member of faculty, the other a senior member of faculty), and one Computer Scientist. The feedback from the latter set of testers resulted in version four of the questionnaire. (See Appendix B for the questions posed during pilot-testing.) Both the cognitive pretests and pilot testing were done by circulating the questionnaire in MS-Word format. At the eleventh hour an online service provider was identified for publishing the questionnaire, and in its migration to this online environment, some questions were slightly adapted given the system constraints of the online system. As such, version five, the final version of the questionnaire, was created. (See Appendix F for the final version of the questionnaire).Testing of the questionnaire was conducted over a four week period.

In order to solicit participation in the study, targeted individuals in Departments (not groups on mailing lists) were sent an: Advance notification e-mail. (See Appendix C) on 29 April. A week later (6 May 2004), everyone in the sample population (individuals and those

on mailing lists) was invited to participate. (See Appendix D for the Invitation e-mail). Given delays with the relaying of messages in some instances (e.g. distribution of messages to MPhil students was effected via intermediaries), effectively, the 'Invitation to participate' took about one week to be distributed. A week later, and two weeks after the initial invitation had first been dispatched, a final reminder notice was sent to everyone (individuals as well as mailing lists), notifying recipients (of the e-mail) of the deadline for participation. (See Appendix E for the 'Reminder notice'.)

The individuals identified to participate in the study were its primary focus rather than the groups. As such, individuals were sent the 'Advance notification' e-mail, and not the mailing list-based groups. Moreover, it seemed superfluous, in an age of frequent unsolicited e-mails, to notify the nebulous members of mailing lists in advance, as it was anticipated that a fair number of mailing list subscribers might very well not be the ideal candidates for study.

Additionally, the deadline for participation was not included in the initial 'Invitation to participate' as I expected that many participants, confronted with a deadline, would postpone participation until later, which in turn might have lapsed into non-participation. As such, participants were only notified of the deadline in the final 'Reminder' message.

Survey content

The questionnaire contained ten sections, consisting of 35 questions and a final declaration granting the use of the response data, which also functioned as an explicit declaration of participation. In order to minimise the annoyance factor of any error messages, only the declaration was configured as a question which required a response. All of the other 35 questions were optional thus. The sections are indicated below, with the number of questions per section indicated in parentheses.

1. introduction
2. definition of terms
3. knowledge about OA initiatives (2 questions)
4. electronic scholarship (15 questions)
5. institutional electronic archives (5 questions)
6. degree of involvement in journal publication (2 questions)
7. use of others' scholarly output (4 questions)
8. demographic information (7 questions)
9. declaration (required)
10. thanks for participation

The ten sections listed above also represent the ten screens navigated by the survey participants.

Structured record reviews

Fink (2003b: 23) defines the structured record review as "…a survey in which the surveyor uses a specially created form to guide the collection of data from financial, medical, school, and other records, including electronic, written, and filmed documents." Moreover, Bell (1993: 69) in describing the analysis of documents as evidence draws a distinction between 'witting' and 'unwitting' evidence. The former is information which the author of the document under investigation wanted to convey, and the latter is "...everything else that can be learned from the document." Web homepages are at once witting and unwitting sources of evidence. When authors (in this case Departments) make their research available via their Departmental Web pages, doing so constitutes witting evidence. The unwitting aspect within the context of this study is their revealing the extent to which they (these Departments) are engaging in Open Access information provision. What follows is a description of the study population, the procedures and measures used.

Study population defined

As already indicated, Fink refers to the use of electronic documents as records which may be reviewed. Within the context of this study, the electronic documents under consideration were the World Wide Web homepages of Academic Departments, Research

Units, and Bureaux as hosted under and indexed by the Stellenbosch University domain www.sun.ac.za.

My conjecture as part of this thesis is that scholars may engage in forms of Open Access information provision even though they might be completely oblivious of debates around Open Access. I chose Stellenbosch University as the institution to study, since my work experience as Web Server Administrator at Stellenbosch gave me an historical sense (though admittedly recent history) of the dynamics and scope of Web hosting at Stellenbosch.

Stellenbosch University (more often referred to as the University of Stellenbosch) is a residential university situated approximately 50km outside of Cape Town, South Africa. Historically it is classified as an advantaged institution that only accepted Caucasian students during most of the Apartheid era in South Africa.

Historically, universities in South Africa were divided along two histories, one a Germanic affiliation via Afrikaans to a Dutch/German heritage, and the other an Anglo-Saxon affiliation via English to a British heritage. Stellenbosch University is regarded as an Afrikaans language institution where undergraduate instruction and postgraduate training was through the medium of Afrikaans. More recently, postgraduate training is predominantly in English, while undergraduate instruction remains in Afrikaans.

Stellenbosch University comprises ten faculties (Arts[104], Agricultural and Forestry sciences, Economic and Management Sciences, Education, Engineering, Health Sciences, Law, Military Sciences, (Natural) Sciences, and Theology) on three campuses. Most of the Faculties are situated in Stellenbosch (main campus). The Faculty of Economic and Management sciences at undergraduate level is situated on the main campus, and the postgraduate Business School is located closer to Cape Town. The entire Health Faculty is situated on a separate campus, midway between Stellenbosch and Cape Town. The Military Academy is located north of Cape Town, on the West Coast of South Africa. Student enrolment for 2004 was approximately 22,000 with 35.6% of enrolment at postgraduate level. Permanently appointed personnel in 2004 consisted of 787 academics, 1,293 administrative and technical staff, and 350 service workers (University of Stellenbosch,

[104] Incorporating the Humanities.

2004). The 2002 academic year saw the awarding of approximately 5,500 Bachelors degrees or Diplomas, approximately 900 Masters degrees, and 113 Doctoral degrees (BioMed Central, 2004).

Furthermore, Stellenbosch University's Engineering Faculty (staff and postgraduate students) developed a micro-satellite, SUNSAT, with funding from a number of private sector firms. The satellite was launched into orbit in 1999.

Procedures and measures

A dedicated listing of Academic departments, Institutes, Bureaux, Schools, Centres, Laboratories, and Units is maintained by the Marketing Division of Stellenbosch University. The 'Units' in question usually, but not exclusively, have a research orientation. The naming conventions are in line with the administrative and organisational structure used by the university. The results for the record review were also categorised using these broad administrative categories.

A form was constructed, using the Marketing Department's listing, and each linked-to homepage was visited to ascertain information regarding research information which had been made available, and any journals which have been hosted. The latter two typologies fit those used by the Open Access movement, namely self-archiving, and Open Access journals. The specific questions posed on the assessment form were:

- Research Information:
    - Is any research information published? Y/N;
    - Are there full-text research publications available? Y/N;
    - Description of research information published (note any anomalies if applicable);
    - Provide general URL for full-text (if available);
    - Last updated date (as per the Dept. Web page concerned);
- Journals hosted
    - Journal(s) online? Y/N;
    - Journal URL;
    - Journal timeframe;
    - Approx. number of full-text publications for all issues listed.

Each Web homepage was thus reviewed using the above set of questions.

This chapter described the methodology employed in conducting the empirical studies for this thesis. The following chapter elaborates upon the Results for these empirical studies.

Chapter 5
Results

The results below illustrate the degree to which questionnaire respondents were familiar with Open Access initiatives, and were in fact investing in Open Access activities. The latter investment in Open Access was also assessed in the structured record review. It is shown that notional knowledge about and awareness of Open Access predominated; that respondents have favourable attitudes to Open Access, but that SAPSE accreditation constrained their publishing in Open Access journals. Furthermore, it was shown that researchers in this study publish in order to share their research results with peers and are not primarily motivated by the SAPSE incentive of funding linked to publication rate. The structured record review showed that there was a limited –yet promising- investment in Open Access by organisational structures at Stellenbosch University. Contrary to expectation, there were more full-text articles available from scholars in the social sciences and humanities, than in the natural sciences. What follows is a detailed analysis of the empirical research undertaken.

Self-administered questionnaire

By way of analysis of questionnaire responses, the level of activity and investment in four new expressions of scholarly communication, within the South African context, are reported on, namely:

- Publication in open access scholarly journals;
- Distribution of research via institutional and/or disciplinary repositories;
- Scholars making their research available via personal Web homepages;
- Making the research output of postgraduates available.

By definition, Open Access entails use of the network (LAN, Internet, WWW) to make such works available.

Overview of question detail

The questions as posed in the questionnaire have been grouped below, and will be addressed in the following order. The original question numbers are indicated in parentheses as an orientating device to the reader.

Respondent profile (Q29 – Q34):

Respondents per broad discipline (Q30); Notification about survey (Q29); Position held (Q31); Primary responsibility in current position (Q34); Highest qualification (Q32); Time elapsed since qualification had been conferred (Q33).

Knowledge about OA initiatives (Q1 – Q2, Q35):

Knowledge about OA initiatives (Q1); Prior knowledge, if extant, obtained where (Q2); Interest in attending an information session on Open Access (Q35).

Scholarly practices and opinions, electronic and other (Q3 – Q17):

Methods of online activity to aid research and/or teaching (Q3); Free availability of teaching material (Q4); Location of such freely available teaching material (Q5); Current electronic dissemination of own research prior to formal publication (Q6); Total number of publications produced during the past five years (Q7); Proportion of post-prints published in SAPSE journals (Q8); Why have you authored and published papers? (Q9); Criteria for choice of journal publication venue (Q10); General disposition towards Open Access methods of information dissemination (Q11); Who should promulgate and fund OA (Q12) ; Publishers should permit articles on departmental or personal Web sites(Q13); Publishers should permit articles on institutional or disciplinary repositories (Q14); Copyright assignment (Q15); Alternatives to copyright assignment (Q16); Disposition to Open Access journals (Q17).

Institutional electronic archives (Q18 – Q22):

Creation/implementation of Institutional Repositories (Q18); Creation/implementation of ETDs (Q19); Electronic submission of Theses and Dissertations required in addition to print submission? (Q20); Encourage M and D students to submit works to an ETD repository? (Q21); Who should manage these archives (IRs / ETDs) (Q22).

Degree of involvement in journal publication (Q23 –Q24):

Administrative involvement in journal publication (Q23); Roles fulfilled in this regard (Q24).

Use of others' scholarly output (Q25 – Q28):

Use of others' scientific works (Q25); Use of Web-based freely available research material (Q26); Which archives, services, or sources used for these works? (Q27); For what purposes were these works used? (Q28).

Response detail

The questionnaire was posted online on the World Wide Web, and as such the survey instrument was so constructed so that each respondent received a unique, browser cookie-based identifier, which acted as a means whereby individual respondents could be 'identified', providing one then with the sample size. Furthermore, cookie-based identification meant that those who had not completed the questionnaire in one sitting could return later to do so, provided that the survey was still available for completion, of course. Total N for the survey was 114, where valid N for a majority of the questions equalled 72. What this means is that, based on the cookie-driven identifier, it was possible to track, in aggregate, which respondent had responded to which questions. What this presents is a situation where N for each question in the survey is tracked. In the detail explicated below, N=72 for each question, unless indicated otherwise. Hewson et al (2003: 38) opines that response rates are generally difficult to calculate when conducting surveys via the Web.

Further with regard to sample size, it is interesting to note that the final question, which in fact was a declaration on the part of survey participants that their responses could be used, was responded to by 74 respondents. The latter declaration was termed as follows:

> I give permission for the University of Stellenbosch to anonymously process my responses for this Survey on Open Access scholarly communication in South Africa for the Computer - Library - and Information Sciences and Information Systems disciplines. (Please tick – if this area is not marked we cannot process your responses.)

Given that the declaration was the only compulsory question in the entire questionnaire (users received a pop-up message, requesting them to tick the 'Yes' box before finalising the questionnaire), it could be said that users could have misread the pop-up as a system failure, as they were expecting to submit the questionnaire, but instead received what seemed like an error message. However, if the latter were the case, I would expect that a majority of respondents would have committed this error. Instead, 74 respondents ticked the 'declaration' box, thus explicitly consenting to participation in the survey. What the latter indicates is that true N for the sample is closer to 74, than it is to 114.

Firstly, the descriptive statistics for each question below will be presented, followed by correlation analyses where these seemed warranted.

Descriptive statistics

Respondent profile (Q29 – Q34)

Summarising the respondent profile, it can be said that a respondent was typically from the LIS services sector, Computer Sciences, or some 'Other' area of employ; was either a Masters/Doctoral student or Senior Lecturer; more than likely possessed some postgraduate training; and had obtained his/her qualification at most within the previous ten years. The detailed profile is explained below.

Findings would indicate that the majority of the survey respondents were from:

- Library- and Information services (33%);
- the Computer Sciences and Information Systems disciplines (24%);
- and Other (e.g. Non-governmental organizations which research ICT issues, and / or Information Technology units within Libraries) (24%).

The full respondent profile per broad discipline is indicated in Fig. 7 below. Furthermore, it is notable that 40% of respondents were within academia (24% Computer Science, 16% Information Science).

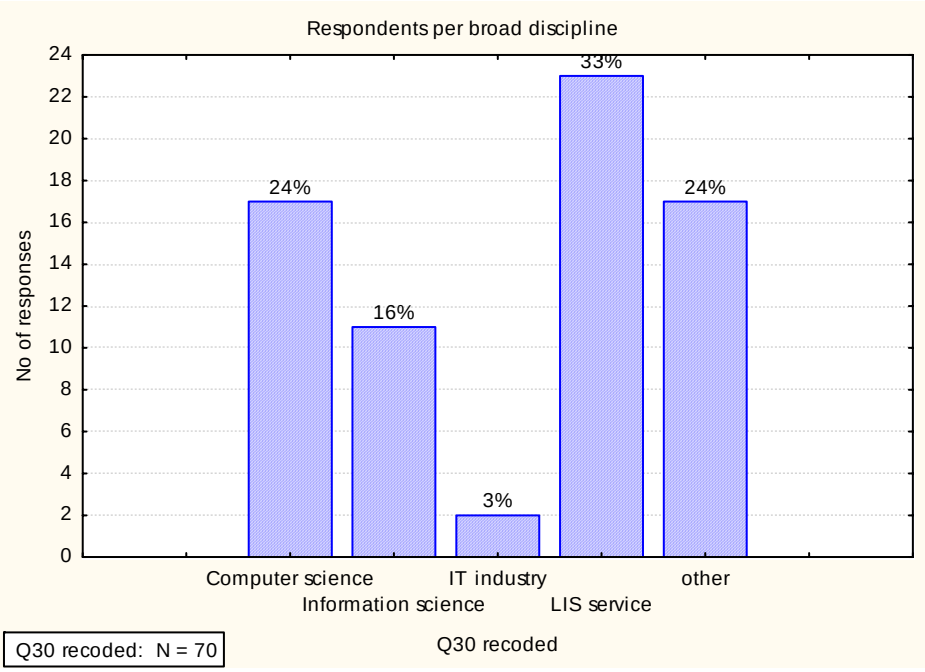

Fig. 7 Questionnaire respondents per broad discipline

The data regarding broad discipline, or place of employ, has been recoded and categories aggregated in Fig. 7 above. What this means is that the label 'Computer science' incorporates Computer Science Departments, Information Systems Departments, or combinations thereof. The 'Information Science' label refers to Library Science Departments, Information Science Departments, or combinations thereof. The foregoing refer exclusively to academic departments within higher education institutions. Though catered for, there were no responses from Information Technology administrative units within higher education institutions. A common misconception is that one should be able to distinguish between those in academia, and those within the services sector, and that the former tend to publish, whereas the latter do not. The underlying assumption in this study, as expressed in surveying the LIS services sector, is that persons within this milieu do publish, not necessarily as frequently as their colleagues in academia, but they do all the same. Further, the 'Other' category of respondents comprised the following:

"Educational technology unit, Education oriented NGO, Professor in a Science Faculty, Professor in Engineering, an IM Dept at a Chemical Engineering firm, Geography and Environmental Management, a Professor at a Graduate Business School who serves on the Senate Library Committee, NGO conducting technology research." What the latter indicates is that, given the interdisciplinary nature of research on Open Access, the survey was responded to by those outside of its stated remit. Could this hint at a need for a cross-discipline Open Access survey in South Africa?

In order to assess the relative efficacy of targeting the survey sample, a question was posed on how participants had been notified about the survey. Bearing in mind that survey participants had been recruited as individuals (at Academic Departments) and groups (Professional Society / Association e-mail lists), it is interesting to note that 63% of the respondents indicated that they had found out about the survey via 'personal e-mail', vs. 21% who had found out "via an e-mail discussion list I subscribe to", and 13% had been notified "via a colleague". In effect, 63% of the individuals recruited had participated, and 21% of the group-based respondents had participated.

The positions held by the respondents were quite varied, with a significant number of responses from those at 'Senior Lecturer" and "Doctoral/Masters student" level, as illustrated in Fig 8 below. Concerning primary responsibilities in the roles that respondents fulfilled, 37% chose the 'Other' category, thus indicating that their primary responsibilities were to perform tasks other than research or teaching. The latter compares favourably with the respondent broad discipline profile explicated above, where 33% were within the LIS services sector. Further with respect to primary responsibilities, 26% of respondents had to conduct both research and teaching; 17% had to conduct research; 13% had to "mostly teach, with some research"; 6% were to "conduct research with some teaching", and a miniscule 1.4% were employed to only teach. For those in the 'Other' category, they indicated their responsibilities as:

"mainly administrative with some teaching and some research, Researcher and director of unit, service profession with some teaching, Head: ICT and conduct research, Research and consultation on information technology use [and] information management, CEO (of Educational Techology NGO) but supervise some research" As is evident from these quoted comments, those who fell into this category did not regard research and teaching as their primary responsibilities, but it is interesting to note that they do perform at least one of the two. Again, we see a diversity of respondents with diverse responsibilities.

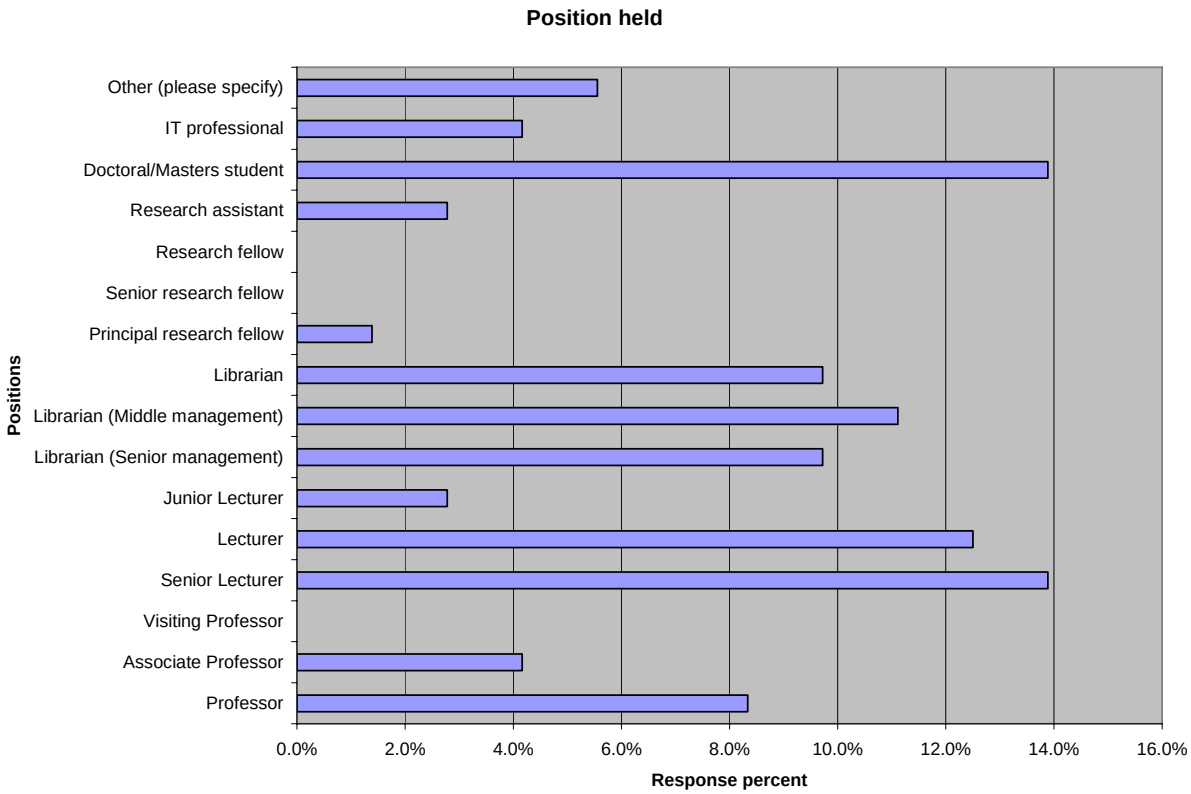

Fig. 8 Positions held by questionnaire respondents

In assessing level of professional education, the majority of respondents had a Masters degree (33%), while 28% had a Bachelors' plus Honours degree, and 21% were in possession of Doctoral degrees. Ten percent had only a Bachelors or first degree, whilst 8% had "Other" qualifications, either a first degree plus postgraduate diploma, or a PhD. The latter distinction between Doctoral and PhD degrees is not as a result of possible researcher bias, but rather that respondents to the survey to whom the PhD degree applied sought to distinguish themselves from other Doctoral qualifications, perhaps to denote that they had obtained their Doctoral qualification abroad. That said, of these higher education degrees, 43% had been obtained within the previous 5 years or less, 35% had been obtained within the past 6 to 10 years; 10% within the past 10 to 15 years; 6% within the past 15 to 20 years; and 7% had obtained their degrees more than 20 years ago. What is evident is that the range of qualifications was mostly spread to along the higher-level qualifications, with 54% in possession of either a Doctoral and/or Masters degree; and 28% with an Honours qualification. It is significant, and favourable that 82% of respondents would have conducted research, and so would be adequately familiar with the research process and behaviour.

Knowledge about OA initiatives (Q1 – Q2, Q35)

Knowledge about Open Access proved to be limited to generic terms, with a marked lack of awareness and familiarity with specific initiatives.

Question 1 of the questionnaire listed a number of acronyms, abbreviations, or nomenclature used in the Open Access arena. Said list comprised:

- Open Access publishing initiatives (PLoS, PubMedCentral, BioMedCentral);
- alternate forms of making research available (Institutional repositories, Open Access journals, Preprints, e-prints, self-archiving, discipline-based archives, and ETDs);
- bodies which are active in promoting Open Access(OAI, SPARC, Free Online Scholarship movement, BOAI, Creative Commons);
- Repositories and digital library services (Citeseer a.k.a. ResearchIndex, NCSTRL, ArXiv, RcLIS, NDLTD, E-LIS, RePEC, DoIS); and
- official statements or declarations regarding Open Access (Berlin Declaration on Open Access, ALPSP Statement, Bethesda Statement, Wellcome Trust statement, IFLA Statement, DC Principles for Free Access to Science).

For these, the abovementioned, respondents had to indicate one of three options, namely, whether they had heard about the item/entity; whether they had not heard about it; or whether they knew what an item/entity is or does.

Where N = 112, as many as 87% of the initiatives and entities listed were unheard of (26 entities out of a list of 30). Merely four of the 30 entities listed had been heard about, or their central functions were known. For the latter 'heard about' or 'known' entities, 41% of respondents had heard about 'Institutional repositories'; and 55%, 45%, and 41% of respondents, had a working knowledge about "Open Access journals", "Preprints", and "e-prints", respectively. It should be borne in mind that survey respondents were presented with a glossary prior to taking the survey. As these definitions could have been still recent in peoples' memories upon their responding to question 1 of the survey, it is possible that people had a working knowledge of these four 'known' entities due to this preparatory blurb. That said, these terms also inform current discourse on Open Access. It could be argued that persons with minimal exposure would be familiar with these terms.

A detailed breakdown of the responses to this question can be seen in Appendix G below.

Respondents to question 1, who were aware of Open Access initiatives, were asked in a subsequent question to indicate how they knew of these initiatives. There were 69 respondents in toto, 65% of whom indicated that they knew through literature related to their profession; 18% knew through colleagues, 4% knew through literature not related to their profession, and 13% replied "Other", usually a combination of the three prior options.

For N = 73, when respondents were asked if they would attend an information session on Open Access, 77% replied "Yes", the balance, "No". Taking the latter into consideration, as respondents indicated in the question subsequent to question 1 that they had knowledge about Open Access initiatives due to professional literature, colleagues, and so forth, it could be argued that people knew notionally about the Open Access movement, but lacked the detailed knowledge of specific initiatives as presented in question 1 itself. Given the rate at which discourse on Open Access is evolving, it should come as no surprise that persons, even though possibly interested in Open Access, might find it difficult to keep track of specific initiatives.

Scholarly practices and opinions, electronic and other (Q3 – Q17)

Respondents were asked to indicate their practices with respect to the use of electronic media, as well as their behaviour in making their research available; how they felt about Open Access methods of information dissemination as venues for their own research; how many papers they would have authored in a specific time-frame; and their behaviour regarding copyright of their works.

The typical respondent used e-mail daily, used a departmental Web site to make teaching material available, used e-mail to disseminate his/her research prior to formal publication, was in favour of Open Access journals, produced many working papers and conference papers, with post-prints constituting a percentage of research output, a subset of which was SAPSE accredited. Furthermore, he/she published in order to inform peers, and chose the journal in which to publish in order to obtain prestige and funding. The typical respondent was of the view that research institutions should promulgate and fund Open Access initiatives, and was strongly in favour of publishers permitting self-archiving. He/she ceded

copyright reluctantly when publishing, and was prone to not discussing copyright when submitting work for publication. Finally, our typical respondent would support Open Access journals if they were listed as SAPSE accredited. Admittedly, the aforementioned profile of scholarly behaviour is quite lengthy, but provides a terse summary of the detail which follows.

It is promising to note the support of Open Access initiatives, and furthermore, to obtain concrete data on the reasons for publishing. It has long been held as a truism in South Africa that, given the funding received from government based on publication rate, researchers primarily publish in order to obtain funding, and not due to altruistic motives characteristic of Polanyi's Republic of Science as discussed in Chapter 3. The responses to this question indicate the contrary namely that researchers publish in order to share their findings. As expected, they choose their journal based on 'prestige and funding'. That said, the respondents' support for Open Access journals 'if they were SAPSE accredited' attests to a reason frequently given for the limited uptake of Open Access in South Africa to date.

In order to gauge past and present usage of networked media, participants were asked to indicate the frequency (never, yearly, monthly, weekly, daily) with which they made use of E-mail, Web sites, and other forms of networked media to aid in their research and/or teaching. The modes for the respective media were as follows, for N = 82: 79% used personal e-mail daily; 29% used discussion-list based e-mail weekly; 55% never used Usenet; 41% used Web sites of professional organisations/associations/societies daily; 36% used homepages of colleagues and peers on a monthly basis; 37% never used blogs; 71% never used live webcasts; and 71% never used Web-based conferences. The distributions for each medium can be found in Appendix G below. Furthermore, in a follow-up question, 66% of respondents (N=82) indicated that they had not made their teaching material freely available on the Web. Of the 34% who had made their teaching material available, 56% had done so via a departmental Web site; 38% had made it available on a freely available Institutional repository; 34% had used their own personal Website in this regard, and 16% had used some "Other" method, such as blogs. 'Other' was also the category chosen by those to whom the question did not apply since they did not teach.

Regarding current dissemination of own research output prior to its formal publication, the significantly preferred method for doing so was via e-mail (49 % of respondents, where

N= 78). This should not be read as disinclination to making research available via other means or methods, as the responses assessing disposition to Open Access information dissemination would attest. For when participants were asked about their general disposition towards Open Access methods of information dissemination, as well as the types of material (documents) to be made available, there was a clear tendency to making already formally published articles (post-prints) available via Open Access journals[105]. If the latter response is taken at face value, it would seem that respondents were willing to publish via a traditional toll-gated journal, and then make that same article available in an Open Access journal. Naturally, the latter could be problematic in view of copyright restrictions. An alternative reading of the responses to this facet of the question could be that respondents were willing to use Open Access journals as first venue for publication. I can only state that either interpretation seems equally valid. There was also a clear tendency to making conference proceedings and research reports available via Institutional Repositories. The counts with respect to other types of research output can be seen in Table 8 below. The most popular OA method per publication type is indicated in bold text. Note that respondents could choose multiple OA methods per publication type.

[105] Note however that the question assesses real as well as projected engagement in Open Access. Distinguishing between real vs. projected behaviour has not been catered for in the question .

Table 8 Disposition to making research available via Open Access methods

	Institutional repository	Discipline/ subject repository	Personal / dept. homepage	Open Access journal	I would not make available
Letters to Editors	20	13	23	**27**	9
Review articles / opinion pieces	27	26	29	**33**	5
Data sets	**19**	11	19	10	13
Working papers	23	19	**31**	16	6
Journal papers (pre-prints)	20	19	**26**	25	10
Journal papers (post-prints)	26	27	28	**39**	6
Conference papers	32	31	31	**33**	3
Technical reports	24	21	**27**	23	4
Research reports	**32**	28	**32**	27	4
Book (chapters)	18	17	**24**	18	15
Book (complete volume)	15	15	10	13	**20**

N=71, response percent total > 100, counts are indicated.

Of the total number of publications produced within the preceding five years (N=59, percent totals > 100%), working papers and conference papers were the most frequently authored type of publication. Respondents indicated values for each publication type, and could answer for each category where appropriate. By way of explication of Table 9 below: where there were 59 respondents to this question as a whole, 24 persons, representing 41% of the respondents, indicated that they had authored 'Letters to Editors', and that these 24 persons together, had authored 59 such 'Letters to Editors'.

Table 9 Total number of publications in past five years

Type of publication	Number of respondents who answered, per publication type.	Percentage of respondents (N=59), per publication type	Aggregate number of publications indicated per publication type
Letters to Editors	24	41%	59
Review articles/opinion pieces	28	48%	36
Data sets	20	34%	6
Working papers	29	49%	**365**
Journal papers (pre-prints)	31	53%	71
Journal papers (post-prints)	37	63%	123
Conference papers	48	82%	266
Technical reports	28	48%	75
Research reports	32	54%	196
Book chapters	25	42%	16
Books (complete volume)	19	32%	2
Total number of publications for past five years			1215

Of the 123 Journal papers (post-prints) reported in the number of publications per type in the table above, the comparative proportion of papers published in SAPSE-accredited journals were assessed. Of these 123 reported journal papers then, and for a total number of respondents equalling 46: 22 respondents indicated that none had been published in SAPSE accredited journals, 21 respondents indicated between 1 and 5 papers had been SAPSE accredited; 1 respondent indicated between 6 to 10 papers, 1 respondent between 11 to 20 papers; and 1 respondent indicated that more than 20 papers had been in SAPSE accredited journals.

In assessing reasons for having authored journal papers, where N=32 and response percent total > 100, the overwhelming reason was "to inform others about my work and results" (78%). A second motivation was "to gain credits for academic advancement" (63%); third, was "to gain/justify research funding" (50%); a fourth motivation was "to get feedback

from reviewers and readers" (49%); and 28% did so in order to "document the work in an archival way". It should be borne in mind that respondents could choose more than one such 'motivation' listed, and a number of respondents had thus chosen multiple such motivations.

With regard to the criteria used to determine which journal an article should be submitted to, authors (N=32, response percent total > 100) cited "prestige – it is on a shortlist of approved journals (promotion, funding)" (69%) as the primary determinant in exercising this choice. A secondary criterion was "dissemination – large circulation, relevant readership" (38%). Furthermore, 22% indicated "timeliness – short time from submission to publication" as a driving factor; 15% indicated "retrieval – journal is indexed in a free Web database"; 13% indicated "availability – articles are available for free on the Web"; and 9% indicated "retrieval – journal is indexed in commercial database", as factors taken into consideration. 19% of respondents to this question indicated "Other" factors, such as "calls for specific topics, relevance to subject material". The latter echo Pouris and Richter (2000).

Concerning the promulgation and funding of Open Access, participants were asked "In a country such as South Africa with a small research base, in your opinion, who should spearhead adoption of Open Access methods of information dissemination and find funding for such efforts?" The majority of respondents (75%) where N=79 and percent total > 100%, felt that research institutions should promulgate and fund Open Access initiatives, rather than government (63%), academic departments (61%), professional associations/societies (56%), or research funding agencies (42%). It should be borne in mind though that respondents could elect more than one such institution, and as such, the responses indicate rather a cascading hierarchy of preference rather than one option being the one preferred option when compared to another. It is interesting to note that respondents seem to prefer an inherently decentralised approach to the adoption and funding of Open Access, rather than the inherently centralised approach of government involvement in this regard. What was surprising was to see the rather low ranking of 'research funding agencies'.

Next, participants were asked whether publishers should permit self-archiving via the posting of articles on various Open Access channels of information dissemination. More

specifically, respondents were asked whether publishers should permit posting of articles on departmental or personal Web sites and whether publishers should permit posting of articles on institutional or disciplinary repositories The distinction between 'departmental or personal Web sites' and 'institutional or disciplinary repositories' is one of formality, and somewhat artificial. It can be argued that the information management practices for the former are less rigorous than those of the latter, hence the distinction in the questions below. In aggregate, approximately 90% of respondents were in favour (either strongly so, or simply 'in favour') of publishers permitting the posting of articles on these various Open Access channels. The results for the aforementioned are summarised in Table 10 below.

Table 10 Publishers should permit self-archiving: in favour or against?

	Publishers should permit articles on departmental or personal Web sites (N=78)	**Publishers should permit articles on institutional or disciplinary repositories (N=78)**
Strongly in favour	65.4%	53.8%
In favour	24.4%	39.8%
Neither in favour nor against	6.4%	3.8%
Against	3.8%	2.6%
Strongly against	0%	0%
Column totals	100%	100%

When asked about their practices with respect to the transfer of copyright to a publisher for purposes of article publication, and particularly to gauge whether authors resorted to copyright assignment (complete transfer of copyright to the publisher) or copyright licensing (partial transfer of copyright to the publisher), the responses were as follows. For N = 77, and the question wording "On the whole, do you assign your copyright to publishers in order to get published?", 54.5% indicated that they had not published; 29.9% indicated that they ceded these rights reluctantly; 6.5% did such cession "freely", while 7.8% revealed that the publishers they work with do not ask for copyright assignment; 1.3% of respondents indicated that they ask to retain copyright and do not enter into 'copyright assignment' agreements.

Respondents were also asked what they did as an alternative to copyright assignment. For N= 57, 66.7% had not published; 15.8% signed the publishers' exclusive license agreement;

3.5% would "amend the publishers' copyright assignment form and return it", and 14% indicated "Other" alternatives to copyright assignment.
"Usually this has not been discussed"
"To questions 15 and 16: I have not published for quite some time. But when I did I was not really concerned with the copyright issues - I was too glad to get something published. I do however strongly believe that it is wrong that the creators of intellectual capital have to forfeit their copyright to journals merely to buy it back at exorbitant prices!" , "We publish our research on our web site under the Creative Commons license."

Furthermore, assessing disposition to Open Access journals per se revealed that 30.1% of respondents (N=73) were amenable to making their works available in this manner, indicating "I would unreservedly publish in such a journal", and 13.7% had already in fact done so. However, 47.9% indicated that they would "publish in such a journal if it were listed by SAPSE". Moreover, 2.7% indicated that they "would not publish in such a journal".

Institutional electronic archives (Q18 – Q22)

Participants were asked to indicate whether their institutions had already implemented an institutional repository (IR), as well as whether they had implemented a digital repository for postgraduate research (ETD). If they had not implemented either of these, they were asked whether they (their institutions) had any plans in this regard for the two types of repositories.

Most institutions had no plans to implement either an IR or an ETD. What is significant is that for those institutions which have or plan on implementing a digital repository, more progress is seen with respect to ETDs rather than IRs. The latter is probably due to a high level of interest in ETD repositories in the higher education sector in recent years in South Africa, with concomitant workshops and dialogue across institutions. Even without an ETD or IR strategy, there seems to be little emphasis on obtaining electronic copies of theses and dissertations. Is the latter a seeming holdover from the print era and surprising, or would it possibly constitute just another administrative burden? Respondents would encourage electronic submission if their institutions had an ETD or IR. The question though is, why wait? Many respondents preferred that the Central Library manage such an archive. Given the percentage of respondents from the LIS services sector, the latter might

come as no surprise. However, when interrogating the data, approximately 50% of respondents to this question hailed from academia, and not the LIS services sector. Could it be said that, even though those within the LIS services sector seem keenly aware of Open Access, many of those did not see a role for themselves in creating and managing such digital archives?

The responses regarding orientation to IRs and ETDs are indicated in Table 11 below.

Table 11 Orientation towards IRs and ETDs

	Type of repository	
Does your institution have:	**An IR (N=72)**	**An ETD (N=73)**
Yes, at present	13% (9)	26%(19)
We plan to implement one	17%(12)	21%(15)
No plans at present	50%(36)	41%(30)
Comments	26% (19)	19%(14)
Column Totals	106% (76, valid N=72)	107% (78, valid N=73)[106]

Frequencies in brackets

As can be gauged from Table 11 above, 50% had no plans to implement an IR, and 41% of respondents had no plans to implement an ETD. The real (versus percentage) number of respondents is given in brackets to easily indicate how many persons had in fact replied for each category. It is a matter of speculation whether, say 9 respondents who indicated that they had already implemented an IR, could be from the same institution.

When asked if their postgraduate students were currently required to submit electronic copies of their theses and dissertations, regardless of whether a digital repository to house such works had been implemented, for N = 72, 27.8% were unsure if any such requirement formed part of an institutional policy or not; 26.4% indicated that electronic submission was mandatory; 22.2% indicated "No"; 18.1% held that electronic submission was done on a voluntary basis; and 5.6% indicated that such electronic submission would be a requirement "in near future (1 year)".

[106] Valid N for the two categories (IRs and ETDs) in this table are based on the summary statistics provided by the online software facility, where respondents were given a unique random number identifier (cookie-based). It can thus be concluded that 4 and 5 extra Ns respectively can be accounted for as persons who indicated whether they had an IR/ETD or not, and then added comments to augment their choices indicated earlier.

Participants were then asked to imagine some future scenario where if their institution had implemented an ETD repository, whether they would actively encourage electronic submission of theses and dissertations. Where N = 74, more than half responded positively (56.8%); 31.1% would encourage such submission if it were "supported administratively"; 6.8% were unsure and would need further information; while 1.4% would not encourage such electronic submission of postgraduate theses and dissertations to an ETD repository.

When asked who should manage these digital institutional archives, be it an institutional repository, or ETD repository, 52.8% (N=72, percent total = 100) felt that the central library should do so. 26.4% of respondents felt that "a pre-existing central structure, such as a unit for research development, or other similar type of entity" should be responsible, while 15.3% thought that a "purpose-built central structure" would be preferable. 6.9% thought that a structure "with connections to my Faculty" should bear this responsibility. Of note here is that respondents could only choose one preferred venue for the management of digital institutional archives. With the Central library indicated as the preferred manager of digital archives, here bias may have stepped in, given that a number of survey respondents originated in the LIS Services sector, but this has already been discussed in the introduction to this section.

Degree of involvement in journal publication (Q23 –Q24)

Participants were also asked to indicate the degree to which they had possibly been involved in the administration of a scholarly journal, as editor, reviewer, and such. First off, of course, participants were asked whether they had had any such involvement in the past or were presently so engaged. The *ex-ante* expectation is that those who are involved administratively will have a greater awareness of Open Access. The latter was found to be the case, but did not prove to be statistically significant. This is discussed in the section of this chapter covering correlation descriptions below.

For N= 72, 75% were not involved administratively in the publication of a journal or edited volume. For the 25% who had answered in the affirmative (N=18 thus, and response percent total > 100), 27.8% had been or were Editors; 38.9% sat on the Editorial Board; 38.9% acted as Review writer; 72.2% had acted as peer-reviewer, and 22.2% of respondents indicated "Other" as category. For those of the 'Other' category, it is evident

that there were other ways in which to be involved in journal publication, not catered for in the survey instrument such as "systems administrator for online journal", "Bibliographic editor", "Business manager which includes production of the journal, subscriptions as well as requests to make the journal available electronically", "contributor/editor of regular column'.

Use of others' scholarly output (Q25 – Q28)

The following set of questions asked respondents about their information use, rather than information production assessed above. Respondents used a range of document sources, which were either used but not essential, or essential to their research. However, pre-prints, images and sound recordings, maps or charts, artefacts, and letters to editors were not used. The high figure for non-use of pre-prints is surprising. Works were sourced primarily via the authors' personal Web page, or a subject/discipline repository, either to prepare an article, or for general research activities.

Respondents were asked about the extent to which they used scientific works (information types) regardless of whether the works had been made available via the World Wide Web. The question was posed so as to ascertain the extent to which various information types formed part of the researcher's scholarship. Respondents had the option to indicate three possibilities, namely that they:

- 'Do not use' a particular information type;
- 'Use, but not essential', or;
- 'Use, essential to my research'.

The results for N =73, response percent total > 100, are illustrated in Table 12 below, modes are indicated in boldface.

Table 12 Extent of use of others' scientific works

	Extent of usage		
Information type	**Do not use**	**Use, but not essential**	**Use, essential to my research**
Journal papers (pre-prints)	**25**	22	20
Journal papers (post-prints)	3	12	**56**
Journals – not peer reviewed	12	**33**	25
Books	1	20	**52**
Working papers	11	**36**	24
Research reports	8	26	**39**
Conference papers	4	26	**42**
Technical reports	15	**28**	24
Theses/Dissertations	10	25	**35**
Abstracts and Indexes	8	21	**41**
Data / statistics	17	**26**	23
Official publications	3	29	**35**
Images or sound recordings	**39**	20	7
Maps or charts	**43**	19	5
Artefacts	**47**	12	4
Letters to Editors	**41**	21	4
Review articles / opinion pieces	9	**37**	22

Frequencies shown (not percentages)

Participants were asked whether they had used "other authors' research material that have been made freely available on the Web". Results indicate that 88% of the respondents (N=72) did indeed make use of such freely available content. Further these 88% respondents (N=64, response percent total > 100) were asked which archives, services, or sources they had used to access such works. The preferred sources for such works were an author's Web page, and discipline/subject archives (67.2% had used an "author's Web page"; 65.6% had used a discipline/subject archive; while 59.4% had made use of a "Department's Web site"; 37.5% had made use of an institutional repository; and 9.4% indicated some other venue for such works, such as "a project repository", "CiteSeer", "I e-mail and ask permission", "via Search engines - you sometimes accidentally make use of the above mentioned sites/pages."). Fig. 9 below illustrates the range of responses.

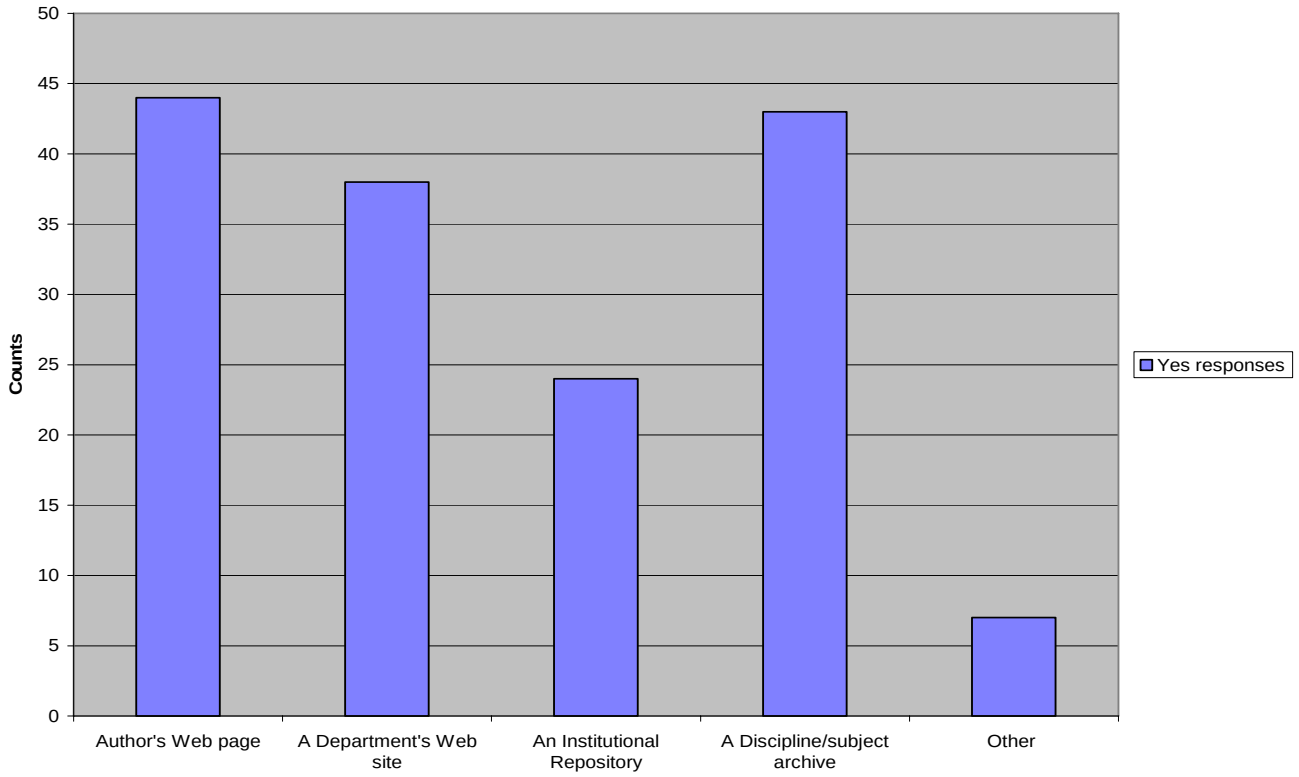

Fig. 9 Preferred sources for others' scientific works

Furthermore, when asked for which purposes the works so sourced had been put to use, 62.5% (N=64) said that they had used such material to "prepare an article"; 59.4% had done so "for personal interest, knowledge or culture", while 43.8% had used the material for "teaching activities". 23.4% had used the material for some other purpose, such as general background research or in providing information to patrons.

Correlation descriptions

Though correlations were run on a number of questions, general tendencies are indicated below, and only those instances where significant correlations were found are described in detail. These correlations below have the null hypothesis as starting point, which says that there is no relationship between variables i.e. $r = 0$. A 5% significance level ($p < 0.05$) was used as guideline for determining significant correlations. For categorical variables the chi-square test was used.

Question 5 and 6 were compared to see if there is a correlation between those who made their teaching material available via some or other electronic means, and those who shared

their research (via some means) prior to formal publication, respectively. There was a tendency, not statistically significant, where respondents who said no to any of the variables for Question 5, also said no to Question 6.

However, a significant association ($p<0.01$) existed between those who made their teaching material available on a personal Web page, and those who shared their research output via their own personal Web page. A significant association ($p<0.01$) also existed between those who made their teaching material available on an institutional repository, and those who shared their research via a Departmental Web site.

Comparing the attitudes of those (question 13) who thought that publishers should permit users to post articles on personal or Departmental Web sites with those (question 14) who thought that publishers should permit users to post articles on institutional or disciplinary repositories, a positive correlation existed ($r=0.75$, $p<0.01$). The latter is illustrated in Fig. 10 below.

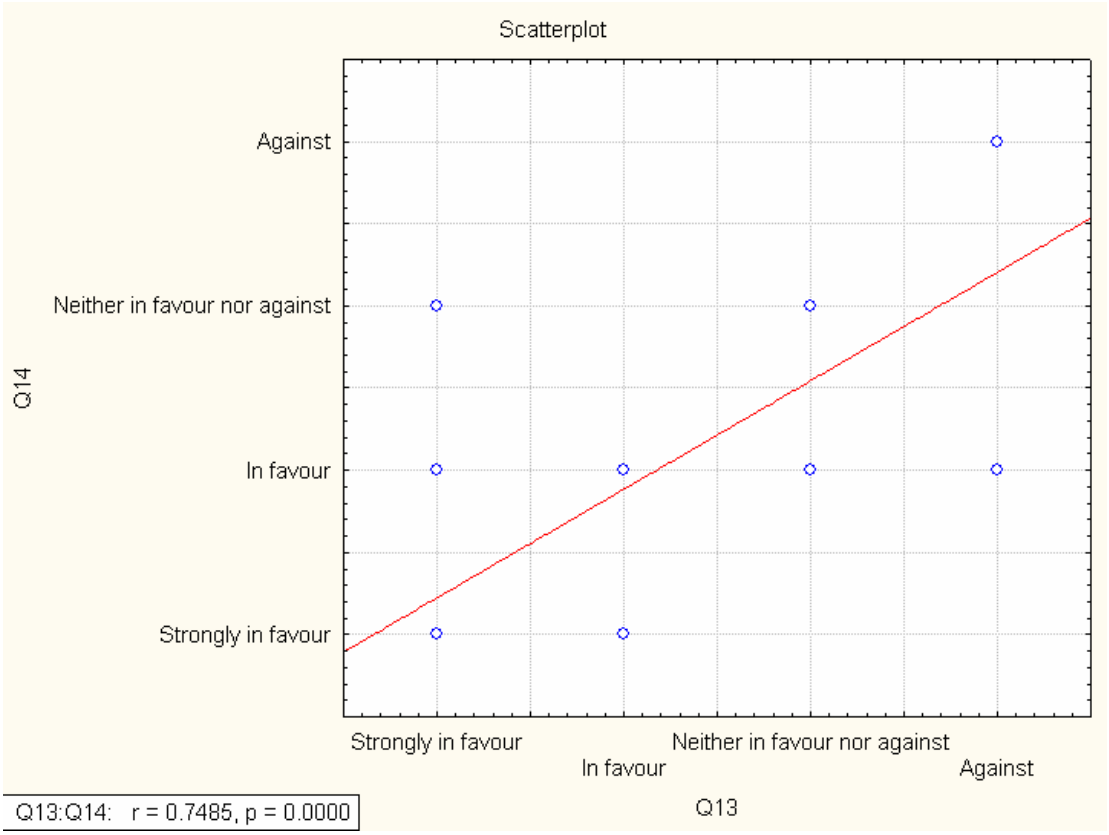

Fig. 10 Support for what publishers should permit authors (Q13 versus Q14)

Comparing the information types used in research versus respondents per broad discipline, a significant association (p=0.02) was found in that Information Scientists tended to use working papers. They regarded working papers as essential to their research. A second statistically significant association (p=0.02) was found between Computer Scientists and their tendency to not make use of 'Letters to Editors' for their research.

Comparing online activities used to aid research and teaching, in effect the use of ICT, with the type of publication produced by the survey respondents, significant negative correlations were found. Using Spearman Rank Order correlations, the following variables were negatively correlated i.e. they had inverse relationships to one another. These variables are indicated in Table 13 below.

Table 13 Type of publication produced versus use of network/ICT facilities

Question 7 variables (type of publication produced)	Question 3 variables (online activities used to aid research and/or teaching)	Spearman Rank Order Correlation r=
Data sets	E-mail discussion lists	-0.47
Working papers	Homepages of colleagues / peers	-0.39
Book chapters	E-mail discussion lists	-0.49
Book chapters	Usenet newsgroups	-0.57
Book chapters	Homepages of colleagues / peers	-0.45

Note that the r value for each negatively correlated relationship is given in the third column. Since these values are all approaching -1, they bear testament to the strong negative relationship between the variables. The table should be interpreted such that, for instance, those who made significant use of E-mail discussion lists were significantly less inclined to produce 'data sets' or 'book chapters', or vice versa, that those who produced significant numbers of 'data sets' and 'book chapters' were less inclined to make use of e-mail discussion lists. The aim of the correlations was to see if those who had published had a preferred method of online activity. Though the latter cannot be inferred from the test, it is interesting to note these inverse trends.

Juxtaposing the types of publication produced with the types of information used for research, significant positive correlations existed between the following information/publication types, as illustrated in Table 14 below. Types which showed no significant correlations are not listed in the table below.

Table 14 Publication type produced versus information type used for research

Publication type produced	Publication / information type used for research	Spearman Rank Order Correlation r =
Data sets	Conference papers	0.56
Working papers	Images/sound recordings	0.39
Journal papers (pre-prints)	Conference papers	0.44
Journal papers (post-prints)	Journal papers (pre-prints)	0.41
	Conference papers	0.46
	Letters to Editors	0.45
Conference papers	Conference papers	0.30
Technical reports	Official publications	0.41
Research reports	Official publications	0.39
Book chapters	Journal papers (pre-prints)	0.48
	Technical reports	0.51
	Images /sound recordings	0.56
	Maps / charts	0.48

As can be seen from Table 14 above, those who produced Data sets, were prone to making use of Conference papers for their research, etc.

No significant associations were found when juxtaposing yes/no responses to "Have you used other authors' scientific works that have been made freely available on the Web?" with responses regarding disposition to making works available via an Open Access method of information dissemination. What this means is that there was no link between the behaviour of other researchers' and the researchers' own behaviour.

Significant associations were found between those persons who were or had been involved administratively in journal publication, and awareness of Open Access. More specifically, those whom had been on editorial boards were found to be more aware of Open Access proponents (items 12 – 16 in question 1 of the survey) and specific instances of extant repositories (items 17 – 24), such as RePEc and others named in question 1 of the survey. Those whom had acted as peer reviewers, had a greater awareness of alternate forms of making research available (items 5 – 11 in question 1 of the survey), as well as greater awareness of implemented repositories (items 17 – 24 of question 1). The strengths of these relationships are indicated in Table 15 below. Significant correlations are indicated in

bold text. Furthermore, variables for Question 1 have been recoded into these aggregate sets, consisting of publishing initiatives, etc.

Table 15 Role in journal production versus awareness of Open Access

	Editor	Editorial Board	Review writer	Peer-reviewer
Publishing initiatives (items 1 – 3)	0.01	0.06	0.02	0.08
Q1: Alternate forms of making research available (items 5 – 11: IR to ETDs)	0.05	0.17	0.06	**0.24**
Q1: OA proponents (items 12 -16: OAI to Creative Commons)	-0.06	**0.21**	0.10	0.11
Q1: Repositories (items 17 – 24 : Citeseer to DoIS)	-0.06	**0.21**	0.13	**0.20**
Q1: Official statements / declarations of support (items 25 – 30: Berlin declaration to DC principles)	-0.03	0.15	0.15	0.17

Marked correlations are significant at $p < 0.05$; N=103

Though tested for, there were no significant correlations or tendencies present between level of seniority and awareness of Open Access; discipline of study and awareness of Open Access; nor between level of education and awareness of Open Access.

Structured record reviews

Stellenbosch University's technological development timeline

Information on the technological development of Stellenbosch University is based on interviews conducted, since many document-based sources in this regard are non-existent or have been misplaced.

At the time of writing, the Information Technology Division of Stellenbosch University, is the chief coordinator of ICT infrastructure on and services to its four campuses, namely Stellenbosch main campus, the Medical Faculty in Tygerberg, the postgraduate Business School in Bellville, and the Military Academy in Saldanha. The strategic management of the ICT infrastructure at the Business School and Military Academy is done by management teams at these sites, and does not reside at the Stellenbosch main campus. The chief remit i.t.o. infrastructure implementation and maintenance for the Information Technology Division are the Stellenbosch main campus and the Medical Faculty, where the latter services are coordinated with those provided by the Bellville and Saldanha sites.

With regard to the management of the University's Web domain and Web servers, the IT Division is responsible for the technology implementation and maintenance, and the dedicated Web Team of the Marketing Division is responsible for the maintenance of the corporate look-and-feel of the primary university Web server namely www.sun.ac.za. Academic Departments, Bureaux, etc tend to appoint 'Pagemasters' to design and maintain their homepages. These pagemasters tend to be administrative staff within these Departments who are tasked with development or maintenance of the Web site, or oftentimes the work is contracted out to Web site developers in the region (small one-person design firms, or students who have appropriate training and experience). The management of these departmental Web pages is very decentralised with respect to the design, and content hosted. The Web server administrator of the IT Division is responsible for the information organisation of the server back-end, providing the Pagemasters with the necessary support with respect to FTP access, and general queries around Web site development.

The Information Technology Division as a dedicated support facility was established in 1986. Prior to this, two information technology management entities existed, namely the decentralised data processing centre and the computation centre. The latter two centres were committee driven, and apparently difficult to manage. The establishment of the Information Technology Division in 1986 instituted a dedicated management structure, with a senior directorship tasked with Information Technology at Stellenbosch University. By 1990 four distinct areas of responsibility had been defined, namely computation services; administrative computing systems; user support; and local area network (LAN) and hardware support. A dedicated Help Desk, providing end-user support, was initiated in 1996, where the call tracking system was developed in-house.

In terms of network infrastructure, that of Stellenbosch University has been characterised as being relatively ahead of most other universities in South Africa, and more so with regard to the use of the network to run services such as card access control systems, tumble dryers, and printers. The earliest instantiation of a LAN was created in 1986, this after government having passed a private law (in 1985) which permitted Stellenbosch University to lay cables under roads – a measure which was previously the sole preserve of the South African telecommunications monopoly. The initial implementation was a Technetix-based LAN, and a migration to ARCNET was effected between 1988 and 1990.

Migration to Ethernet was started in 1991, and ARCNET was still run in parallel. A complete switchover to Ethernet was made in 1995. The complete adoption of Ethernet at Stellenbosch University is characterised as having been relatively late compared to other universities in South Africa. Stellenbosch University is regarded as an early adopter of Novell Netware, and more particularly the use of Novell Directory Services (NDS).

The use of E-mail at Stellenbosch University was initiated in 1988 via a link to Rhodes University. The first e-mail application used at Stellenbosch was an in-house product named Netmail, with subsequent migration to Pegasus Mail in 1994, and the implementation of Microsoft's Exchange2000 in 2001. Stellenbosch University is said to be the first university in South Africa which has fully implemented and run Microsoft's Exchange server. Apparently, universities have always had relatively good contact with one another with respect to who was using which facilities, more particularly, e-mail facilities.

Stellenbosch University developed its own Administrative Computing System in 1986, which was operationalised in 1990. The services run on this platform are human resources, finance, student administration, and management information. At the time of writing, Stellenbosch is migrating the Human Resources module to the Oracle platform. The management information component regarding data warehousing and reporting may also be migrated to the Oracle environment. Between 1995 and 1999 a formal cooperation agreement was entered into between Stellenbosch University and the two other institutions in South Africa who were using the same administrative computing system. The aim of this partnership was to further develop the administrative computing system, and to draft clients to whom this product could be sold to. One client had been drafted during the timeframe of the partnership.

Stellenbosch University has also implemented an university portal, where the 'holy grail' as it were is to implement a single sign-on service. What the latter entails is that a single user signing on to one service e.g. the portal, will automatically have access to a range of other networked services. The challenge of implementing the latter is the integration of systems and the proper management of identity. Identity management is complicated when one user has many roles, and the assignment of associated rights then becomes tricky.

In summary, Stellenbosch University was an early adopter of a number of technologies, as well as creator of at least two software products, namely, an e-mail client, and an administrative computing system. The reasons behind in-house development were three-fold. Due to sanctions, access to software was limited. Even if access could be gained to overseas software products, they were simply too expensive to acquire. Furthermore, due to a lack of technology standards, acquiring software products from abroad was simply not feasible. These days, there is more of a tendency to look for off-the-shelf products first, and then to consider in-house development.

Stellenbosch University is also seeking a better research information system, which would manage research outputs (for funding purposes) as well as for the management of research projects and project funding (grant funding as well as other outside sources of funding). A product has been acquired in an attempt to manage the latter, but it is described as being technologically advanced but lacking in terms of functionality and support. It is posited that a more sensible route would be for all South African universities to together bid for a research information system, in contrast to the current situation where each university has implemented, more often than not, a different research information system. The complicating factor in trying to acquire a product from abroad, is that it cannot be used off-the-shelf, since the functionality needed for the statutory reporting required for government subsidy of research publications is not available, and would need to be developed. An argument in favour of the creation of institutional repositories is that it can be seen as a research information system, and can be used for reporting of the latter sort.

Other respects in which Stellenbosch University is ahead is in its implementation of the Vista flavour of WebCT, the learning management system. The cost recovery for Internet use done by Stellenbosch, is also a feature being monitored by other institutions. End-users at Stellenbosch University are charged for Internet use beyond the university's firewall, in effect, beyond the university's Internet domain. This Internet use is charged according to the amount of data (in Megabytes) transferred to and from a user's account. It should be noted here that such Internet use fee is incurred when end-users make use of the World Wide Web, and not for general e-mail use. An initial flat registration fee is charged per annum for network access, and a pay-per-use component is in place for the quantity of data requested via habitual World Wide Web surfing. Differential pricing is used and depends on the time of day that the facility is used e.g. it is cheaper to use the Internet late evening

and during the night. Many higher education institutions in South Africa do not make use of such cost recovery models, and it is said that untrammelled use by end-users at any time of the day leads to a degradation in service, since a minority of users may make use of 80% of the bandwidth through downloading large volumes of data and through making use of data streaming applications. The latter has implications for the development and use of digital repositories. I will return to this point in Chapter 6 below.

Structured record review detail

The various organisational structures reviewed as part of this study were as follows. There were 140 Academic departments, four Bureaux, 22 Centres, 10 Faculties, 11 Institutes, three Laboratories, six Schools, and 16 Units. A complete listing of the latter can be found in Appendix H. It should be borne in mind that the hyperlinks for some of the Departments listed resolved to the same URL. This was particularly the case for the links "civil engineering", "geotechnical and transport engineering", "structural engineering and information technology", and "water engineering and engineering management". Furthermore, many of the 'Units' did not have dedicated homepages, but rather had links to contact e-mail addresses. The categories 'Faculty' and 'School' were not evaluated since they are top-level descriptive homepages with links to their associated Departments, Institutes, etc.

Two trends were evident in the review, namely that Academic Departments in the Natural Sciences tended to make extensive bibliographical listings of publication and patent output per year available. The latter was almost done with inordinate rigour. The second trend was that Academic Departments in the Humanities and Social Sciences were very prominent in either engaging in self-archiving, in hosting scholarly journals, or in promoting scholarly journals. The latter trend is contrary to expectation, since it is often argued that scholars in the Social Sciences / Humanities lag in the adoption of Open Access when compared to those in the Natural Sciences. The argument proffered in the latter regard states that the publication cycles between the two science cultures (Humanities and Social Sciences vs. Natural Sciences) differ considerably; that the former is slower than the latter; that theory formation in the former is slower than the latter. As a result, the speed of theory formation is extrapolated to the speed with which new modes of scientific communication diffuse. Furthermore, the discipline of High-Energy Physics is renowned for its seminal pre-print

repository, arXiv[107], and is in turn viewed as having set the tone for digital repositories and the nature of scientific communication within the broader Natural Sciences. My findings suggest that, at least at Stellenbosch University, the science cultures differ in this regard.

Engaging in self-archiving

Of the 140 Academic departments surveyed, seven had full-text publications online of individual researchers. Two bureaux out of a total of four had full-text publications online; three out of 22 Centres; one out of 11 Institutes, and one out of 16 Units. The type and quantity of full-text publications available varied considerably, with the Academic Departments within the Humanities and Social Sciences making up almost 50% of those Academic Departments that did make full-text articles available, the remainder coming from Departments within the Natural Sciences. Contrary to expectation and as argued above, these three Academic Departments (Afrikaans and Dutch; History, Sociology and Social Anthropology) within the Humanities and Social Sciences were engaging in self-archiving, making the full-text of research articles available. The Academic Departments within the Natural Sciences with full-text articles were Forest Science, Geology, Human Nutrition, and Microbiology.

Of note is that two Departments whose disciplines have a long history of subject-repositories, namely Physics and Economics, with the arXiv and RePEC archives, did not have full-text articles listed on their Departmental Web sites. It could be argued that the authors in these Departments might have made their works available as full-text in these aforementioned archives. However, if the latter was the case, I would expect any publications listed on the Stellenbosch homepages to have links to their copies available from these subject archives. The latter is not the case. More particularly, the Economics Department has an extensive listing of recent journal articles; research projects and reports; conference papers; completed doctoral dissertations; books; and doctoral projects in process, none of these full-text. Electrical and Electronic Engineering have annual research reports available as full-text.

Three Academic Departments (Aeronautics; Physiotherapy; Family Medicine and Primary Care) have links to subject archives, and free journals online, respectively. Aeronautics has a link to the Langley Tech Reports Server; Physiotherapy has links to PubMed (a free

[107] Initiated in 1991 and located at http://www.arxiv.org; variously referred to as the LANL (Los Alamos National Laboratory) archive, and latterly the Cornell archive.

online bibliographic service to medical literature) as well as a link to http://www.freemedicaljournals.com ; Family Medicine and Primary Care has a link to PubMed.

Engaging in Open Access journal publishing

Of the nine Academic Departments involved in the journal publication sphere (either through hosting journals or through providing a platform for information about journals of specific scholarly societies) five were merely promoting the journals of associated professional societies, the remainder (Afrikaans and Dutch, Ancient Studies, General Linguistics, and Journalism) were engaging in Open Access publishing, making the full-text of journal issues available for free. It should be noted that the nine Academic Departments involved in the journal publication/promotion sphere, were all within the Humanities and Social Sciences, none within the Natural Sciences. One Centre had the full-text of one journal issue available (African Centre for Investment Analysis promoted the 'African Finance Journal').

The empirical results for the questionnaire-based study indicate that respondents were well-disposed to Open Access scholarly communication, but generally lacked extensive awareness of specific Open Access initiatives. Respondents tended to have notional awareness of Open Access. Investment in Open Access scholarly communication through the use of the various channels of Open Access is still relatively low when considered in the context of making their own research available. The use of Open Access venues in order to access the works of others shows a higher level of activity when compared to level of activity in making their own works available. Comparing the latter dissemination practices to information use practices, it seems that Computer- and Information Scientists are far greater users of Open Access-based information than providers of such information. Respondents were overwhelmingly in favour of publishers' permitting self-archiving, but their personal behaviour indicated that many did not negotiate copyright agreements with publishers.

The large number of responses from Library- and Information Science (LIS) Services would seem to indicate that persons within the LIS services community are more keenly aware of the crisis within scholarly communication. This is hardly surprising given that LIS services bear the brunt of the crisis when footing the bill for ever-increasing journal prices.

In this regard ever-shrinking library budgets have had to accommodate these price increases.

What is encouraging is the percentage of respondents from across the research disciplines, which would seem to indicate an awareness, which cannot be generalised to the broader South African scholarly community, of the debate around greater accessibility and availability of research output.

E-mail predominates as the preferred medium for sharing research works, and the establishment of IRs and ETDs is markedly low. The latter is surprising, since software for creating digital repositories is freely available, and there is an ever-increasing base of institutions implementing digital archives.

Though not indicated overtly in the survey, yet gleaned from the homepages visited when compiling the contact details of the survey sample, and as seen in the structured record review, the tendency to making information available about the types of research conducted, or the range of research areas covered can be seen. In the latter cases full-text is seldom provided.
Respondents felt that research institutions should promulgate and fund Open Access initiatives, and that Central (institutional) libraries should manage such archives.

The structured record review reinforces the picture of low levels of activity and investment in Open Access as gleaned from the questionnaire-based study. The surprising finding in the structured record review has been the predominance of the Humanities and Social Sciences in engaging in Open Access information provision (especially self-archiving, but in journal article publication also).

Chapter 6
Discussion and Conclusion

What follows is an integration of the main arguments raised in the foregoing chapters. It will be shown that, in a world of the rise of the entrepreneurial university, openness of scholarly systems needs to be mandated as openness will not happen of its own accord. Such mandating in South Africa, together with Open Access developments abroad, will increase the amount of reliable research information available to researchers, globally and in South Africa. At the same time, South African research will gain greater exposure. More than this, such stimulation of the core component of a national system of innovation may go some way to alleviate the declining global competitiveness of South African scholarship. The argument which permeates this thesis, as elaborated upon in the preceding chapters and revisited below, suggests that minimal amendment of current legislation will constitute mandating Open Access in South Africa. Following the policy recommendation made below, factors limiting the adoption of Open Access in South Africa are briefly mentioned, followed by an overview of the limitations of this study. Thereafter areas for further research are elaborated upon, and the chapter, and thesis, ends with the Conclusion.

Responding to the research questions

The responses to the research questions raised in this thesis rest upon two pillars, namely, a theoretical framework, and an empirical study consisting of two surveys, one questionnaire-based, the other, a structured record review. The aims, theoretical underpinnings, and results of the empirical study are briefly revisited below, creating a context for the recommendation for mandating Open Access scholarly communication in South Africa.

Background

Even though the absolute number of publications of South African scholars has grown in the period 1995-2000, South Africa's scholarly publication rate has not kept pace with publication rates of other nations, and in fact shows a decline (Pouris, 2003: 426). The latter suggests a declining global competitiveness of South African science as a whole. Furthermore, a declining publication rate, characterised by a decline especially among junior South African researchers, suggests a structural problem in the national system of innovation (Boshoff and Mouton, 2003). The declining publication rate can be viewed as a

knowledge diffusion problem, and possibly even a knowledge generation problem. However, since Open Access scholarly communication is an overt intervention regarding knowledge diffusion, this thesis limits itself to the dynamics of knowledge diffusion. Increased knowledge generation can be seen as a relatively longer-term positive consequence of improved knowledge diffusion. The latter is ably demonstrated by the knowledge production function of Romer (Furman et al, 2002), where the quantity of new ideas produced in a society (and consequent economic growth) is dependent upon the 'stock of ideas available to researchers'.

Knowledge generation and diffusion is at the heart of long-term economic growth (Alcorn, 1997: 80). Scholarly communication, and more specifically scholarly publication, is an important manifestation of knowledge generation and diffusion. That greater access to research literature (increased knowledge diffusion) will lead to the advancement of science and will be especially advantageous to, and a needed countermeasure for, an increasingly marginalised science of the developing world is the commonly held reasoning behind Open Access scholarly communication. The argument against the current reader-pays subscription-based publication model is that it in essence stifles knowledge diffusion through prohibitive journal pricing.

The aims with this thesis are two-fold: to assess awareness of and levels of investment in Open Access modes of scholarly communication within South Africa, and to create a benchmark document of South Africa's current involvement in various Open Access initiatives. Creating such a benchmark document is driven by the perceived need for a comprehensive scholarly record on Open Access in South Africa.

Central questions posed

The central questions posed in this thesis are:

Q1: Since Open Access scholarly communication finds expression through four core activities, do authors and researchers in South Africa engage in these four core activities, and hence engage in Open Access scholarly communication?;

Q2: Does Open Access scholarly communication in South Africa require facilitation through national information policy instruments?;

Q3: Would such national information policy instruments have consequences for a national system of innovation?

A1: The empirical results from the questionnaire-based survey suggest that authors and researchers are engaging, to a limited degree, in Open Access information provision. Furthermore, the awareness of Open Access seems to be notional, seemingly limited to knowledge about general concepts rather than detailed knowledge about initiatives abroad. Empirical results from the structured record review suggest that Open Access information provision predominates in the Humanities and Social Sciences.

A2: Results from the theoretical study (Chapters 2 and 3), together with the low level of awareness of and investment in Open Access scholarly communication (A1 above) suggest that national information policy would stimulate activity in this regard.

A3: Results from the theoretical study (Chapter 3) suggest that universities are central to a national system of innovation and that openness of scholarly communication is central to a national system of innovation, therefore implementing national information policy which encourages scholarly communication to be a more open system, will have consequences for the national system of innovation. These consequences are demonstrated i.a. by Romer's growth theory (Furman et al, 2002).

The arguments underpinning the responses to the research questions are revisited below.

Methods

This thesis has been structured around two core sections, a theoretical framework based in the literature, and an empirical study. The central concepts of scholarly communication and Open Access, national information policy (NIP), and national system of innovation (NSI) were elaborated upon in the theoretical framework (Chapters 2 and 3). The empirical part of this study, described in Chapters 4 and 5, in turn consist of two parts. Both parts used the survey method, however the first part made use of a questionnaire instrument, and the second part made use of a structured record review. Both empirical studies were used to assess levels of activity and extent of adoption of Open Access within a defined South African scholarly community. The questionnaire instrument surveyed a scholarly community defined according to discipline. Additionally, the questionnaire instrument attempted to assess levels of awareness of international Open Access activities and initiatives within a defined scholarly community. As such, scholars within the Library-, Information-, and Computer Sciences, and Information Systems disciplines were surveyed. The structured record review surveyed a scholarly community defined according to

institution, covering a cross-section of disciplines. The scholarly community in question was the academic departments, research units, and bureaux at Stellenbosch University. More specifically, the Web sites of these departments and units were interrogated (reviewed) to gauge levels and extent of Open Access activity.

Empirical results

Regarding the questionnaire-based survey, there was a diversity of respondents from within the Library-, Computer-, and Information Sciences, and Information Systems disciplines, with respondents from the Library and Information Services sector predominating. Respondents' work responsibilities consisted of either research, teaching, or a combination of both of these. It is significant, and favourable that 82% of respondents would have conducted research, and so would be adequately familiar with the research process and behaviour. What is encouraging is the percentage of respondents from across the research disciplines, which would seem to indicate an awareness, which cannot be generalised to the broader South African scholarly community, of the debate around greater accessibility and availability of research output.

The typical respondent used e-mail daily, used a departmental Web site to make teaching material available, used e-mail to disseminate his/her research prior to formal publication, was in favour of Open Access journals, produced many working papers and conference papers, with post-prints constituting a percentage of research output, a subset of which was SAPSE accredited. Furthermore, he/she published in order to inform peers, and chose the journal in which to publish in order to obtain prestige and funding. The typical respondent was of the view that research institutions should promulgate and fund Open Access initiatives, and was strongly in favour of publishers permitting self-archiving. He/she ceded copyright reluctantly when publishing, and was prone to not discussing copyright when submitting work for publication. Finally, our typical respondent would support Open Access journals if they were listed as SAPSE accredited. What was surprising to see was the rather low ranking of 'research funding agencies' as possible funders and promoters of Open Access.

The establishment of IRs and ETDs is markedly low. Most institutions had no plans to implement either an IR or an ETD. The latter is surprising, since software for creating digital repositories is freely available, and there is an ever-increasing base of institutions

implementing digital archives. What is significant is that for those institutions which have or plan on implementing a digital repository, more progress is seen with respect to ETDs rather than IRs. The latter is probably due to a high level of interest in ETD repositories in the higher education sector in recent years in South Africa, with concomitant workshops and dialogue across institutions.

Even without an ETD or IR strategy, there seems to be little emphasis on obtaining electronic copies of theses and dissertations. Is the latter a seeming holdover from the print era and surprising, or would it possibly constitute just another administrative burden? Respondents would encourage electronic submission if their institutions had an ETD or IR. The question though is, why wait? Many respondents preferred that the Central Library manage such an archive. Given the percentage of respondents from the LIS services sector, the latter might come as no surprise. However, when interrogating the data, approximately 50% of respondents to this question hailed from academia, and not the LIS services sector. Could it be said that, even though those within the LIS services sector seem keenly aware of Open Access, many of those did not see a role for themselves in creating and managing such digital archives?

Survey participants were asked to indicate the degree to which they had possibly been involved in the administration of a scholarly journal. The *ex-ante* expectation is that those who are involved administratively will have a greater awareness of Open Access. The latter was found to be the case, but did not prove to be statistically significant. Significant associations were found between those persons who were or had been involved administratively in journal publication, and awareness of Open Access. More especially, those whom had been on editorial boards were found to be more aware of Open Access proponents (items 12 - 16 in question 1 of the survey) and specific instances of extant repositories (items 17 - 24), such as RePEc and others named in question 1 of the survey. Those whom had acted as peer reviewers, had a greater awareness of alternate forms of making research available (items 5 - 11 in question 1 of the survey), as well as greater awareness of implemented repositories (items 17 - 24 of question 1).

Respondents were well-disposed to Open Access scholarly communication, but generally lacked extensive awareness of specific Open Access initiatives. Respondents tended to have notional awareness of Open Access. Investment in Open Access scholarly communication

through the use of the various channels of Open Access is still relatively low when considered in the context of making their own research available. The use of Open Access venues in order to access the works of others shows a higher level of activity when compared to level of activity in making their own works available. Comparing the latter dissemination practices to information use practices, it seems that Computer- and Information Scientists are far greater users of Open Access-based information than providers of such information. Respondents were overwhelmingly in favour of publishers' permitting self-archiving, but their personal behaviour indicated that many did not negotiate copyright agreements with publishers.

Though not indicated overtly in the survey, yet gleaned from the homepages visited when compiling the contact details of the survey sample, and as seen in the structured record review, the tendency to making information available about the types of research conducted, or the range of research areas covered can be seen. In the latter cases full-text is seldom provided.

The structured record review reinforces the picture of low levels of activity and investment in Open Access as gleaned from the questionnaire-based study. The surprising finding in the structured record review has been the predominance of the Humanities and Social Sciences in engaging in Open Access information provision (especially self-archiving, but in journal article publication also).

Theoretical underpinnings

The South African National System of Innovation is described as robust and vibrant, especially with regard to expenditure on research and development (Kahn, 2004; Blankley and Kahn, 2004) and South African innovation policy is described as sophisticated (Mani, 2001), yet structural problems have been identified in the NSI (Boshoff and Mouton, 2003), characterised by a decline in the competitiveness of South African research publication rates when compared on a global scale. The latter in effect can be identified as a knowledge diffusion problem in the NSI. Open Access scholarly communication is an overt intervention in knowledge diffusion.

I define Open Access as the low-barrier diffusion of scholarly research. 'Low-barrier' is used in an economic sense, and functions as an explicit acknowledgement

of the hurdles scholars in developing countries may face, such as porous electricity and network infrastructure; non-competitive monetary exchange rates which militate against the acquisition of already exorbitantly priced research from abroad; or combinations of these.

Open Access itself finds expression primarily through four avenues:

1. Publication in Open Access journals;
2. Making research available in an institutional or disciplinary (a.k.a. subject-based or topic) digital archive/repository;
3. Making research available via Departmental or Personal homepages;
4. Making the research output of postgraduates available via Electronic Theses and Dissertations (ETD) digital repositories.

The evolution of the scholarly communication system, currently manifested in debates around Open Access, has garnered much attention in the past decade or so, its having been driven by factors such as:

1. the 'serials crisis' - referring to the spiralling costs of scholarly literature in recent times (Cummings, et al. 1992: 83);
2. the growth in scholarly research output (Crane, 1972: 12; Pouris, 2003);
3. a means to circumvent growing limited access to the increasing volume of research literature; (Lynch, 2003)
4. that access to research by and in the developing world will be greatly improved; (United Kingdom House of Commons..., 2004)
5. that researchers at poorly funded institutional libraries will have increased access to the research literature; (Lynch, 2003)
6. the argument that publicly-funded research by rights should be more accessible to the tax-paying public;
7. that institutional repositories specifically are needed to manage and preserve new digital scholarly materials such as simulations, data sets, visualizations, and models, which do not form part of the established scholarly publication chain; (Lynch, 2003)
8. the advent and ubiquity of the Internet, in the context of the Information Society.

In fact, theories around the Information Society (which can also be referred to as the 'Knowledge Society', and which for the purposes of this thesis are terms I conflate) inform

our understanding of the changes in scholarly communication in recent times. It is evident that there has been a shift away from infrastructure to application, content and services in the developed world when discussing the 'Information Society'. With infrastructure still of very real concern to those in the developing world, the question is whether they too have made a shift to a focus on application, content and services for existing networks.

Seminal initiatives with regard to Open Access have been undertaken at international, trans-national, and national levels. International initiatives have been that of the Scholarly Publishing and Resources Coalition; Public Library of Science; Budapest Open Access Initiative; Open Archives Initiative; BioMed Central. A number of position statements and declarations in support of Open Access have been launched (e.g. Wellcome Trust position statement on Open Access; Bethesda Statement on Open Access; Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities). Sometimes there are specific initiatives which arise in particular countries and particular research domains, but which become trans-national in nature when researchers and scientific societies from other countries endorse these position statements. These statements of national and international support should be seen for their full worth, since these are statements endorsing Open Access which are being signed by senior ranking government research administrators, and policy-makers. Frequently university administrators at the level of presidents, rectors, and vice-chancellors are also involved. Other statements listed in the questionnaire-based survey for this study were, the ALPSP (Association of Learned and Professional Society Publishers) statement, the International Federation of Library Associations and Institutions (IFLA) statement on Open Access to Scholarly Literature and Research Documentation; and the Washington D.C. Principles for Free Access to Science (a.k.a. the DC principles). State-led and national initiatives abroad can be instructive for similar policy initiatives in South Africa. National initiatives are mainly of two types: those fomented by government decree, and those driven by science councils and/or university administrators. National initiatives have arisen in the United Kingdom, United States, the Netherlands, Germany, Italy, Scotland, and Australia. Trans-nationally, the European Union has also issued a discussion policy briefing on Open Access.

Participation of developing countries in networked research dissemination initiatives are being constrained by porous infrastructure or are being neglected in favour of initiatives favouring general social and economic upliftment. This is at the level of policy intervention.

At the level of scientists themselves, it seems many, much like their counterparts in the developed world, are not aware of a global information access problem. The increasing marginalisation of Africa (Castells, 1998: 90), and Africa's 'technological apartheid' (Castells, 1998: 92) are due to low computer and Internet penetration, and also due to the lack of a reliable electricity supply (Ondari-Okemwa, 2004: 366). The marginalisation Castells refers to has consequences for Africa's contribution to global scholarship. Altbach and Tefera (1998: viii) claim that "The revolution in knowledge distribution is, in general, bypassing Africa" (My emphasis added). Davis and Carden (1998: 20) say "[i]solation resulting from inadequate communication infrastructure is the critical bottleneck for many researchers in developing countries..."

It is said that the knowledge gap is widening, and that a state of knowledge imperialism[108] will take hold, where researchers in developing countries, through lack of access to reliable research information, will have to receive foreign aid of a different sort (Arunachalam, 1999: 470). The latter seems to have manifested itself with initiatives such as HINARI, and AGORA. He adds that developing countries will increasingly be unable to "…contribute to, and take advantage of, knowledge in the sciences" (Arunachalam, 1999: 465). Furthermore, Arunachalam (1999: 476) finds that the exposure of journals from developing countries to the wider scientific community is severely constrained, and that of these developing-country journals, certain developing countries[109] tend to dominate. That said, a more recent indication is that the proportion of publications from non-Western countries indexed in the ISI Science Citation Index (SCI) has increased (Swan, 2004), and that beyond the ISI SCI, scientific activity in developing countries has grown (Jacobs, 2001). Grey (2000: 182) predicts that the future for African scholarly publishing might well be electronic, and that South Africa could play a pioneering role in this regard if it is prepared to seize the opportunity.

Two South African authors, Lor and Britz (2003) consider the information flows from south to north and promulgate open archiving and self-archiving as a means whereby African scholars may disseminate their findings cost-effectively, as well gain access to

[108] The use of the term 'imperialism' can be seen in a pejorative sense, and I am aware of much historical sensitivity around the use of the term. A better formulation might be 'knowledge dependence' or 'knowledge aid', which would emphasise that scholars in developing countries would become marginalised and dependent on Western donors in yet another sphere of their professional lives (the other sphere being research funding). Knowledge dependence has already manifested itself in the form of 'donations' of research literature.

[109] "China and India in Asia, South Africa and Nigeria in Africa, and Brazil, Argentina and Mexico in Latin America dominate the scene" (Arunachalam, 1999: 476).

global scholarly discourse and output. Later, Britz (2004: 200) highlights the role that Open Access can play in fomenting social justice around information provision, when viewed in the context of information poverty. The International Council for Scientific and Technical Information (ICSTI) (2003) cautions that the needs of developing countries implicitly may differ from those of developed countries in an age of Open Access.

Institutional repositories, discipline-/subject repositories, and Open Access journals have evolved globally during the past decade. Awareness of specific repository implementations was tested for in the questionnaire-based survey of the defined set of South African scholars. The repositories were chosen for inclusion in the survey either because they are of the oldest repository implementations[110] (with the ex-ante expectation that they should be relatively familiar to the questionnaire respondents) or because they were specific subject-based repositories within the Computer-, Library-, and Information Sciences[111]. One information retrieval tool[112] used frequently by Computer Scientists was also listed in the survey instrument.

Again with regard to South Africa, it is found that only three OAI-compliant institutional repository implementations currently exist; and that an early foray into Open Access was the creation of the South African ArXiv mirror site in 2000 by Wits University. South Africa has four[113] Open Access journals at the time of writing, and two[114] of these are accredited by the Department of Education.

At the time of writing, 197 South African journals have been accredited by the DoE, with about 30 South African journals indexed by the ISI. Thus far, and results from the questionnaire-based survey show that, SAPSE funding and its associated accredited journals list have been major barriers to the adoption of Open Access journals in South Africa.

Research publication rate is a measure of the intellectual strength of a country's science system and ability to innovate. Considering research publication rate, Pouris (2003: 426)

[110] ArXiv, RePEc, PubMedCentral, NDLTD.
[111] NCSTRL, RcLIS, E-LIS, DoIS.
[112] Citeseer (a.k.a. ResearchIndex).
[113] Sahara Journal of the Social Aspects of HIV/AIDS; Smithiana Bulletin; South African Journal of Animal Science; South African Journal of Information Management.
[114] 'South African Journal of Information Management' (indexed on the SA-specific SAPSE list); 'South African Journal of Animal Science' (indexed by the ISI).

laments that "(t)he overall picture of South African science, as measured by the ISI data, is one of deterioration and decline." An exception to this general decline is the Social Sciences and Humanities in South Africa, which showed an increase in world proportional research publication output between 1995 and 2000 (Pouris, 2003: 427). The latter is significant when viewed in light of the empirical structured record review undertaken as part of the study for this thesis, where it was found that more scholars in the Social Sciences and Humanities were engaging in Open Access activities, compared to scholars in the Natural Sciences.

Turning to innovation, at a technological and organisational level, it is generally regarded as a key driver of economic growth in industrial economies (Solow, 2003: 1). Additionally, Alcorn (1997: 79) says that the 'growth of knowledge' is generally accepted as the most significant source of long-term economic growth. Conceição et al (2000: 11) affirm the latter, and regard knowledge as a key for economic development. They add that "(t)he lack of resources and infrastructure to deal with knowledge diffusion, storage, and use in underdeveloped regions is pervasive" (Conceição et al, 2000: 11). Romer (Furman et al, 2002: 902) defined an ideas-driven endogenous growth theory which posits that research and development activity (and hence ensuing economic growth) is sensitive to the knowledge stock available to researchers. He defined a national ideas production function where the 'Rate of new ideas production is equal to the number of ideas workers multiplied by the stock of ideas available to researchers. Simply put, Romer's theory establishes a direct link between economic growth and the importance of access to research output.

According to Smits (2002: 875) innovation theories to date have had two approaches, namely one which focuses on processes of innovation, and one which focuses on systems of innovation. The systems-level approach acknowledges a complex policy environment and the roles of various actors in innovation, and of how these interact and possibly influence one another. For the purposes of this study, I use Galli and Teubal's definition of 'national system of innovation' (NSI), which they define "…as the set of organizations, institutions, and linkages for the generation, diffusion, and application of scientific and technological knowledge operating in a specific country" (1997: 343).

Larédo and Mustar (2001b: 501 - 502) regard the quality of research originating in the public sector as a key strength in any country's system of innovation. The national system

of innovation approach is seminal for its acknowledgement of the role of national policy and the active role played by government (Furman et al, 2002: 903). Archibugi and Michie (1997: 134) hold that, beyond acknowledgement of government's role, the literature on national systems of innovation in fact advocate for the greater role of government in fostering innovation. Etzkowitz and Leydesdorff (1997) introduced the triple-helix model of university, industry, and government relations or linkages, representing respectively the knowledge-, economic-, and political sectors. The triple-helix accounts for the increasingly important role of universities - the knowledge sector thus - in enhancing innovation and economic development.

Recommendation: mandate Open Access

To date, Open Access initiatives in South Africa have been disparate and in effect exist and are operated in relative isolation. There has not been an overwhelming national thrust endorsing Open Access. This isolation characterising Open Access initiatives is nothing new, in that isolationism seems to characterise South African scholarship nationally (Mouton, 2000) and internationally (Mouton and Dowling, 2001; Kahn, 2004). Given what I perceive as the urgency of the matter, and in order to avoid increasing knowledge dependence, South Africa cannot rely on the current rate at which disparate Open Access initiatives are implemented to 'get us there'. Thus there is a need for policy which mandates Open Access.

What form should Open Access policy take in South Africa? Should it be innovation policy, science policy, or national information policy? Should it be innovation policy which is regarded as a strength of our NSI, or should it be information policy, which has been characterised as a weakness with respect to implementation? As has already been explicated above, policy, broadly defined and cognisant of influences – and unintended consequences – from various spheres, might suffice. When addressing knowledge diffusion, the natural remit is information policy given that the definition used in this thesis has been "…the set of all public laws, regulations, and policies that encourage, discourage, or regulate the creation, use, storage, and communication of information" (Rowlands, 1996: 14, quoting Weingarten). Furthermore, I use the term 'information policy' to designate public policy which incorporates information-, science and technology-, as well as innovation policy. National information policy refers to those policies instituted by the State rather than firms or organisations.

The centrality of knowledge, rather than the specific area in which policy should or can be drafted, seems suggested by Caraça (2000: 32) when he says that "[s]cience policy will have to be closely linked to policies in all other fields of knowledge, from the arts and humanities to the cognitive and social sciences." Centrality of knowledge is again hinted at when we encounter De la Mothe's (2003: 199) definition of innovation policy as "concerned with stimulating, guiding, and monitoring knowledge-based activities within a political jurisdiction – typically, a nation, or a region."

Pouris (2003: 428) argues for the implementation of adequate policy measures to bolster South Africa's research impact and publication record if it wants to be regarded as an African intellectual and educational hub. Smith (1997: 86 - 106) describes the importance of public policy in developing and maintaining physical infrastructures (roads, electricity, telecommunications) and knowledge infrastructures (universities, research laboratories, libraries, databases, etc) which have effects on the economic performance of innovation systems. Smith adds that the "…storage, access, availability, dissemination,…" (1997: 101) is a neglected part of science and technology policy and that "…basic scientific results - stored in libraries or in university departments…" are key contributors to industrial innovation (Smith, 1997: 102). In conclusion, Smith says that the "…scale and openness of such (knowledge) systems is an important issue in public policy, with potentially large effects on innovation performance" (Smith, 1997: 102).

A number of scholars have written about the openness of scholarly systems. Foray (1997) writes within the context of a national system of innovation, Arunachalam (2004) writes about Open Access within a science and technology policy context, and David (2003a) writes from the perspective of research management.

Foray regards knowledge distribution and knowledge openness as "…a critical characteristic of any system of innovation" (1997: 64). He posits further that it is economically efficient to facilitate wider distribution of existing knowledge and to increase inexpensive access to latest research findings, since knowledge generation is cumulative in nature, and so is dependent on research which has gone before. He regards knowledge as both an output of the innovation process, as well as an input of the knowledge generation process (1997: 65).

Foray's writings of 1997 predate the Open Access movement, yet he argues for a mandated convention of openness when he says (1997: 66):

Open access that distributes knowledge widely and rapidly

- Facilitates independent replication of findings;
- Promotes swift generalization of results;
- Avoids excessive duplication of research;
- Increases the probability of creating useful new products, processes, and ideas arising from novel and unanticipated combinations because new knowledge is available to many researchers;
- Thus raises the social value of knowledge by lowering the chance that it will reside with persons and groups who lack the resources and ability to exploit it.

The increasing emphasis on universities becoming entrepreneurial results in a clash of cultures between open and closed scholarly systems. David (2003a) sees a dichotomy between this openness, characteristic of the 'Republic of Science', and the proprietary 'Realm of Technology'. Increasingly the latter is being mandated in lieu of the former. David (2003a, 2003b) argues for a balance between these two systems, and as we have seen above, Foray (1997: 79) argues that openness of scholarly systems needs to be mandated and actively encouraged, since openness will not happen of its own accord.

There are other reasons to consider in mandating openness of scholarship. We see that Western governments and other high-level political actors, such as funding agencies and as detailed in Chapter 2 above, are calling for Open Access scholarly communication. The latter is not a question of using initiatives in the developed world to set the tone for change in the developing world. Rather, what we may see with increased Open Access in developing countries, is an increase in the exposure of the research and ideas of scholars in these regions. The recommendation with regard to an Open Access mandate is not new. A similar case for mandating Open Access is made by Harnad et al (2003) for the UK research system with regard to its Research Assessment Exercise (RAE). Harnad et al argue for UK university staff to maintain a standardised RAE-CV with, i.a., online links to self-archived versions of papers in a university's institutional repository.

Not referring to Open Access, but rather to the use of the NSI as a framework for policy, Edquist (2004: 200) opines that the NSI framework may be more useful for small countries and less relevant for large ones[115], depending also on whether the national system is federated or not. Even so, large countries still rely on national laws and national policies, and here too the NSI framework may be useful. Admittedly, science in South Africa does not operate in a federated system, as is the case of larger countries such as the United States. The SAPSE publication subsidy seems to underscore this lack of federation in the South African science system. That said, noted scholar in the digital library arena[116], Clifford Lynch, in an interview with Hepfer (2004: 344) argues for limited government intervention in Open Access, when he says:

> The notion of governmental underwriting is a bit scary, both because of the potential long-term instability of the funding and also because of all the policy strings that can come along with such support.

In South Africa we already have this 'policy string', and it is commonly referred to as the SAPSE system (described in Chapter 2 above). Furthermore, Davis and Carden (1998: 15), in an article detailing 'research effectiveness and R&D evaluation in developing countries' , characterise higher education and research in developing countries as being largely government-funded and hence government–dependent. They add that a small pool of research talent is usually concentrated in universities and that "…the sources of institutional support and research support are relatively more concentrated in the hands of the governments in the South….Performance evaluation in a university setting frequently has political overtones. In developing countries, universities are usually the most politically sensitive S&T actors" (Davis and Carden, 1998: 15). The SAPSE, now HEMIS system, in South Africa attests to the involvement of government in higher education and more specifically research.

Considering the range of South African policy instruments and bodies established in the national information -, science and technology-, and innovation policy arenas, it can be argued that we have an enabling policy environment in South Africa. I would like to suggest that the enabling environment consists of the following:

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[115] Edquist provides no explicit definitional distinction between small and large countries. It may be inferred that he uses the scale and definitions in an economic sense as well as a geographical sense.
[116] And who practices in the federated science system in the United States.

- White Paper on Science and Technology (where a role for the NSI is described as i.a. the diffusion of new knowledge) (DACST, 1996);
- National Archives Act of 1996 (to preserve, make accessible, and promote the use of records where 'recorded' refers to information independent of its medium)(Republic of South Africa, 1996);
- Official Publications Depositories as per the Legal Deposit Act of 1997 (liberal reading suggests national digital repositories)(Republic of South Africa, 1997b);
- National Council for Library and Information Services (whose functions include advising the Minister of Arts, Culture, Science, and Technology[117] and the Minister of Education on the ways in which new ICTs "...should be harnessed to achieve improved integration, equity, cost-effectiveness and quality in library and information services;" (Republic of South Africa, 2001a))
- National Advisory Council on Innovation (responsible i.a. for coordination, stimulation, and the promotion of cooperation within the NSI; international coordination and liaison with scientific fields abroad; coordination of S&T policy with policy in other sectors)(Republic of South Africa, 1997a);
- Subscription to the CODATA, ICSTI, and OECD formulations regarding access to research data and information; and that LIASA tacitly supports the IFLA Declaration;
- Subscription to the UNESCO World Conference on Science and WSIS formulations regarding, sharing of scientific information and knowledge, and Open Access, respectively;
- The South African government's aim of having a gross expenditure on research and development (GERD) of 1% of GDP by the year 2005 (Blankley and Kahn, 2004:9) (which suggests a potential for increased funding of science practice and possibly infrastructure);

Against the backdrop of this enabling environment, one would do well to consider the type of policy process needed. Bartzokas and Teubal (2001) identify three types of policy process, namely minor, major, and integrated. The enabling environment described above suggests that we need the restructuring of an existing programme, and as a result we need a minor policy process. The types of policy processes, their respective objectives, and the associated policy phases, are indicated in Table 16 below. The respective phases within

[117] Note that the reference to the DACST is outdated, given the split in the ministries as of 2002.

policy processes are also delineated by Bartzokas and Teubal (2001), which are tabulated in Table 17 below.

Table 16 Types of Policy processes

Type of policy process	Objective	Phases involved
Minor	Restructuring of existing programme	3
Major	Design and implementation of important new programme	2 + 3
Integrated	A new explicit strategy; a reconfiguration programme portfolio; and implementation	Many different combinations

Source: After Bartzokas and Teubal, 2001: 27

Table 17 Phases of Policy processes

Phase	Objective	Tasks - Activity	Outcome
1.Upstream – Strategy formulation	Formulate an explicit strategy	Search, Research and interaction (stakeholders and experts), generating a Vision/Strategy	Set of priorities in innovation, technology and for the business sector
2.Downstream – Programme identification and design	Design of an important new programme	Identifying the Set of programs; preliminary design; trial implementation, final design	A set of programmes and programme designs which 'fit' priorities
3.Downstream – Programme implementation; Assessment	Successful implementation and learning	Full implementation; operational adjustments; research on impacts and on success/failed factors	Contribution to business sector restructuring; New information about 'policy needs'

Source: After Bartzokas and Teubal, 2001: 25

The minor policy process which I hereby suggest involves a minimal legislative overhaul. In effect, I would like to suggest an amendment to the policy which currently requires statutory reporting on research in South Africa. The policy instrument requiring amendment is the 'Policy and Procedures for Measurement of Research Output Of Public Higher Education Institutions' (Republic of South Africa. 2003.). The latter policy, published in October 2003 in the Government Gazette Vol 460, issue 25583 (Regulation gazette 7794) comes into effect 1 January 2005. The formulation of this policy was called for as part of the Higher Education Act 101 of 1997. Funding linked to publication rate, the SAPSE system thus, mandates that researchers currently report on their research output. The rating of scientists in South Africa by the National Research Foundation is another such area where reporting is done, however this latter form of reporting occurs voluntarily, and is not directly incentive-driven as is the SAPSE system[118]. Considering also survey respondents' indicating funding organisations as the least preferred body to promulgate and fund Open Access, using the NRF reporting mechanism might not be viewed favourably by scholars. Furthermore, survey respondents chose government as a second option (after research institutions) to promulgate and fund Open Access.

I would hereby suggest that government should mandate Open Access, in the interest of publicly accessible science and greater knowledge diffusion, through a simple legislative clause in the existing policy indicated above, which would state that:

1. pre-prints and e-prints of all articles arising out of publicly-funded research should be made available[119] via an Open Access venue of the researcher's choosing. Such venue would, at the very least, be an OAI-compliant e-prints repository (own Web site[120] / Dept. Web site / Institutional repository / subject repository / national repository). A second venue for the researcher would be to publish in an Open Access journal.
2. researchers would report on the venue of such an Open Access version of a research article. Currently, researchers provide proof of the acceptance of an article for publication or proof that an article has been published, with associated

[118] The 'reward' with in being a rated scientist takes the form of recognition by peers and an increase in stature which could result in increased project funding. The fiscal reward is thus downstream in this regard.
[119] The reader is reminded that making an e-print or pre-print available is not tantamount to publishing. The aim is to make the research available; publication occurs as a separate and distinct process.
[120] Whether the researcher makes use of an own Web site in this regard is dependent on whether the site resides in an OAI-compliant environment or not.

documentation from a journal. What this clause would require is that for every article reported on, an associated URL would be cited.

Some may argue that clause two may be open to abuse. To make such an argument would fundamentally question the integrity of scholars in reporting on their research, which I consider inappropriate. That said, analogous to the DINI system experimented with by German scholars, certification and accreditation of repositories may be introduced. If a similar initiative were launched in South Africa, it would limit the range of self-archiving venues in which authors could make their works available. For instance, certification and accreditation of such venues could eliminate personal Web sites as venues for self-archiving, and secondly, presuppose that all disciplines have dedicated subject archives, which as yet is not the case. Both aspects, certification and accreditation of repositories, and diffusion of subject-archives across disciplines, are as yet in their infancy.

Whether self-archiving or publishing in an Open Access journal, the timeframe within which such posting of content may be effected by South African scholars should take cognisance of whether the results of the research lead to patentable products or processes. If the latter is the case, the posting of articles might very well be delayed so that the researcher(s) may reap the financial rewards. The latter financial rewards could be quite substantial if Bayh-Dole type of legislation is enacted in South Africa. Fig. 11[121] below illustrates the positive income effect for public sector research since the enactment of the Bayh-Dole provision of 1980 in the United States.

[121] There seems to have been a dearth of data for the years 1982 -1985, and 1987 (Etzkowitz, 1997: 144)

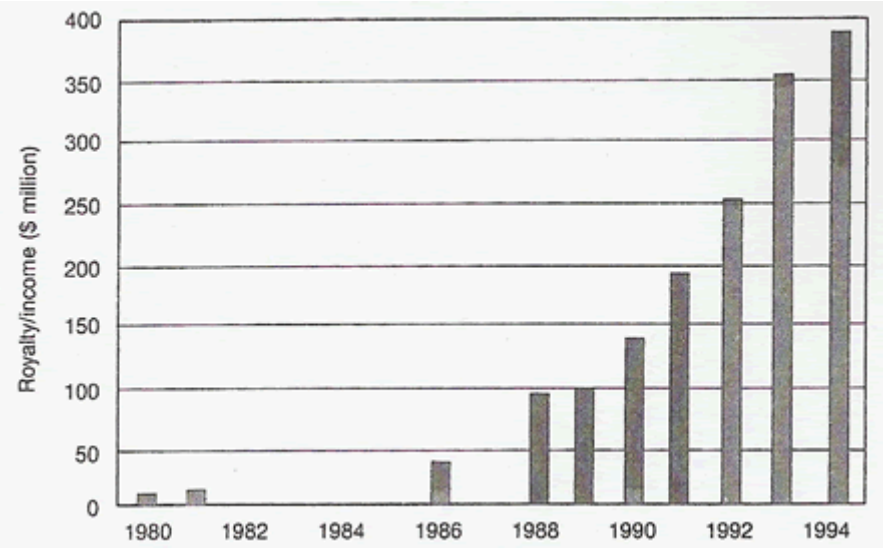

Fig. 11 Royalty income earned by US public sector research due to the Bayh-Dole Act (Etzkowitz, 1997: 144)

An argument for mandating Open Access scholarly communication through national information policy is perhaps best placed in a context described by Koomey (2001: 88). He indicates that any and all technology and policy choices imply a value judgement on the part of the persons exercising such choices. He devises a matrix indicating how society chooses, and the degree to which, if they are at loggerheads or not, a solution may be arrived at, and if so, which method may be employed to arrive at such a solution. He defines facts (see Table 18 below) as "…assertions about the physical world that can be verified through experiment, direct measurement, or observation." and values as "…explicitly subjective and are an expression of the ideas and feelings that are most important to us" (Koomey, 2001: 88).

Table 18 How society chooses (Koomey, 2001: 88)

	Agree on values	Disagree on values
Agree on facts	Computational decision	Negotiate
Disagree on facts	Experiment	Paralysis or chaos

Where on the above grid are current debates on Open Access scholarly communication? It seems that the profusion of initiatives suggests that actors in the scholarly communication chain can either:

- disagree on the facts (e.g. prices of scholarly journals have increased exponentially say scholars and librarians, but many publishers regard this as legitimate business practice) and agree on values (e.g. scholars in developing countries need greater access to research literature); - which results in experimentation; or
- agree on facts (e.g. journal cancellation policies disadvantage the scholar and publisher; decreased knowledge diffusion leads to decreased knowledge generation) and disagree on values (e.g. publishers have a legitimate business right in charging the prices that they do – it is the free market system at work; the 'Republic of Science' is characterised by a gift-exchange ethos) – which results in negotiation.

The many Open Access initiatives described throughout this thesis tend to attest to both experimentation and negotiation.

Factors limiting Open Access adoption in South Africa

In order to successfully implement an Open Access scholarly communication mandate, one should acknowledge possible limiting factors which could impede progress in implementation. What follows are descriptions of these limiting factors.

Bandwidth

The underlying assumption of this thesis is that all researchers at higher education institutions in South Africa have access to the TENET network, and therefore have adequate bandwidth. It is said that due to the pay-per-use component of Internet use at Stellenbosch University, degradation in service due to limited bandwidth is seldom experienced. The latter is not the case necessarily at other South African higher education institutions, where cost recovery is not done on Internet use. Anecdotal evidence suggests that a lack of cost recovery on Internet usage, or a lack of bandwidth throttling when demand is at a premium, often leads to diminished capacity on university networks other than those of Stellenbosch University. If accessing Open Access literature is more often a frustrating experience, the benefits will not be fully realised.

Open Access journals and the SAPSE system

A citation impact study by Testa and McVeigh limited to the 5,876[122] Science journals (in the natural sciences) indexed by the ISI, indicates that 192 Open Access journals already form part of this 5,876 set (McVeigh, 2004:2). It should be noted that in this regard the SAPSE system by proxy (using the ISI indexes to populate the SAPSE list of accredited journals) militates against scholars publishing in Open Access journals given that the set of Open Access journals in the ISI is as yet so relatively limited. The results from the questionnaire-based survey suggest the need for an increased uptake of Open Access journals within the ISI indexes, since survey respondents indicated that they would publish in an Open Access journal if they were SAPSE accredited.

Bayh-Dole type of legislation

Though there are avowed positive consequences to implementing Bayh-Dole type of legislation in South Africa, the unintended consequence could be that it fosters a closed scholarly communication system as defined by Foray (1997), since the ethos surrounding such legislation enforces private ownership above research as a public good. The increasing emphasis on universities becoming entrepreneurial results in a clash of cultures which David (2003a) sees as a dichotomy between openness characteristic of the 'Republic of Science' and the proprietary nature of the 'Realm of Technology'. Recall that David (2003a, 2003b) argues for a balance between these two systems. Furthermore, note that the profusion of institutional repositories in the United States (60 OAI-compliant repositories at the time of writing[123]) seems to not have been inhibited by the Bayh-Dole Act.

Concerns of scholars

A commonly encountered feature of surveys on Open Access to date is the concern expressed by survey respondents around Open Access (Swan and Brown, 2004; Muthayan, 2003; Rowlands et al, 2004[124]). It should be borne in mind though that these aforementioned surveys do not limit themselves to a discovery of only authors' concerns, but have various other motivations not reported on here. This thesis has purposely avoided researching the concerns of scholars' as I felt that any new insights in this regard would not

[122] As a matter of interest, the number of Science journals indexed by the ISI in 1994 is reported as being 3,400 (Mouton and Dowling, 2001: 141), reflecting a growth in the number of journals of almost 73% over a period of eight years.

[123] The highest number of repositories per country in a global tally. See also Appendix L.

[124] Rowlands et al.'s study became available in June 2004. Leslie Chan alerted me to the studies by Swan and Brown (2004) and Muthayan (2003) in August 2004. Muthayan's paper is of interest since the study was conducted at three South African higher education institutions.

be forthcoming. Concerns of scholars around matters of copyright, plagiarism, and quality control should be acknowledged. Though, the issues raised around quality control seem moot since an argument in favour of Open Access does not automatically constitute an argument in favour of abandoning peer-review mechanisms. Suber (2004) was already referred to in this regard earlier in this thesis.

Limitations of the study

This thesis considers the policy environment which would facilitate a move to Open Access scholarship, rather than the arguments which may be proffered in order to convince scholars to participate in Open Access activities. The latter is a matter for further investigation.

It is said that the Open Access movement in South Africa needs an organising body such as TENET which would spearhead Open Access scholarship, similar to the way in which the current tertiary education network infrastructure is managed. TENET is regarded as having considerable influence and clout within the higher education sector. In fact, the SARIS project argues for the creation of a TENET-like structure for research information in South Africa (SARIS, 2004). Maybe the following from Faulkner (2002: 145) hints at why TENET has so much clout. Citing a 1992 study by Sørensen and Levold[125], Faulkner (2002:141) indicates:

> They [argue] that... 'technology is usually surrounded by a larger number of powerful political and economic actors than is science…[thus] …science involves less of the social, and the social terrain on which scientists manoeuvre is much simpler than that of engineers' (Sørensen and Levold, 1992: 16).

Other areas which have a bearing on scholarly communication, but which have not been treated in detail in this thesis are debates around impact factor of journals and how such impact factor is calculated. Promotion and tenure practices which have a bearing scholarly behaviour have not been considered. Copyright has been dealt with in a cursory fashion in both the theoretical framework as well as questionnaire-based survey, but a more comprehensive treatment is possible. Furthermore, possible effects of GRID technologies on scholarly publication and -communication have not been addressed in this thesis.

[125] Sørensen, K and Levold, N. 1992. Tacit networks, heterogeneous engineers, and embodied technology. *Science, Technology and Human values*, 17 (1):13-35.

The nature of the sample selected for the questionnaire-based survey, its being a convenience sample, serves to indicate the range of opinions within a community (Antonius, 2003: 116), but these opinions cannot be generalised across the wider South African scholarly community.

Furthermore, this thesis is limited in not having addressed the role of education policy and policy addressing skills or human resource development. Both of these aforesaid areas have been subject to numerous legislative changes in South Africa in recent years and have a bearing on the higher education environment: the environment in which scholars are expected to publish and do research.

Areas for further research

Admittedly, as evidenced by Rehman's (1996) scope of information policy and addressed in Chapter 3 above, all areas of national policy mentioned by him - cultural policy; communication policy; education policy; industrial policy; economics policy; trade policy; health policy; environment policy; and agricultural policy - but not explicitly addressed in this thesis, ideally should be considered. What the latter suggests is a comprehensive follow-up study, taking these complementary facets into consideration.

There is a need to follow-up the structured record review with a survey of departments in an attempt to ascertain why they have either posted full-text articles online, or why they have posted lengthy bibliographic lists of publications online, but failed to make the full-text available.

A third study which arises out of this thesis, is a survey of South African journals (especially those accredited by the DoE) with respect to their copyright and licensing agreements, in order to ascertain whether they currently permit self-archiving of published papers, or, at the very least, are amenable to doing so. The latter study would emulate that of the RoMEO project conducted in the United Kingdom.

Finally, the range of respondents to the questionnaire-based survey from those outside of its stated remit, suggests the need for a comprehensive cross-discipline Open Access scholarly communication survey in South Africa.

Conclusion

It has been argued that South Africa's declining scholarly publication rate, and by proxy its national innovation system, can be made more robust through the implementation of appropriate national information policy. South Africa thus has a problem of knowledge diffusion where it has been argued that Open Access scholarly communication may go some way to alleviating this knowledge diffusion problem. Results from the empirical studies as well as various Open Access initiatives highlighted throughout this thesis, indicate that Open Access adoption in South Africa to date has been disparate, uncoordinated, and decentralised. Furthermore, awareness of Open Access scholarly communication initiatives was shown to be notional in the survey population studied. It has been argued that an enabling policy environment already exists in South Africa, and that an amendment is needed of current policy requiring scholars to report on their research output which is a mechanism used by scholars to obtain publication rate funding from the state. The latter I regard as a minor policy intervention in the sense that it would be minimally disruptive to the science system as a whole. Said amendment of the current statutory reporting requirement would firstly, mandate that scholars make pre-prints and e-prints of their research available via an Open Access venue, and secondly, that they would report on having done so as part the annual statutory reporting which they already do.

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Appendices

Appendix A

Questionnaire (screenshot of final version online)

Fig. 12 Screenshot of questionnaire online - Introduction

Appendix B

Questions posed during questionnaire pilot testing

Evaluators of the questionnaire instrument were posed a series of questions to direct their critique of the instrument. These questions are listed below, and are based on Fink (2003b:109-110).

The cover letter to the questionnaire[126]:

Is the cover letter clear about the study's aims, and the role of the study participant?

Questions assessing the questionnaire instrument:

1. Are instructions for completing the survey clearly written?
2. Are questions easy to understand?
3. Do you know how to indicate responses (e.g. circle or mark a response) for each question? Are the response choices exhaustive?
4. Do you understand what to do with the completed questionnaire?
5. Do you understand when to return the completed questionnaire?
6. Is your privacy as respondent protected and respected?
7. How long has it taken you to complete the questionnaire?
8. Do you have any suggestions regarding the addition or deletion of questions, clarification of instructions, or improvements in questionnaire format?

[126] The questionnaire in MS-Word format had an accompanying cover letter. The cover letter was eliminated with the online publication of the survey instrument.

Appendix C

Advance notification e-mail

From: De Beer Jennifer <jad@sun.ac.za>
Sent: 30 April 2004 12:53
To: De Beer Jennifer <jad@sun.ac.za>
Subject: Survey on Open Access scholarly communication in South Africa

Stellenbosch, 30 April 2004

Dear Prof /Dr /Sir /Madam:

RE: SURVEY ON OPEN ACCESS SCHOLARLY COMMUNICATION IN SOUTH AFRICA

You are hereby notified of an upcoming survey about Open access scholarly communication in the disciplines of Computer Science, Information Systems, and Library and/or Information Science in South Africa.

The 'Open access movement' champions the free or low-barrier dissemination of scholarly research. The purpose of the questionnaire, to be distributed via e-mail during the first week of May 2004, is to establish your level of awareness of Open access initiatives, as well as the extent to which you use networked technologies to share your research output such as journal articles, conference papers, and the like.

Please complete the questionnaire as soon as you receive it via e-mail. I will be most happy to provide you with the results of the study at the completion of the project. Moreover, if you have any questions about the survey, please feel free to contact me, Jennifer De Beer, via daytime telephone 021 808 2071, cell number 082 2006 761, or via e-mail <jad@sun.ac.za>

Advance thanks for your time and assistance, kind regards,

Jennifer De Beer

Lecturer in Socio-Informatics

Centre for Knowledge Dynamics and Decision-making, Information Science,

Universiteit Stellenbosch University

http://www.sun.ac.za/infoscience/staff_jennifer.html

+27 (0)21 808 2071 (t)

+27 (0)21 808 2117 (f)

Appendix D

Invitation to participate

From: De Beer Jennifer <jad@sun.ac.za>
Sent: 06 May 2004 15:35
To: De Beer Jennifer <jad@sun.ac.za>
Subject: Survey on Open Access scholarly communication in Computer-, Library-, and Information Sciences, and Information Systems

Stellenbosch, 6 May 2004

Dear Prof /Dr /Sir /Madam:

RE: SURVEY ON OPEN ACCESS SCHOLARLY COMMUNICATION IN SOUTH AFRICA

You are hereby invited to participate in a survey on Open access scholarly communication in the broad disciplines of Computer-, Library-, and Information Sciences, and Information Systems, in South Africa.

The 'Open access movement' champions the free or low-barrier dissemination of scholarly research. The purpose of the questionnaire is to establish your level of awareness of Open access initiatives, as well as the extent to which you use networked technologies to share your research output such as journal articles, conference papers, and the like.

#Who should participate?
South African practitioners/researchers in the abovementioned disciplines, who are required to present and/or publish their research findings. Typically, persons in the target audience will be situated in Academia, Research Units, the IT industry, and Library- and/or Information Services within South Africa.

The questionnaire is available at http://www.surveymonkey.com/s.asp?u=75384473542 and takes at most 20 minutes to complete.

#Confidentiality
All details given will be treated in the strictest confidence. Only summarized results and analysis will be made public.

Moreover, if you have any questions about the survey, please feel free to contact me, Jennifer De Beer, via daytime telephone 021 808 2071, cell number 082 2006 761, or via e-mail <jad@sun.ac.za>

Advance thanks for your time and assistance, kind regards,

Jennifer De Beer
Lecturer in Socio-Informatics
Centre for Knowledge Dynamics and Decision-making, Information Science,
Universiteit Stellenbosch University
http://www.sun.ac.za/infoscience/staff_jennifer.html
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+27 (0)21 808 2117 (f)

Appendix E

Reminder: deadline for participation

From: De Beer Jennifer <jad@sun.ac.za>
Sent: 20 May 2004 14:21
To: (Recipient list suppressed)
Subject: Reminder: Open Access Survey closes 26 May at 17:00 (GMT +2)

Dear Colleague,

The reaction to the "Survey on Open Access scholarly communication in Computer-, Library-, and Information Sciences, and Information Systems" has been phenomenal, and many of our peers have taken the 20 minutes to participate. Many thanks to those who have taken time out from busy schedules.

A reminder then to those who have not yet participated, that the survey closes Wednesday 26 May at 17:00 (SA time). Your contribution will be very valuable in providing an even better picture of orientation to 'Open Access' for your discipline. For your convenience, a copy of the original invitation is included below.

Dear Prof/Dr/Sir/Madam:

RE: SURVEY ON OPEN ACCESS SCHOLARLY COMMUNICATION IN SOUTH AFRICA

You are hereby invited to participate in a survey on Open access scholarly communication in the broad disciplines of Computer-, Library-, and Information Sciences, and Information Systems, in South Africa.

The 'Open access movement' champions the free or low-barrier dissemination of scholarly research. The purpose of the questionnaire is to establish your level of awareness of Open

access initiatives, as well as the extent to which you use networked technologies to share your research output such as journal articles, conference papers, and the like.

#Who should participate?
South African practitioners/researchers in the abovementioned disciplines, who are required to present and/or publish their research findings. Typically, persons in the target audience will be situated in Academia, Research Units, the IT industry, and Library- and/or Information Services within South Africa.

The questionnaire is available at http://www.surveymonkey.com/s.asp?u=75384473542 and takes at most 20 minutes to complete.

#Confidentiality
All details given will be treated in the strictest confidence. Only summarized results and analysis will be made public.

Moreover, if you have any questions about the survey, please feel free to contact me, Jennifer De Beer, via daytime telephone 021 808 2071, or via e-mail <jad@sun.ac.za>

Advance thanks for your time and assistance, kind regards,

Jennifer De Beer
Lecturer in Socio-Informatics
Centre for Knowledge Dynamics and Decision-making, Information Science,
Universiteit Stellenbosch University
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Appendix F

Questionnaire

Survey on Open Access scholarly communication in South Africa

Introduction

Survey on Open Access scholarly communication in South Africa for the Computer - , Library - , and Information Sciences, and Information Systems disciplines

By Jennifer De Beer
Lecturer in Socio-Informatics
jad@sun.ac.za
Dept. of Information Science,
Stellenbosch University,
Private Bag X1, MATIELAND, 7602

Who should participate?

This survey is directed at South African practitioners/researchers in the abovementioned disciplines, who are required to present and/or publish their research findings. Typically, persons in the target audience will be situated in Academia, Research Units, the IT industry, and Library- and/or Information Services within South Africa.

Time to completion?

There are 35 questions in toto, and the questionnaire takes at most 20 minutes to complete.

Confidentiality

All details given will be treated in the strictest confidence. Only summarized results and analysis will be made public. In the interests of keeping this survey truly anonymous, you will not be asked for a contact e-mail address. However, should you be interested in receiving the results of this survey, do not hesitate in sending an e-mail to jad@sun.ac.za

If you have any other questions about this survey, please feel free to contact me, Jennifer De Beer, via daytime telephone +27 (0)21 808 2071, cell number +27 (0)82 2006 761, or via the e-mail jad@sun.ac.za

Click “Next” to continue.

Survey on Open Access scholarly communication in South Africa

Definition of Terms

For the purposes of this study, the following definitions are used:

- **pre-print** - version of an article which has been submitted for official publication, yet not yet accepted for publication;
- **post-print** – peer-reviewed version of article, accepted for publication and yet-to-be published, or already published;
- **e-print** – electronic version of a pre-print or post-print;
- **institutional repositories** – a central storage server for the management and dissemination of digital research (and sometimes teaching-) materials created by the institution and its research staff, excluding Masters theses and Doctoral dissertations;
- **ETDs** – Acronym for **E**lectronic **T**heses and **D**issertation**s** signifying a central storage server for the management and dissemination of postgraduate digital research materials created by the institution's Masters and Doctoral students;
- **Open access journal** – journal which makes research articles freely available online immediately upon publication, or makes articles available for free six months after the original publication date.

Click "Next" to get started with the survey. If you'd like to leave the survey at any time, just click "Exit this survey". Your answers will be saved.

Survey on Open Access scholarly communication in South Africa

Knowledge about Open Access initiatives

1. Preliminary field scan. Below are listed frequently used acronyms, abbreviations, or phrases used in the Open Access arena. Please indicate your degree of familiarity with these, by ticking in the column which best represents your level of awareness at present. (Please tick as appropriate – mark only one)

	Phrases, acronyms, abbreviations	**I have not heard about it**	**I have heard about it**	**I know what it is / what it does**
1	PLoS			
2	PubMedCentral			
3	BioMedCentral			
4	Serials crisis			
5	Institutional repositories			
6	Open access journals			
7	Preprints			
8	e-prints			
9	Self-archiving			

10	Discipline-based archives			
11	ETDs			
12	OAI			
13	SPARC			
14	Free Online Scholarship movement			
15	BOAI			
16	Creative Commons			
17	Citeseer a.k.a. ResearchIndex			
18	NCSTRL			
19	ArXiv			
20	RcLIS			
21	NDLTD			
22	E-LIS			
23	RePEc			
24	DoIS			
25	Berlin Declaration on open access			
26	ALPSP statement			
27	Bethesda statement			
28	Wellcome Trust statement			
29	IFLA statement			
30	DC principles for Free Access to Science			

2. If you already know about Open Access initiatives, can you say how you know of them? If you are unfamiliar with Open Access initiatives please skip to Question 3. (Please tick as appropriate – mark only one)

Through literature related to my profession	
Through colleagues	
Through literature not related to my profession	
Other, please specify	

Survey on Open Access scholarly communication in South Africa

Electronic scholarship

3. Please indicate on average, how much you use, or have used in the past, any of the following methods of online activity to aid in your research and/or teaching:
(Please tick as appropriate– mark only one per method)

Activity	Degree of usage				
	Never	Yearly	Monthly	Weekly	Daily
E-mail (personal)					
E-mail (discussion lists)					
Usenet newsgroups					
Web sites (Of Professional organizations/ associations / societies)					
Web sites (homepages of colleagues / peers)					
Web sites (blogs)					
Webcasts (live)					
Web-based conferences					

4. Have you ever made your teaching material freely available on the World Wide Web (excl. e-learning environments such as WebCT, and Blackboard)? YES ___ NO ___ (Place X)

5. If you have replied 'YES' to question 4, where have you made your teaching material available? (Please tick where appropriate - mark as many as apply.)

On the Departmental Web site	
On my personal Webpage	
On a freely available Institutional repository	
Other (please specify):	

6. How do you electronically disseminate or share the full text of your research output prior to its formal publication?
(Please tick as appropriate– mark as many as apply)

I do not	
My own personal Web page	
On the Departmental Web site	
On a freely available Institutional repository	
On a freely available Disciplinary archive (e.g. NCSTRL, CoRR, E-LIS, DLIST)	
On freely available (open access) electronic journals or conference proceedings	
Email (personal)	
Email (discussion list)	

Other (Please specify)	

7. Please indicate the total number of publications you have produced during the past five years, for each type of publication indicated below. Please indicate approximate values.

Type of publication	**Approximate number published:**
Letters to Editors	
Review articles / opinion pieces	
Data sets	
Working papers	
Journal papers (pre-prints)	
Journal papers (post-prints)	
Conference papers	
Technical reports	
Research reports	
Book chapters	
Books (complete volume)	

8. Of the total number of journal papers (post-prints) indicated in question 7 above, how many of these have you published in SAPSE approved journals? If you have not published, please skip to question 11.

None	
1 to 5	
6 to 10	
11 to 20	
More than 20	

9. If you have published, why have you written journal papers? If you have not published, please skip to question 11. (Please tick – mark as many as apply)

To inform others about my work and results	
To gain credits for academic advancement	
To gain/justify research funding	
To get feedback from reviewers and readers	
To document the work in an archival way	
Other (Please specify)	

10. If you have published, on which criteria do you base your choice of journal, when submitting an article?

(Please tick – mark as many as apply)
If you have not published, please skip to question 11

Prestige – it is on a shortlist of approved journals (Promotion, funding)	
Dissemination – large circulation, relevant readership	
Timeliness – short time from submission to publication	
Availability – articles are available for free on the Web	
Retrieval – journal is indexed in commercial database	
Retrieval – journal is indexed in a free Web database	
Other (Please specify)	

11. Which of the following publications have you made /would you make available via an Open Access method of information dissemination (e.g. institutional repository, discipline/subject repository, personal/dept. homepage, Open Access journal ?) (Please tick as appropriate– mark as many as apply)

Type of publication	**Institutional repository**	**Discipline/ subject repository**	**Personal / dept. homepage**	**Open access journal**	**I would not make available**
Letters to Editors					
Review articles / opinion pieces					
Data sets					
Working papers					
Journal papers (pre-prints)					
Journal papers (post-prints)					
Conference papers					
Technical reports					
Research reports					
Book (chapters)					
Book (complete volume)					

12. In a country such as South Africa with a small research base, in your opinion, who should spearhead adoption of Open Access methods of information dissemination and find funding for such efforts? (Please tick – please mark as many as apply)

Academic departments	
Professional associations/ societies	

Research institutions	
Funding agencies	
Governments (through Education budgets)	
Comments?	

13. Authors frequently cite publisher copyright agreements as barriers to adopting Open Access methods of information dissemination. Do you agree that authors should be permitted by publishers to post their articles on their departmental or personal Web sites? (Please tick – mark only one)

Strongly in favour	
In favour	
Neither in favour nor against	
Against	
Strongly against	

14. Again with regard to copyright, and regardless of your answer to question 11 above, do you agree that authors should be permitted by publishers to post their articles on institutional or disciplinary repositories? (Please tick – mark only one)

Strongly in favour	
In favour	
Neither in favour nor against	
Against	
Strongly against	

15. There are two ways in which to transfer copyright to a publisher for purposes of article publication, either via assignment (complete transfer of copyright to the publisher) or via license (partial transfer of copyright to the publisher). On the whole, do you assign your copyright to publishers in order to get published? (Please tick – mark only one)

I have not published	
Yes, freely	
Yes, reluctantly	
No, most publishers I work with do not ask for copyright assignment	
No, I ask to retain my copyright	

16. As per question 15 above, if you do not assign copyright, what do you usually do? (Please tick – mark only one)

I have not published	
I sign publishers' exclusive license agreement	

I amend the publishers' copyright assignment form and return it	
Other, please specify:	

17. Recent times have seen the move by some journal publishers to an Open Access journal publication model, whereby research articles are made freely available online immediately upon publication, or where articles are made available for free six months after the original publication date. Which of the following most applies to you? (Please tick – mark only one; comments can be added)

I have published in such a journal	
I would unreservedly publish in such a journal	
I would publish in such a journal if it were listed by SAPSE	
I would not publish in such a journal	
Comments?	

Survey on Open Access scholarly communication in South Africa

Institutional electronic archives

18. Does your institution have an Institutional Repository (IR) (a central storage server for the management and dissemination of digital research materials created by the institution and its research staff, excluding Masters theses and Doctoral dissertations) (Please tick as appropriate– mark only one; comments can be added)

Yes, at present	
We plan to implement one	
No plans at present	
Comments?	

19. Does your institution have an Electronic Theses and Dissertations (ETD) Repository (a central storage server for the management and dissemination of postgraduate digital research materials created by the institution's Masters and Doctoral students, excluding works of research staff other than postgraduate students) (Please tick as appropriate– mark only one; comments can be added)

Yes, at present	
We plan to implement one	
No plans at present	
Comments?	

20. Regardless of whether your institution has an ETD Repository, does your institution require the electronic submission of students' Masters theses and Doctoral dissertations, in addition to print submission? (Please tick as appropriate– mark only one)

Yes, mandatory	
Yes, voluntary	
Yes, in near future (1 year)	
Not sure	
No	

21. Do you, or would you, encourage your Masters and Doctoral students to deposit electronic copies of their theses and dissertations in an institutional ETD repository? (Please tick as appropriate– mark only one; comments can be added)

Yes	
Yes, if supported administratively	
Not sure, need further information	
No	
Comments?	

22. For either of these archives (Institutional repository and /or ETD repository), in your opinion, who should manage the archives?:
(Please tick as appropriate– mark only one; comments can be added)

A pre-existing central structure, such as a unit for research development, or other similar type of entity.	
A purpose-built central structure.	
The central library.	
A structure with connections to my Faculty.	
Comments?	

Survey on Open Access scholarly communication in South Africa

Degree of involvement in journal publication

23. Are you, or have you in the past been, involved administratively in the publication of a journal or edited volume? YES ___ NO ___ (Place X)
If 'NO' please skip to question 25.

24. If you answered 'YES' to question 23, the roles you fulfill are, or have been, …
(Please tick – please mark as many as apply)

Editor	
Editorial board	

Review writer	
Peer-reviewer	
Other, please specify:	

Survey on Open Access scholarly communication in South Africa

Use of others' scholarly output

25. To what extent do you currently use any of the following information types (from any provider) in your research? (Please place an X in the appropriate box for each type).

Information type	Do not use	Use, but not essential	Use, essential to my research
Journal papers (pre-prints)			
Journal papers (post-prints)			
Journals – not peer reviewed			
Books			
Working papers			
Research reports			
Conference papers			
Technical reports			
Theses/Dissertations			
Abstracts and Indexes			
Data / statistics			
Official publications			
Images or sound recordings			
Maps or charts			
Artefacts			
Letters to Editors			
Review articles / opinion pieces			

26. Have you used other authors' scientific works that have been made freely available on the Web? YES_____ NO _____ (Place X) If "NO", please skip to Question 29.

27. If "YES" to question 26, which archives, services or sources have you used to access such works? (Please tick – please mark as many as apply)

Author's Web page	
A Department's Web site	
An Institutional Repository	

A Discipline /Subject archive	
Other (please specify)	

28. If 'YES' to question 26, for which purpose(s) did you use these works? (Please tick – please mark as many as apply)

To prepare an article	
For my teaching activities	
For personal interest, knowledge or culture	
Other, please specify:	

Survey on Open Access scholarly communication in South Africa

Information about you

29. How did you find out about this survey?

Via personal e-mail	
Via an e-mail discussion list I subscribe to	
Via a colleague	
Other (please specify)	

30. Where do you work? (Please tick)

Combined Computer Science / Information Systems Dept.	
Computer Science Dept.	
Information Systems Dept.	
Combined Library and Information Science Dept.	
Information Science Dept.	
Library Science Dept.	
Information Technology (administrative) Dept.	
Information Technology company	
Library/ Information Service	
Other (please specify)	

31. Which one of the following best describes your current situation? (Please tick)

Professor	
Associate Professor	
Visiting Professor	
Senior Lecturer	
Lecturer	
Junior Lecturer	
Librarian (Senior management)	
Librarian (Middle management)	
Librarian	
Principal research fellow	
Senior research fellow	
Research fellow	
Research assistant	
Doctoral/Masters student	
IT professional	
Other (please specify)	

32. What is your highest qualification at this stage?

B-degree	
B + Hons degree	
M-degree	
D-degree	
Other (Please specify)	

33. How long since you have obtained this degree?

5 years or less	
6 -10 years	
10 – 15 years	
15 – 20 years	
More than 20 years	

34. In your current position, your primary responsibility is to:

Conduct research	
Conduct research with some teaching	
Conduct both research and teaching	
Mostly teach, with some research	
Teach	
Other, please specify:	

35. Would you be interested in attending an information session on this subject? YES ___ NO ___ (Place X)

Survey on Open Access scholarly communication in South Africa

Declaration

36. I give permission for the University of Stellenbosch to anonymously process my responses for this Survey on Open Access scholarly communication in South Africa for the Computer -, Library -, and Information Sciences, and Information Systems disciplines.

YES _____ (Please tick– if this area is not marked we cannot process your responses.)

Thank you very much for completing this questionnaire.

Jennifer De Beer
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Appendix G

Additional tables and graphs for a sub-set of questionnaire responses.

Additional information is provided here as an adjunct to information in the main text. Table 19 indicates the responses to a question assessing level of awareness of Open Access as phrased in the questionnaire instrument. Table 19 is continued on the next page. Table 20 indicates the frequency with which respondents make use of ICT as part of their scholarly activity.

Table 19 Degree of awareness of Open Access

Item/Entity	Level of awareness (%)		
	I have not heard about it	I have heard about it	I know what it is / what it does
PLoS	**81**	7	11
PubMedCentral	**68**	15	16
BioMedCentral	**64**	23	13
Serials Crisis	**67**	20	13
Institutional Repositories	25	**41**	34
Open Access journals	9	35	**55**
Preprints	25	30	**45**
e-Prints	24	35	**41**
Self-archiving	**41**	36	22
Discipline-based archives	**42**	33	25
ETDs	**46**	22	31
OAI	**69**	13	18
SPARC	**64**	23	12
Free Online Scholarship movement	**61**	23	16
BOAI	**88**	9	3
Creative Commons	**75**	10	15
Citeseer a.k.a. ResearchINdex	**56**	20	25
NCSTRL	**92**	3	5
ArXiv	**84**	8	8
RcLIS	**93**	4	3

Item/Entity	Level of awareness (%)		
	I have not heard about it	I have heard about it	I know what it is / what it does
NDLTD	**88**	5	7
E-LIS	**74**	19	7
RePEc	**93**	5	2
DoIS	**86**	8	7
Berlin Declaration on Open Access	**60**	26	13
ALPSP Statement	**87**	10	4
Bethesda Statement	**80**	17	3
Wellcome Trust statement	**88**	10	3
IFLA statement	**63**	25	12
DC principles for Free Access to Science	**82**	12	6

Modes in bold text

Table 20 Electronic scholarship – use of ICT

	Frequency (%) N=82				
	Never	Yearly	Monthly	Weekly	Daily
E-mail (personal)	0	1	4	16	**79**
E-mail (discussion lists)	23	8	18	**29**	22
Usenet newsgroups	**55**	12	16	9	8
Web sites (of professional organisations/associations/ societies	2	4	16	36	**41**
Web sites (homepages of colleagues/peers)	10	15	**36**	19	19
Web sites (blogs)	**37**	11	22	20	11
Webcasts (live)	**71**	16	7	5	1
Web-based conferences	**71**	14	9	4	1

Modes in bold text

Appendix H

Structured record review: Organisational structures surveyed at Stellenbosch University.

Below is a listing of Academic departments, Bureaux, etc, the Web homepages of which were surveyed to ascertain if they engaged in self-archiving or journal publication/hosting. Those marked with an asterisk (*) did not have dedicated Web homepages, and merely contact e-mail links.

Academic Departments

1 Academic Development (Military)
2 Accountancy
3 Accountancy and Auditing (Military)
4 Actuarial Science
5 Aeronautics
6 African Languages
7 Afrikaans and Dutch
8 Agricultural Economics
9 Agronomy
10 Anaesthesiology and Critical Care
11 Anatomical Pathology
12 Anatomy and Histology
13 Ancient Studies
14 Animal Science
15 Applied Mathematics
16 Biochemistry
17 Biochemistry (Medical)
Med biochem
Med physio
18 Biology, Molecular and Cellular
19 Biology, Oral Health
20 Botany
21 Business Management

22 Cardiothoracic Surgery
23 Chemical Pathology
24 Chemistry and Polymer Science
25 Civil Engineering
26 Community Health
27 Computer Information Systems (Military)
28 Computer Science
29 Computer Skills
30 Conservation Ecology
31 Consumer Science
32 Dermatology
33 Didactics
34 Drama
35 Economics
36 Economics (Military)
37 Educational Policy Studies
38 Educational Psychology
39 Electrical and electronic Engineering
40 English
41 Entomology and Nematology
42 Environmental Education Programme
43 Family Medicine and Primary Care
44 Fine Arts
45 Food Science
46 Forensic Medicine
47 Forest Science
48 French
49 General Linguistics
50 Genetics
51 Geography (Military)
52 Geography and Environmental Studies
53 Geology
54 Geotechnical and Transport Engineering
55 German

56 Graphical Design
57 Greek
58 Haematological Pathology
59 Hebrew
60 History
61 Horticultural Science
62 Human Nutrition
63 Industrial Engineering
64 Industrial Psychology
65 Industrial Psychology (Military)
66 Information Science
67 Internal Medicine
68 Jewellery Design
69 Journalism
70 Latin
71 Logistics
72 Mandarin
73 Mathematics
74 Mathematics (Military)
75 Mechanical Engineering
76 Medical Microbiology
77 Medical Virology
78 Mercantile Law
79 Mercantile and Criminal Law (Military)
80 Metallurgy
81 Microbiology
82 Military History
83 Military Strategy
84 Music
85 Nautical Science
86 Neurosurgery
87 Nuclear Medicine
88 Nursing
89 Obstetrics and Gynaecology

90 Occupational Health
91 Occupational Therapy
92 Old and New Testament
93 Ophthalmology
94 Orthopaedics
95 Otorhinolaryngology
96 Pediatrics and Child Health
97 Pharmacology
98 Philosophy
99 Physical and Mathematical Analysis
100 Physics
101 Physics (Military)
102 Physiological Sciences
103 Physiology (Medical)
104 Physiotheraphy
105 Plant Pathology
106 Plastic and Reconstructive Surgery
107 Political Science
108 Political Science (Military)
109 Practical Theology and Missiology
110 Private and Roman Law
111 Process Engineering
112 Psychiatry
113 Psychology
114 Public Law
115 Public and Development Management (Military)
116 Radiation Oncology
117 Radiodiagnostics
118 SUNSTEP Outreach Programmes
119 Signal Processing
120 Social Work
121 Sociology and Social Anthropology
122 Soil Science
123 Speech-language and Hearing Therapy

124 Sport Science
125 Statistics (Military)
126 Statistics and Actuarial Science
127 Structural Engineering and Information Technology
128 Surgery
129 Systematic Theology and Ecclesiology
130 TRAC Outreach Programmes
131 Town and Regional Planning
132 Transport Economics
133 Urology
134 Viticulture and Oenology
135 Water Engineering and Engineering Management
136 Water Science
137 Wood Science
138 Xhosa
139 Zoology

Bureaux

1 Bureau for Chemical Engineering
2 Bureau for Continuing Theological Education/Research
3 Bureau for Economical Research (BER)
4 Bureau for Industrial Mathematics (BIMUS)

Centres

1 African Centre for HIV/AIDS Management
2 African Centre for Investment Analysis
3 Beyers Naudé Centre for Public Theology
4 Centre for Applied Ethics
5 Centre for Bible Translation in Africa
6 Centre for Disabled Care and Rehabilitation
7 Centre for Geographical Analysis*
8 Centre for Higher and Adult Education
9 Centre for International and Comparative Politics
10 Centre for Invasion Biology (CIB)

11 Centre for Knowlegde Dynamics and Decision-making
12 Centre for Macromolecules and Materials (UNESCO)
13 Centre for Military Studies
14 Centre for Nutrition Information
15 Centre for Process Engineering
16 Centre for Research on Science and Technology
17 Centre for Statistical Consultation
18 Centre for Teaching and Learning
19 Centre for Theatre Research
20 Information Centre for Childrens' Literature and Media
21 Language Centre
22 Media Centre (Education)

Faculties

1 Faculty of Arts
2 Faculty of Agricultural and Forestry Sciences
3 Faculty of Economic and Management Sciences
4 Faculty of Education
5 Faculty of Engineering
6 Faculty of Health Sciences
7 Faculty of Law
8 Faculty of Military Sciences
9 Faculty of Science
10 Faculty of Theology

Institutes

1 Institute for Futures Research
2 Institute for Mathematics and Science Education
3 Institute for Plant Biotechnology
4 Institute for Polymer Science
5 Institute for Sport Science
6 Institute for Structural Engineering
7 Institute for Theoretical Physics
8 Institute for Thermodynamics and Mechanics

9 Institute for Transport Engineering
10 Institute for Water and Environmental Engineering*
11 Institute for Wine Biotechnology

Laboratories

1 Electronic Systems Laboratory
2 School for Basic and Applied Health Sciences
3 Writing Laboratory

Schools

1 Biological Sciences, School for
2 Business School
3 School for Allied Health Sciences
4 School for Public Management and Planning
5 School for Public and Primary Health Sciences
6 School of Medicine

Units

1 Research Unit for Experimental Phonology (NEFUS)
2 Sun e-shop
3 Unit for Advanced Production (SENROB)*
4 Unit for Afrikaans
5 Unit for Computers and Control*
6 Unit for Continuing Education*
7 Unit for Continuing Training*
8 Unit for Document Design
9 Unit for Educational Psychology
10 Unit for Electrical Energy*
11 Unit for English
12 Unit for Industrial Engineering*
13 Unit for Religion and Development Research (URDR)
14 Unit for Research on Mathematics Teaching
15 Unit for Signal Processing*
16 Unit on Anxiety and Stress Disorders

Appendix I

Main sources of information policy in South Africa to date.

To date the main document-type sources of information policy in South Africa have been the following. Their broad remit is indicated in parentheses.:

- Independent Broadcasting Act (1993); (Television and Radio broadcasting)
- Reconstruction and development Base document of the ANC(1994) and the Reconstruction and Development Programme;
- Green Paper on Telecommunications (1995); (Telecomm)
- White Paper on Telecommunications (1996); (Telecomm)
- Telecommunications Act (1996);
- National Information Technology Forum position paper (1996);
- National Archives of South Africa Act (Act 43 of 1996); (Archives)
- Legal Deposit Act (1997); (Archives)
- National Library of South Africa Act no 92 (1998); (Archives)
- State Information Technology Agency Act 1998; (IT in Government)
- Broadcasting Act (1999); (Television and Radio broadcasting)
- IT Policy for Government: Draft document (1999);
- Promotion of Access to Information Act (Act 2 of 2000); (Access to records)
- SAITIS Sector Development Framework (2000); (IT sector)
- National Council for Library and Information Services Act (2001), (Information services)
- Electronic Communications and Transactions Act (2002); (E-commerce and information security)
- Interception and Monitoring Act (Information security)
- Electronic Communications Security Act (COMSEC) (Information security)
- Intelligence Services Control Amendment Act -2002 (Information security)
- King II Report on Good Governance (Code of Conduct, not legislation), to improve transparency and accountability of publicly-listed companies (Accounting and financial reporting).

Appendix J

National branches of the International Council for Science (ICSU) in South Africa.

Note that only two of the 32 societies listed, made mention of Open Access in their 2003 Annual reports.

To provide an idea of the range of societies, and hence disciplines, concerned, the branches are: Committee on Data for Science and Technology (CODATA); Committee on Space Research /Scientific Committee on Solar-Terrestrial Physics (COSPAR/SCOSTEP); International Astronomical Union (IAU); International Brain Research Organisation (IBRO); International Cartographic Association (ICA); International Council for Scientific and Technical Information (ICSTI); International Geosphere-Biosphere (Global Change) Programme (IGBP); International Geographical Union (IGU); International Mathematical Union (IMU); International Union for Quaternary Research (INQUA); International Union of Biochemistry and Molecular Biology (IUBMB); International Union of Biological Sciences (IUBS); International Union of Crystallography (IUCr); International Union of Forestry Research Organisations (IUFRO); International Union of Geodesy and Geophysics (IUGG); International Union of Geological Sciences (IUGS); International Union of Immunological Societies (IUIS); International Union of Microbiological Societies (IUMS); International Union of Nutritional Sciences / International Union of Food Science and Technology (IUNS/IUFost); International Union of Pure and Applied Chemistry ((IUPAC); International Union of Pure and Applied Physics (IUPAP); International Uniion of Pharmacology ((IUPHAR); International Union of Physiological Sciences (IUPS); International Union of Psychological Sciences (IUPsyS); International Union of Theoretical and Applied Mechanics (IUTAM); International Water Association (IWA); Microscopy Society of Southern Africa (MSSA); South african Association for Laboratory Animal Science (SAALAS); Scientific Committee on Antarctic Research (SCAR); Scientific Committee on Problems of the Environment (SCOPE); Scientific Committee on Oceanic Research (SCOR); Union Radio Scientifique Internationale (URSI).

Appendix K

Global tally of institutional members of BioMed Central (December 2004)

These institutional members are research institutions, such as universities. Institutional membership is an additional revenue stream for publishers using the author-pays publishing model. Readers have free access, and authors pay to publish. Authors resident at institutions with BioMed Central memberships do not pay individual fees to publish, and in effect are exempt from paying the article-processing fee for the membership year in question. The table below illustrates the number of institutions per country signed up at BioMed Central in December 2004. Within the table below, ideally one would want to have a third column indicating the total number of candidate institutions per country. However, that information is lacking. The table is provided to contextualise South Africa's participation at the time of writing.

Table 21 Number of institutions per country which are BioMed Central institutional members

Country	Number of institutions per country, paying BioMed Central membership fee	Country	Number of institutions per country, paying BioMed Central membership fee
Australia	20	Lithuania	1
Austria	2	Malaysia	1
Barbados	1	Mexico	2
Belgium	4	Netherlands	7
Bulgaria	1	Norway	11
Canada	24	Peru	1
Chile	2	Poland	1
China	1	Singapore	1
Denmark	4	Slovakia	2
Estonia	1	South Africa	3
Finland	7	Spain	5
France	4	Sweden	6
Georgia	1	Switzerland	6
Germany	38	Trinidad and Tobago	1
Hungary	2	United Kingdom	126
India	2	United States	144

Country	Number of institutions per country, paying BioMed Central membership fee	Country	Number of institutions per country, paying BioMed Central membership fee
Ireland	1		
Israel	1		
Italy	25		
Jamaica	1		
Japan	1		
Korea,Republic of	1		

Appendix L

Global tally of institutional repositories[127] (December 2004)

Presented below are country tallies of implementations of institutional repositories, categorised in three ways: country, archive type, and the type of software installed.

Table 22 Number of institutions per country which have institutional repositories

Country	Number of institutions per country having registered their institutional repository	Country	Number of institutions per country having registered their institutional repository
United States	60	Portugal	2
United Kingdom	36	Spain	2
Canada	20	Belgium	2
Germany	16	Austria	2
France	15	Switzerland	2
Sweden	13	Mexico	2
Netherlands	12	Ireland	2
Italy	11	Colombia	1
Australia	10	Educational[128]	1
India	5	Namibia	1
Denmark	4	Israel	1
Hungary	4	Peru	1
China	4	Croatia	1
Brazil	4	Norway	1
South Africa	3[129]	Slovenia	1
Japan	3	Finland	1

[127] As per the Institutional Archives Registry at http://archives.eprints.org/index.php?action=browse
[128] Possible error in information provided by registering entity upon submission
[129] These being:
Rand Afrikaans University Electronic Theses and Dissertations;
University of Cape Town Computer Science Research Document Archive;
University of Pretoria Electronic Theses and Dissertations.
Source: http://archives.eprints.org/index.php?action=home&country=za

Table 23 Tally of institutions per institutional repository type

Archive material type	Number
Research institutional or departmental	126
Research cross-institution	35
e-Theses	30
Demonstration	23
Other	13
e-Journal/Publication	13
Database	3

Table 24 Tally of institutions per IR software installation used

Software	Number
GNU EPrints v2	131
GNU EPrints v1	17
DSpace	31
ARNO	2
CDSWare	2
DiVA	1
other	59

Appendix M

African Open Access journals (January 2005)

Presented below are the details of African journals as indexed on the Directory of Open Access Journals (DOAJ). The South African journals are marked with an asterisk (*).

Table 25 African Open Access journals as per the Directory of Open Access Journals

No.	Journal title	ISSN	Subject	Publisher	Language	Keywords	Start year
1	African Journal of Biomedical Research	11195096	Medicine(General) - Biology	Ibadan Biomedical Communications Group	English	biomedicine	2003
2	African Journal of Biotechnology	16845315	Biology	Academic Journals	English	biotechnology	2002
3	African Journal of Environmental Assessment and Management	14387890	Environmental Sciences	AJEAM/RAGÉE	English, French	Environmental science, Africa	1999
4	African Journal of Neurological Sciences	10158618	Neurology	Pan African Association of Neurological Sciences	English, French	neurology	1995

No.	Journal title	ISSN	Subject	Publisher	Language	Keywords	Start year
5	African Journal of Reproductive Health	11184841	Gynecology and Obstetrics	Women's Health and Action Research Centre (WHARC)	English, French	reproductive health, women's health	2001
6	African Population Studies	08505780	Economics	Union for African Population Studies	English, French	population studies, demography, Africa	1994
7	African Studies Quarterly: the online journal of African studies	10932658	History – Social Sciences	University of Florida, Center for African Studies	English	African studies, area studies, social science, Africa, history	1997
8	AIDS Research and Therapy	17426405	Medicine (General) – Allergy and Immunology	BioMed Central	English	HIV-1, treatment strategies, Africa, Asia	2004

No.	Journal title	ISSN	Subject	Publisher	Language	Keywords	Start year
9	Annals of African Medicine	15963519	Medicine (General)	Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria, Annals of African Medicine Society	English	Sociology, African migration	2003
10	Chimera	15461130 (and EISSN 15461122)	Economics – Political Science	USA/Africa Institute, Florida, USA	English	Education, health, governance, diplomacy, economics, economic development, Technology, culture	2003
11	Írinkerindo: a Journal of African Migration	d0000911 (and EISSN 15407497)	Sociology	Editors: Mojubaolu Olufunke Okome and Bertrade Ngo Ngijol-Banoum	English	Sociology, African immigration	2003

No.	Journal title	ISSN	Subject	Publisher	Language	Keywords	Start year
12	Jenda: a Journal of Culture and African Women Studies	15305686	History – Gender Studies	Africa Resource Center	English	Africa, women studies, cultural studies	2000
13	Journal on African Philosophy	15331067	Philosophy	Africa Resource Center	English	Philosophy, Africa	2002
14	Marine Ornithology	d0000061	Zoology	African Seabird Group et al	English	Ornithology, zoology	1988
15	Sahara Journal of the Social Aspects of HIV/AIDS*	17290376	Medicine (General) – Allergy and Immunology	South African Medical Association Health and Medical Publishing Group	English, French	Sub-Saharan Africa, epidemiology, immunology, virology, health, education, social issues, economic issues	2004
16	Smithiana Bulletin*	16844130	Biology – Ecology – Aquaculture and Fisheries	South African Institute for Aquatic Biodiversity	English	Ecology, biology, aquaculture	2003
17	South African Journal of Animal Science*	03751589	Animal Sciences	South African Society for Animal Science	English	Animal science	2001

No.	Journal title	ISSN	Subject	Publisher	Language	Keywords	Start year
18	South African Journal of Information Management*	1560683x	Business - Education	InterWord Communiations and Dept. of Information Studies, Rand Afrikaans University, SA	English	Information management (IM) theory, IM technologies, knowledge management, competitive intelligence, education, business	1999
19	The Journal of Food Technology in Africa	10286098	Nutrition and food sciences	Innovative Institutional Communications	English	Food technology, agriculture	2001
20	West Africa Review	15254488	History	Africa Resource Center	English	West African studies, area studies, Africa	1999

Appendix N

SAPSE: New policy for accredited journals as of 2004 (as per December 2003)

Presented below is a copy of a posting on the Stellenbosch University electronic news bulletin, dated 3 December 2003, and available at http://www.sun.ac.za/news/NewsItem.asp?ItemID=5170&Zone=E05 .

New Policy for Accredited Journals from 2004

(3-12-2003)

The DoE (Department of Education) yesterday announced details of a new policy for the survey and recognition of research publications which will come into effect from 2005 for outputs published in 2004.

The new policy differs from the present policy in the following respects, among others:

1. For the purposes of subsidy, only articles in recognised journals, books for the specialist and published proceedings will be taken into account (reports on commissioned or contract research and patents will not be recognised).

2. Recognised journals are journals listed in:

· ISI (Institute of Scientific Information) journals – which include the Science Citation Index, Social Sciences Citation Index and Arts and Humanities Citation Index.
(the complete list of journal titles can be viewed at http://www.isinet.com/cgi-bin/jrnlst/jloptions.cgi?PC=master)

· IBSS (International Bibliography of the Social Sciences): four disciplines are represented viz. anthropology, economics, political science en sociology).
(the complete list of journals is available at http://www.lse.ac.uk/collections/IBSS/about/journalsA.htm)

· DoE-accredited list of South African journal titles (197), i.e. exclusive of those SA journal titles which are already included in the ISI- or IBSS-lists. This list will be published annually on the DoE website. (If requested, the DoE will provide assistance to obtain registration of SA titles on the ISI- or IBSS-lists.)

(The complete list of the DoE-accredited SA journal titles can be viewed at http://www.sun.ac.za/Research/geakkrediteerde_joernale.doc)

3. Upon submission, books and published proceedings published in a language other than English will, in order to qualify for subsidy, have to be accompanied by a summary in English (1 page per book and an abstract per proceeding). Books submitted for subsidy purposes should be accompanied by the reports of two independent assessors not attached to the particular institution. The report should evaluate the book as a research output. A book should comprise at least 60 pages, excluding references and appendices.

4. Published proceedings submitted for subsidy purposes should have an ISBN number.

5. Regarding the moratorium since 1998 on the addition of new journals, the DoE proposes:
5.1 To recognise journal research outputs published from 1998-2003 if the journals are in the list of approved journals in terms of the new policy, and
5.2 To evaluate any outstanding journals in terms of the current policy.
As yet, no closing dates or prescribed forms and procedures have been announced. Staff members will be notified at an appropriate time when these become available.

The complete policy was published in the Government Gazette (Regulation gazette 7794, Volume 460, Pretoria, 14 October 2003, Government Gazette no 25583, also available at http://www.education.gov.za/content/documents/307.pdf)

Enquiries may be addressed to...<name suppressed>
Division of Research Development
3 December 2003