Scientific and Technological Information Services in Australia

I. History and Development

MICHAEL MIDDLETON

ABSTRACT An investigation of the development of Australian scientific and technological information (STI) services has been undertaken. It comprises a consideration of the characteristics and development of the services, which is the focus of this part of the paper, along with a broader examination of discipline formation in information management covered in Part II. This first part of the study provides an historical overview of the development of several of the services that were established in the 1970s. Specific reference is made to Australian Agriculture and Natural Resources Online (AANRO), the Australian Medical Index (AMI), Australian Nuclear Science & Technology Information (ANSTI), Australian Transport Index (ATRI), AusGeoref and its forerunner AESIS, and the Australian engineering database (ENGINE). The account includes a summary of the policy environment that influenced the development of databases and which supported the original STI services. Some observations are made about STI publishing output from Australia, the way it is reported and how appropriate reporting and documentation of that output might continue.

Information management is a term that has been appropriated by various groups of information professionals since the 1970s and applied to a wide range of functions. It therefore suffers a variety of definitions that differ in emphasis according to the disciplinary background of the definers. Emphasis may be on systems for conveying information (of concern to those working in corporate management, information systems and content management) or on the documents that carry information (as in recordkeeping, librarianship, document management).

The various occupations that pursue their distinct visions of information management have differentiated themselves through attention to different types of documents and different approaches to information organisation. However, the prevalence of digital media, the increasingly inclusive utilisation of metadata across document types, and acceptance of information as a corporate resource, mean that a concerted view of information management is becoming more likely. Wilson is among the more prominent writers who have paid attention to the definition of information management. His thorough observations[1] are not repeated here, except to note that they encompass all types of information resources from within or outside organisations. The shaping of disciplinary understanding would be assisted by case studies of information

Michael Middleton, School of Information Systems, Queensland University of Technology, Brisbane 4001. Email: m.middleton@qut.edu.au

management application. There are examples of these in the literature,[2] but they are not documented with reference to a disciplinary framework.

The following account uses an information management perspective to investigate Australian scientific and technological information (STI) services. The work is in two parts. The first part (this paper) is an examination of the history and development of the STI services, with some remarks about their continuation and necessity. The second part is a consideration of the extent to which a consolidated view of information management may be applied to provision of STI services.[3]

STI services were chosen for the study for a number of reasons. They were expected to represent many of the purposes to which information management principles could be put into practice. They each provide an example of a service that is produced by one institution principally for the benefit of many others; they were developed at the time when consciousness of information management principles was nascent; they form a relatively distinct set of cases for examination; and they appear to be a valuable resource whose continuation cannot be taken for granted, and which may benefit from exposure to further scrutiny.

Many types of services or systems that involve information management could be examined. They range from systems for inventory control or personnel management, to services that are more concerned with documents in the conventional sense such as recordkeeping or cataloguing services. The discrete group of services chosen has been maintained continuously over an extended period of twenty to thirty years. Similar services in the social sciences and humanities exist. Although many of the observations in this work may also be applied to such services, they are outside the purview of this work.

STI services themselves are sometimes differentiated into bibliographic (reporting the literature using metadata) and non-bibliographic (maintaining the type of factual information that when online is increasingly used for e-research through time series and other data compilations). Bibliographic services tend to be fewer in number but are more widely used. For example Russell and Hartwell, in a directory of agricultural information sources then available in Australia, identified 21 bibliographic databases, many of them produced outside Australia, and 62 non-bibliographic databases, all produced in Australia.[4] This work is confined to bibliographic services, and comprises case studies of six such services.

Research Method

This paper has arisen from a detailed case study of several STI services using a case study protocol, and supported by interviews with key participants, exploration and use of different versions of databases produced, and reference to literature, archives and supporting material created to support users of databases. A descriptive case study methodology[5] is applied in which the unit of

analysis is a system of action – in this situation the establishment and maintenance of a service, applied over multiple cases.

Project objectives included providing an overview of development of STI services in Australia, extending this overview with a detailed investigation that takes account of public policy influences and corporate imperatives, and testing the utility of a case study procedure derived from a description of discipline formation. Information was collected via a combination of approaches requiring examination of published and archival documentation; interviewing of key figures who were involved in the creation of the national services; and study of the systems underlying, and functionality provided by each of the services. Case study questions were structured according to the context of a recently written book on information management.[6] The outcomes are documented case studies of the STI services, an overview of development reported in Part I, and an analysis of discipline formation reported in Part II with respect to operational, analytical and administrative domains.

In Part I, the characteristics of the databases are compared within the context of some commentary on national scientific publication, the use of databases that record the output, and public policy influence on their development. This leads to some discussion about the ways in which continuation of the STI services may be ensured.

Scientific Publication Output

Bibliographic STI services have performed an important role in the information life cycle. Secondary sources of information, such as specialist bibliographies on scientific subjects originated in the eighteenth century and, by the beginning of the twentieth century, had been formalised into abstracting and indexing services, such as *Chemical Abstracts*, that were the forerunners of many of the STI databases available today.

The future of the scholarly publication that is reported and accumulated in these databases has been the subject of intense scrutiny in recent times through conferences and numerous publications. Stakeholders such as authors, editors, publishers and research managers continue to grapple with the changes made possible in publishing models through development in information and communications technology (ICT).

Greater apparent accessibility through the internet, particularly the Web, has been facilitated by systems such as content management and cooperative work groups, together with facilities such as digital archives and e-prints servers. These have been bolstered by what is sometimes called the hidden Web – the great number of databases available via subscription through Web interfaces, though not usually available to Web search engine crawlers. Many of these databases have been available since long before the Web, at least for provision of metadata. They provide a continuing impetus for information quality and increasingly they link full text with metadata. Yet they must

contend with multiple alternative avenues to the same information, as access to the same digital content is facilitated through stand-alone and aggregated portals of universities and professional associations. A case in point can be found in contributions to *AARL*, which are made available on the publications server of the Australian Library and Information Association (ALIA). Metadata for the contributions is provided in a number of international and national databases. Some of these, for example the ACER database *A*$^{+}$ *Education* and the NLA *APAIS* database, also provide links through to the full text at ALIA. As authors hold copyright for the material, contributions may also be made available via their own institution's servers in the form of preprints or postprints, thereby becoming accessible directly via search engines or more refined approaches, such as NLA Arrow or Google Scholar.

Increased access to information does not necessarily equate to improved organisation. Although a case may be made for multiple metadata descriptions to suit different contexts of use, many of the avenues to the same content may provide cursory or uncontrolled metadata and rely on full-text indexing for access. The resulting reduced ability to filter and refine search results could see the document hidden within large yields of search results.

The importance of providing access to the nation's research output was recognised long before the Web and was one of the early stimulants to information policy discussion. In the area of STI Australia's contribution to the overall literature is about 2% of the world total, though in some fields – certain branches of astronomy, medical science and agriculture – output has been disproportionately high. Recognition of the relatively small proportion of Australian literature being indexed internationally happened in the 1960s but it took some time before there were significant attempts to quantify what was *not* being covered. These attempts were generally undertaken as part of the process of identifying publishing that had to be inspected by institutions establishing database services. Such analyses were internal working documents. Some became public as databases were created along with guides to database coverage.

However, there were some published analyses across databases. For example, in 1981 Abbott reported on 1970s data showing the number of Australian journals covered by 13 overseas STI databases, and noted that there continued to be gaps locally, resulting from areas that CSIRO's Australian Science Index (*ASI*), extant since 1976, was not covering.[7] In 1983 Byrne looked into social sciences and the humanities, as well as STI.[8] His analysis showed that the coverage of literature from Australian sources varied, usually within the range of 1-3% of the global output. He also compared the international coverage of Australian STI research literature with its coverage in *ASI*, noting that coverage of Australian periodicals by the relevant international abstracting and indexing journals duplicated between about 20-80% of what was being covered by *ASI* depending upon discipline. Later he expressed

concern that for engineering research there were no counterparts in Australia of the US National Technical Information Service (NTIS) or the Comprehensive Dissertation Index.[9]

These early analyses were confined to Australian publications and were not investigating the significant amount of material published outside Australia by Australian authors. It was another decade before further analyses of this type were undertaken. For example, Royle analysed contributions in different disciplines to determine how citation index coverage compared with specialist database coverage. She confirmed that approximately 2% of total international output across the sciences and social sciences emanated from Australia, while finding significant variations in such fields as geosciences (3.91%), medicine (1.23%) and agriculture (2.79%). She also noted the disparity between the rate at which Australian journals cited overseas journals and the extent to which the overseas journals reciprocated.[10]

Increasing efforts of universities to find performance measures for their academic staff in terms of research publication prompted further research with citation analysis. We begin to see a re-orientation from what has been published, to how much influence that publication has supposedly achieved. This means that greater attention is being paid to impact measures, typically derived from the citation counts of publications reported by the Institute for Scientific Information (ISI) citation indexes, for example through the *Journal Citation Reports* (*JCR*). Although caution in interpretation of such data has been advised,[11] making use of metrics such as *JCR* provides appears to be gathering momentum at the present time as attempts are made to derive scholarly performance indicators for Australia's incipient Research Quality Framework.

Using ISI data Butler and others have conducted a number of analyses of the Australian share of scientific publication and of impact in different sectors. Studies of the health sciences found that Australia's share of publications in ISI medical journals increased by 25% between 1986 and 1995.[12] The average 'relative citation impact' (the share of international citations relative to the share of international publications) for the period was one (a relatively strong indicator of notice attracted). Longitudinal studies of scientific output have also been used to consider measures of research productivity. A low point of 1.88% of the international total reported by ISI in 1988,[13] had in 1999 risen to 2.23% (a 13% increase that was matched by a similar share of citations in the period from 1990 to 1998).[14]

This apparent increase may be explained by the inclusion of publications arising from greatly increased international collaboration. Relative impact, which declined in all fields except the agricultural sciences through the 1980s, has had a more varied performance in the 1990s, with both physical and biomedical sciences rising and earth sciences returning to former levels. Butler finds that although the amount of publication is increasing significantly, more

of it is appearing in lower-impact journals. Part of the explanation, she suggests, may be the 'push to evaluate research on the basis of publication output, with little reference to the quality of that output'.[15] Because allocation of public research funding to universities had been based to some extent on the amount of publication by researchers, it may have stimulated an increase in gratuitous publication.

Adoption of impact factor measures further predisposes academic researchers to publish in highly ranked international journals rather than national ones. Determinants of quality are difficult to substantiate and this makes the comparison of impact factors contentious. Yet there is a need to gather more data on the local impact factors of national scholarly publications whose viability is in danger unless they become more highly regarded internationally. Fostering local publication requires commitment from professional associations, embracing of rigorous approaches to refereeing and improving digital visibility.

Among factors that might promote local publication are:

- ensuring that those who are helping to frame research quality measures pay particular attention to the need for support of high quality national journals and the local impact that these may achieve
- creating citation databases of national journals to complement ISI data
- increasing refereeing rigour and filtering of articles for local journals, including stronger association with output of refereed conference publications
- raising the international profile of journals by promoting them as international journals based in Australia, rather than Australian journals with some international content
- maintaining an investment in meta-information production and aggregation for our own literature in concert with that of international equivalent databases.

This investigation is concerned principally with the last of these points, with a focus on STI databases.

Database Development and Information Policy

Several factors contributed to the development of Australian STI services during the 1960s. They include:

- recognition of the need for an information policy framework to promote a more significant role for STI resources in economic development
- improved dissemination of information, as international publishers of abstracting and indexing services began to consolidate their output in databases and associate these databases with effective information retrieval systems
- concerns about the low proportion of local output recorded in international publications and the need to complement it with local material

- a desire to record comprehensively the national scientific documentation output.

The uneasy connection of public policy direction and ad hoc institutional initiative has been described in more detail elsewhere.[16] However, some aspects of the relationship are reviewed here as a preamble to an analysis of information services.

It was the library community that was most actively concerned with policy to frame the development of STI services. In 1972-73 a group of prominent business and industry leaders was commissioned by the National Library of Australia (NLA), with government support, to form the Scientific and Technological Information Services Enquiry Committee (STISEC). STISEC commissioned formal studies quantifying the extent of recorded Australian publication and reported to NLA's Council concerning the coordinated development of local services. STISEC recommended both the development of a national information policy and a national central STI authority to act as the focus for activities and promote their orderly development.[17] Other policy documents in the area, for example, an OECD examiner's report on science and technology in Australia, supported this view.[18]

Horton considered that the STISEC report was the prime factor leading to the amendment of the National Library Act to make it clear that the NLA's responsibilities included science and technology.[19] However, it can be said that a focus for STI leadership was never satisfactorily attained because the interests of the two most prominent and likely lead agencies, the NLA and the CSIRO, were not fully reconciled.

The CSIRO, although forming to some extent a distributed national science library, was reluctant to take on a greater resource provision role without dramatic provision of additional resources. Among its statutory functions since its 1949 enabling Act were the collection, interpretation, dissemination and publishing of information relating to scientific and technical matters. It observed part of this role through active collaboration with other agencies in the development of databases. An example was the *Australian Bibliography on Agriculture* (*ABOA*).

Repeated organisational reviews made recommendations about the CSIRO's role in provision of STI services.[20] For example, with respect to the NLA's Australian National Scientific and Technological Library (ANSTEL), it was thought that rationalisation, correlation, and reduction in duplicated resources and functions were needed. One inquiry saw that there appeared to be opportunities to relate the ANSTEL service to the CSIRO's Central Information Library and Editorial Service (CILES). However, its relevant recommendation went no further than to review the internal organisation of this information service 'in relation to an Australia-wide service involving all other possible sources, such as the National Library'.[21]

ANSTEL had been created by the NLA as one of three 'national libraries' (the others being for the social sciences and the humanities) to function within the NLA, each promoted within the concept of an entity called the Australian Library Based Information System (ALBIS). ANSTEL embodied such initiatives as an industry network, which was initiated to produce current awareness bulletins in STI, and an industry reports database.[22] Unfortunately the NLA was unable to communicate the objectives of ALBIS in a way that engaged the wider information services community. This was despite the claim of the NLA Director-General George Chandler that there was no opposition or jealousy from the CSIRO or Australian government departments to the NLA's plan for country-wide information services based upon computers. He refuted library sector claims that his institution was running into friction with other powers wanting to carry out similar services.[23] Ultimately, however, the NLA was unable to obtain enough resources for the 'libraries within a library' policy to fulfil its many objectives.

On the other hand, the NLA was able to point to some successes. Earlier STI developments such as *MEDLARS,*[24] and current awareness services from *BIOSIS* databases were brought under the umbrella of ANSTEL. A significant venture outside ANSTEL was the *ERIC* research project which ran from 1972 to1974.[25] Although it was developed using a database focused on education, this joint investigation by the NLA and IBM was significant for STI services. Its success meant that it became a precursor for AUSINET, which was to provide a platform for databases across the spectrum of knowledge and to give stimulus to Australian database development. AUSINET was established as a cooperative enterprise in which a number of databases were pooled for shared access. It was initiated in 1976 following the success of a project to enable searching of the ERIC database and the desire of Monash University for further development of online facilities. Following discussions with the NLA, those two institutions along with eight others including the Australian Roads Research Board (ARRB) became founding members.

Policy drive from outside the library community was slow in coming. Information policy at the time was of little interest to the emergent information and communication technology sectors. However, the scientific community began to state a need for effective information resources. The Australian Science and Technology Council (ASTEC), in a report examining science and technology in Australia,[26] made recommendations about supporting the development of library-based and other information services. Later the federal Department of Science championed the effective provision of STI for research and industry[27] and promoted coordination of services, for example, at a national workshop.[28] At this forum discussion repeatedly referred to the ineffective use of the many services then under way. Reasons put forward included lack of coordination, a need for identification of agency

responsibilities at national level, insufficient awareness by potential users and inadequate training.

Reservations about the absence of overall guidance and authority for database development had been expressed, for example, by Swan.[29] However, the view of ANSTEL's then director was that, if a national database policy were needed, it would be necessary to demonstrate the failings of present services, and show how policy could improve on existing mechanisms for costing, identifying funding sources and establishing monitoring mechanisms.[30] Still, a number of piecemeal policy initiatives occurred within individual government departments that did stimulate the progress of STI services. In some respects the progress they achieved was in spite of policy and the lack of coordination between the lead institutions that established and provided the services. Regardless of the misgivings about coordination, the ad hoc development resulted in extensive services based upon international databases, complemented by the production of local databases. The Australian Database Development Association was formed and began to produce guides to the range of databases[31] and provide guidance and encouragement for potential developers.

A couple of decades later information policy is much more the province of ICT, the media and commerce. Little attention is now being paid to content and database development. It may seem that ongoing production and coverage is ample but there are indicators that more needs to be done with respect to scanning and description of Australian content.

STI Services

The current online versions of the databases considered here were preceded in several cases by current awareness services using batched search strategies in order to produce regular listings for researchers by Selective Dissemination of Information (SDI). CSIRO pioneered this by developing its own software to search its own compilations, complementing the batch searching it was carrying out on overseas databases. The Department of Supply's *ADSATIS* service (which subsequently became *DISTIS*[32]) was another early example of SDI. In this case indexing metadata for research reports was combined with library accession data to provide SDI for departmental scientists.

RMIT Publishing's Informit[33] service now provides an online platform for most of the Australian STI services. RMIT Publishing as Informit started producing CD-ROM databases in 1990 under the name Informit and now publishes scores of Australian databases across many disciplines. It started the online service in 1998 and since 2000 this has included a number of databases that include full text. To varying extent, the records are also replicated in international databases. Among the databases on Informit are several that have a history of continuous development since the 1970s and 1980s. These are the Australian Medical Index (*AMI*) produced by the NLA; the Australian Nuclear

Science & Technology Information (*ANSTI*) by the Australian Nuclear Science and Technology Organisation (ANSTO); the Australian Natural Resources Index (*ANR-I*) by Infoscan for several government resource agencies; the Australian Transport Index (*ATRI*) by the ARRB Group; and the Australian Engineering Database (*ENGINE*) by Engineers, Australia.

The following analysis focuses on these five Informit databases, along with what is now the Australian component of the international *Georef* database *AusGeoref* produced by Geoscience Australia. This database was formerly *AESIS* and its early development has been previously reviewed.[34] The characteristics and development of the services are described under the following subheadings:

- *overview* of characteristics
- *production,* in order to provide some comparison of relative throughput
- *database platforms,* in order to review the different ways in which the databases have been made available
- *coverage,* in order to examine the selection of material for the databases
- *record format,* in order to compare information organisation, and
- *search aids,* for a brief overview of user assistance beyond online help.

In addition to the databases listed above, other specialist databases in the STI area are produced. For example, since 1982 with the assistance of the CSIRO, the Great Barrier Reef Marine Park Authority has produced *REEF*. However, analysis is confined to the 6 databases listed in Table 1.

Overview of Characteristics

Table 1 summarises the databases by broad subject area, provides a brief digest of historical information and comparison of characteristics. Some information about the structure and search facilities of each of these databases is available within the database assistance information on Informit. Drynan has recently reviewed several of them.[35]

Production

As shown in Table 1, four of the databases have had the one producer since their inception, although in *ATRI*'s case the name of the producer has changed several times. *AusGeoref* has been produced since 2003 by Geosciences Australia after a two-year hiatus following the demise of the Australian Mineral Foundation which had maintained *AESIS* for 25 years since 1976. Australian Agriculture and Natural Resources Online *(AANRO)* was formerly produced as the separate databases *ABOA* (by CSIRO) and *STREAMLINE* (by the Department of Resources and Energy) but since 1996 has been consolidated as one database produced by the Infoscan company.

The databases have begun in different years and in some cases have made efforts to include material from prior to their commencement date. However, it

is instructive to compare the database input over the last few years. Table 2 is derived from PY (publication year) indexes for each database on Informit.

Two characteristics can be seen. There is significant lag time in getting data into services – although all data were collected in early 2006, in many cases a great deal more 2005 material would be expected by the date of analysis. There is an apparent tapering off in three of the five databases – this appears to be related to the lack of resources to get material into the databases rather than less publication in Australia or more publication overseas.

Database Platforms

Informit, which began publishing databases on CDROM in 1990 and commissioned its online service in 1998, is now a vendor of each of the databases except *AusGeoref*, which may be searched on a subscription basis through the American Geological Institute as an independent subset of *Georef*.[36] The Australian content has grown to in excess of 65 000 records.

AANRO appears on Informit as *ANR-I* in current and archival versions but it is also available as a knowledge base with links to other material via its own portal. *ANSTI* is alternatively available consolidated within the entire INIS database.

Prior to Informit a succession of platforms provided access to the databases. AUSINET had been established as a cooperative enterprise in which a number of databases were pooled for shared access. It was initiated in 1976 following the success of the project to enable searching of the ERIC database and the desire of Monash University for further development of online facilities. Following discussions, the NLA, Monash University and eight other institutions, mainly universities but including ARRB, became the founding members. AUSINET functioned with IBM STAIRS software which facilitated databases structured with paragraphs (text search facilities such as Boolean and proximity) and formatted fields (coded data permitting relational operations typically used to refine a search). Sorting of search results and saving of search statements for re-use was possible. AUSINET used the computing facilities at what was then ACI Computer Services (later Ferntree) at Clayton in Victoria, with initial participants using leased line services at a cost of $3 000 per month. There was stress on the development of uniquely Australian material.

Table 1: Australian STI Databases

	Earth Sciences	Engineering	Health Sciences
Present name	Georef (Aust component)	ENGINE	AMI (includes HEAPS)
Commenced	as AESIS 1976	1982	1983
Producer	AMF 1976-2001 Geoscience Australia 2003-	Institution of Engineers, Australia	NLA
Subject matter	Earth sciences	Engineering	Health and medicine
Coverage	(1907-) 1975-2001	1980	1968
Annual size	~4 000	~1 300	~2 000

Overseas material	About Australia 1979-	No	About Australia; by Australians
Types of documents	BCDJMRrTS	BCGJNRT	BCJPRV
Vendors	AUSINET CLIRS Informit AMF	AUSINET 1983-1987 AUSTRALIS 1987- Ozline Informit	Aust Medline network Ozline Informit
International ties	No	No	Medline complementary Some overlap 2001-
Vocabulary control	*Australian Geoscience, Minerals and Petroleum Thesaurus*	SHE (Subject Headings for Engineering) 1993 EI 1993 -	*MeSH*
Current awareness	*AESIS Quarterly* AESIS special lists	No	Tailored searches
Other outputs	AESIS cumulation – fiche Retrospective list series	No	Bibliographies
Full text	No	No	Meditext link 1996-
Present name	AANRO	ANSTI	ATRI
Commenced	ABOA 1975 (from AGRIS), Streamline 1982	1972	1977
Creators	CSIRO (ABOA) Dept Resources, Energy (Streamline) Infoscan for AANRO	AAEC, ANSTO	ARRB Group. Formerly ARRB until 1995, then ARRB Transport Research Ltd
Subject matter	Agriculture, water resources	Nuclear science and engineering	Road research
Coverage from	1941-	1970	1975
Annual size	~5 000-6 000	~800-1 000	~1 600
Overseas material	About Australia	No	Yes (from?)
Types of documents	BCDJMOPRTV	BCDGJMRTS	BCDJORST
Vendors	AUSINET 1983 AUSTRALIS STREAMLINE (WATR) Informit STREAMLINE 1992- ABOA 1996- Infoscan 1999-	ANSTO Informit	AUSINET 1978-1982 AUSTRALIS (INROADS) Ozline Informit
International ties	ABOA subset for Australian component of AGRIS	Australian component of INIS	30% of ARI goes IRRD
Vocabulary control	*CAB thesaurus* AGRIS Categorisation *AGDEX* adapted *AQUALINE thesaurus* (STREAMLINE)	*INIS Thesaurus*	*IRRD Thesaurus* *ATRI Thesaurus*
Current awareness	STREAMLINE update	Tailored searches	*Australian Road Index* *Australian Road Research in Progress* *ARRB Publications Index*
Other outputs	Annual bibliographies from ABOA	No	Thesaurus for ATRI

	Water research in Australia (from STREAMLINE)		
Full text	Some links to Web material	No	No

Key for Types of Documents

A: Audio recordings	G: Government papers	O: Ongoing research	T: Theses
B: Books	J: Journal articles	P: Pamphlets / posters	V: Visual media
B: Book reviews	L: Legislation	R: Reports: technical, grey	W: Websites
C: Conference papers	M: Maps	r: Reports – open-file	
D: Digital data and software	N: News items	S: Standards / specifications	

Table 2: Record Counts by Publication Year* (Informit 27/02/06)

Year	ENGINE	AMI	ANR-I	ANSTI	ATRI
Other; prior	18 860	44 364	89 866	15 939	79 659
1992	486	3 868	6 105	989	8 029
1993	3 256	4 196	5 952	868	7 104
1994	2 075	5 049	5 904	198	6 552
1995	1 206	5 156	4 855	1 341	5 373
1996	1 777	4 585	4 905	984	5 188
1997	545	5 441	5 636	467	4 682
1998	998	5 004	5 723	536	4 916
1999	1 630	4 404	5 512	943	4 145
2000	1 433	4 104	4 826	1 995	5 253
2001	1 057	4 943	3 694	1 160	4 465
2002	712	6 288	1 826	1 698	4 188
2003	762	5 454	3 001	1 790	4 110
2004	526	5 623	2 302	448	4 321
2005	137	4 689	472	1	2 182
2006	-	20	-	-	36
Total	35 460	113 188	150 579	30 557	150 203

* *ANR-I* figures are for combined current and archive databases

The CSIRO's AUSTRALIS was initiated in 1987 to enable consumer access to scientific databases reticulated through its telecommunications network CSIRONET and via the telephone service. Databases were moved from it when Informit went online in 1998. Retrieval software was also IBM STAIRS. The NLA's OZLINE ran from 1987 to 1998 with both a STAIRS and alternative SOFI public user interface. For a time *AESIS* was also available on the Computerised Legal Information retrieval (CLIRS) platform operated by Computer Power, using Status software. It formed an element of the Australian Resources Industry Database concept.

Coverage and Source Documents

Summary of subject content of each of the databases is given within their respective Informit help facilities. An indication of the types of documents that are scanned is provided within Table 1.

For *AMI*, a selection policy has been articulated for items in those documents that are considered. From this policy, the guidelines are to:

- include all original items regardless of form or length or publication date; editorials and letters if they are substantial; reprints of earlier items are indexed if they have not already been reported in *AMI* or the Australian Public Affairs Information Service (*APAIS*); and biographies and obituaries if there is a discussion or description of the person's work or contribution to medicine, and
- exclude items outside the stated subject categories; editorials that 'editorialise'; book reviews; summaries of previously published material or about a conference; and reprints of items that have already been reported in *AMI* or *APAIS*.[37]

One result of this policy is that, unlike Medline, some conferences that are published only as collections of abstracts are included, not for the individual abstracts but for the conference as a whole. As indicated by an NLA employee,

> the other big departure… from Medline practice was that we decided to index a lot of conference proceedings, including conference abstracts where that was all that was available… Medline has never done… abstracts where that was the only output from a conference… But we did, though not comprehensively, because there are just so many of them…[38]

Two of the services work with publicly available detailed guidance documents. *ANSTI* has a detailed subject guide that describes the scope of material that is put into the International Nuclear Information System. *AANRO* has the benefit of a detailed content policy document.[39] This is exemplary in that it provides guidelines for inclusion of material with reference to form (differentiated by item and collective level) and authority of information resources; audience, and audience priorities; geographic coverage inclusions and exclusions; appropriate websites for gateway access; as well as itemised content categories, also prioritised. The policy also itemises periodical coverage for Australia and overseas periodicals that are scanned for Australian content.

Table 3 shows an example of distribution by document type, in this case for the *ATRI* database on Informit.

Table 3
ATRI Document Types (from Informit, 20/3/06)

Document type	Records
Article (journal)	39 927

Audiovisual	134
Book	820
Chapter (book)	52
Conference paper	34 499
Journal	1 416
Conference proceedings	3 497
Research report	15 697
Standard	1 497
Statistics	514

Record Format

Most of the records in databases use a format like that shown for *ENGINE* in Figure 1, which contains typical bibliographical metadata based upon description of title, authorship, affiliation, publication dates, indexing (based upon a controlled vocabulary), additional indexing in the form of identifiers, and an abstract. However, they also include specific data elements that may enhance access based upon the discipline.

ATRI records provide for:

- a geographic location element (GL), not controlled in an authority file, e.g. the Asia-Pacific region appears as Asia Pacific, Asia-Pacific and Asia-Pacific region
- bibliographic level (BL), which indicates principally whether entire documents, parts of documents or ongoing series are being described
- records source (RSO) to indicate the organisation (in coded form) that has contributed the metadata
- an indicator for URIs (URII) to show if a link is provided to websites or documents: if the indicator is Yes, there is not necessarily a direct link to a document but to a website from which documents are available, and
- the library location (LL) field lists the participating libraries that hold the serial under their National Union Catalogue (NUC) codes, and the Holdings (HS) field indicates the extent of the physical copies.

Figure 1
ENGINE Record (adapted from Informit, 19/01/06)

TI:	Computer systems for asset and risk management
AU:	ROBINSON, R; ANDERSON, K
AUF:	Viner-Robinson-Jarman-Pty-Ltd
SO:	Sixth National Local Government Engineering Conference: effective management of assets and environment: Hobart 25-30 August 1991: preprints of papers. p106-110
DT:	Conference Paper
IM:	Barton: IEAust, 1991
PY:	1991

PDS:	5p ill 7 refs
SE:	National Conference Publication (IEAust) no. 91/14
SMJ:	MANAGEMENT computer applications; RISK STUDIES computer applications
SMI:	MUNICIPAL ENGINEERING project management; HEALTH HAZARDS management; ACCIDENT PREVENTION management; ACCIDENTS computer aided analysis; RISK STUDIES assessment; COMPUTERS, PERSONAL applications
ID:	OCCUPATIONAL HEALTH AND SAFETY ; GEOGRAPHIC INFORMATION SYSTEM ; HAZARD REGISTER ; FAULT AND EVENT TREES ; ENERGY DAMAGE MODELS ; PRE EVENT RISK MANAGEMENT ; POST EVENT RISK MANAGEMENT ; FOURTH GENERATION INTERACTIVE PROGRAMMABLE SOFTWARE ; FACILITIES MANAGEMENT ; HAZARD MANAGEMENT
ABI:	Yes
AB:	This paper covers the use of expert systems for both risk assessment and asset management. In addition to technical considerations and user interface design matters, the paper addresses the practical aspects of implementing an effective, personal computer based risk, asset and space management system. It discusses the implementation of a number of such systems in different organisations and emphasise that whilst asset and space management systems are perhaps desirable in today's economic climate it is the need to satisfy risk related statutory and regulatory demands that seems to be the primary impetus.
DN:	911500

AANRO records provide for:

- the name of sponsor (NOS) field, which may also contain information about contract, grant, and/or project numbers when the described item is the result of a funded project; searchable by individual keywords
- the geographic location (GL) field, to produce keyword and phrase indexes for Australian place names, agro-ecological regions and drainage divisions
- the subject headings (SU) field, which is based upon the *CAB Thesaurus* and classification codes known as CABICODES; searchable by either keyword or phrase indexes, and
- the author (AU) field includes author affiliations, which also searchable, although keyword searching using Boolean uniterms is advisable because the affiliations are not based upon an authority file.

AMI records provide for:

- the abstracts (AB) that utilise those existing in the original documents or are created by indexers if not provided by authors or editors; codes used are for institutions rather than individuals
- transliterated titles (TT)

- the full-text indicator (FTI) and associated link (FT) via URI to the *Meditext* file of full-text material available through Informit
- the author address (AD), which was included in *AMI* before it became available in the Medline files, and
- publication type (PT), in which a limited set of terms (such as biography, cases, reviews) is used to provide information about form of content.

ENGINE records provide for:

- author affiliation fields (AUF) that may be searched by keyword or phrase if trying to identify particular institutions
- name of sponsor (NOF) that includes contract, grant, or sponsoring agency names and numbers related to funded projects; keyword- but not phrase-searchable
- subject headings that are aggregated (SUA) but also differentiated as major (SMJ) and minor (SMI), which provides for search refinement; they are based upon thesaurus terms and may have subheadings appended as shown in Figure 1, and
- the identifier (ID) field that contains additional terms that are important but not in the controlled vocabulary.

ANSTI records provide for:

- the NT field, which includes reference to a URL for full text of the article when it is freely available
- the CA field for corporate authors, based upon an authority file of corporate author names and corresponding codes, so that there is standardisation of affiliations in the database
- the C1 and SCC fields, which contain codes from an authority list that represent the broad subject categories of the document, and
- the descriptors used for indexing are drawn from the INIS thesaurus and have the label SU; the thesaurus is used to assign additional SUP terms that are hierarchically broader in an automatic process known as up-posting.

Although *AusGeoref* records have been able to retain many of the former *AESIS* record data elements, some specialist elements such as the basin field (BS) for geological basins and the map reference fields (M100, M250) are now subsumed within index terms and therefore are not independently searchable.

Table 4
Informit Elements for ATRI and ANSTI (28/02/06)

Label	Field Name	Database
AB	Abstract	Both

ABI	Abstract Indicator	Both
ABL	Abstract Language	ATRI
AC	Australian Coverage	ATRI
BL	Bibliographic Level	ATRI
C1	Subject (Primary Category Code)	ANSTI
CA	Corporate Author	Both
CA	Corporate Author	ANSTI
CN	Name of Conference	ATRI
CPF	Publication Frequency	ATRI
DN	Document Number	ATRI
DT	Document Type	ATRI
DT	Document Type	ANSTI
GL	Geographic Location	ATRI
HS	Holdings Statement	ATRI
IB	ISBN	Both
ID	Identifier	ATRI
IRF	Issue	Both
IS	ISSN	Both
JT	Journal Title	Both
LA	Language	Both
LL	Library Location	ATRI
NT	Notes	Both
PA	Personal Author	Both
PD	Date of Publication	Both
PG	Pagination	Both
PP	Place of Publication	ATRI
PU	Name of Publisher	ATRI
PY	Publication Year	Both
RPN	Report/Patent Number	ANSTI
RSO	Record Source	Both
SE	Series	Both
SO	Source	Both
SCC	Subject (Category Code)	ANSTI
SU	Subject	Both
SS	Search Subjects	ANSTI
SUC	Subject (Category)	ANSTI
SUP	Subject (Proposed)	ANSTI
TI	Title	Both
URI	Uniform Resource Identifier	ATRI
URII	URI Indicator	ATRI
VRF	Volume	Both

Informit makes efforts to standardise data elements. However, there remain significant differences between databases that have arisen from a combination of legacy systems, requirements for interfacing with other databases, and special inclusions. Table 4 compares data elements for *ATRI* and *ANSTI*.

Search Aids

The online versions of the databases are each accompanied by help facilities that provide descriptions of searchable and displayable fields, along with suggestions for use of research protocols. Each of the databases makes use of at least one controlled vocabulary for describing subject content. These vocabularies, which in some cases have varied over time, are listed in Table 1. The thesaurus used for indexing references to the *AESIS* prior to it becoming *AusGeoref* was locally produced by the Australian Mineral Foundation (AMF) and went through several editions, firstly as the *Australian Thesaurus of Earth Sciences and Related Terms*, before becoming the *Australian Geoscience, Minerals and Petroleum Thesaurus*. This hard copy and digital thesaurus was a product of the AMF created independently of the *AESIS* process but readily usable for indexing the database.

Maintenance of Services

Since the 1970s a variety of approaches has been adopted for building databases that support STI services. The CSIRO was initially prominent in this respect. The organisation had been creating bibliographies before the advent of computing. Being at the forefront of early computing science development and also of publishing scientific journals, it also moved into computer-supported publication and database creation and development of information retrieval software. This included servicing online provision of both reference and source databases either of its own creation (such as *ASI*, *ABOA*), or produced by others in specialised areas such as *REEF*.

However, even though the CSIRO provided the AUSTRALIS platform for a decade in the 1980s and 1990s, it has continued to support content creation through periodicals and has supported creation of abstracting and indexing services, it was not predisposed to commit fully to the national service that its legislation supported. A former CSIRO employee comments:

> and life became progressively more difficult in terms of funding, staffing and all the rest of it. But, even at that time the CSIRO Board was taking fright at the implications providing a national, a truly national service rather than a service turned only towards CSIRO's own scientists.[40]

For a time the NLA made an attempt to focus on STI through ANSTEL, which took under its umbrella the national Medline service that had already been running in conjunction with the Department of Health. This service was

complemented later by *AMI* and *Meditext*, which provides full text associated with metadata.

Neither the STISEC reports nor the ALBIS proposal were particularly concerned with private sector support for information service development. However, it was clear that an information industry was developing during the 1980s. For example, Klingender canvassed ways in which public information should be delivered over a private network (AUSINET), while justifying the unpopular decision to drop certain low-use databases from the network.[41] He was looking for more certainty to enable the private sector to generate the profits to make service viable, such as a government commitment not to establish similar networks, fixed term exclusive contracts, and release from obligation to mount databases. At the same time he lamented the slow response received to requests for information on policy when his company needed to make large capital investments in computing, not knowing about the continuing support for the services for which they provided a platform.

On the same subject Judge, reviewing public/private sector interaction,[42] noted that Australia needed inexpensive communication for access to local and overseas databases, appropriate local input to overseas databases, and locally produced databases providing comprehensive deeper coverage required for Australian purposes, all allied with a strong library and document delivery system. He concluded that a public-private distinction might be blurred by cooperation by an envisaged 'third sector' that might take the form of a public non-governmental establishment, a government established company, or a combination (like AUSINET) to which both sectors would contribute.

Coxon was pessimistic about development of online services,[43] gloomily indicating a trend away from library-based public services to more commercially oriented approaches. At the time he was writing CSIRONET had been established on a cost recovery basis with the AUSTRALIS service being developed, ACI had assumed proprietor status for AUSINET after it was found that 'an independent user community hadn't emerged to fulfil a management role', and fees (though less than cost recovery) had been introduced for Medline after pressure to charge the money-making medical community.

From an STI bibliographic database point of view at least, the private sector has not seen value in maintaining such services. The AMF was unable to sustain *AESIS*, and its successor is now supported by a government entity. *ANSTI* and *AMI* have always been public sector, though in the case of *AMI* there is contracted private sector indexing. *AANRO* is public sector-financed but produced contractually privately. *ENGINE* is produced by a not-for-profit association that has restrained itself in recent times to coverage of its own publications. ARRB, although it obtains private sector funding for research work, has its information services infrastructure – and thereby *ATRI* production – financed by state and federal government authorities.

Looking to the future, Drynan concluded that production of local databases was unlikely to provide financial bonus but that it could be fostered by constant marketing, verbal support and a 'buy Australian' approach.[44]

The CSIRO's role in supporting secondary services has decreased over time, as has its proportion of Australian scientific publication,[45] but it seems that it could have a significant role to play at least in terms of stimulation, coordination and enhancement of production of databases.

Discussion

Although search engines and aggregated databases have the ability to bring together material reported and stored in different repositories, dispersion can be avoided by the value-adding process of bringing together material at one source with common metadata. This supports the identification of content produced nationally. It also better facilitates monitoring of productivity. Procedures whereby national input is provided to international services and then combined with locally produced international publication 'backfilled' from the international services into consolidated local databases provide the most effective approach for doing this. This would also leave Australian researchers less subject to the vagaries of international services.

There has been a plethora of metadata schemas developed in recent years to support various types of information services. Despite attempts to consolidate some of these in fairly compatible formats, the standardisation to the extent that it comes is often developed by vendors in order to present a singular view of databases available on platforms. Such is the case with Informit, which produces a reasonably coherent view across databases, including those of STI. Nevertheless Australian STI services could benefit from a shared approach to producing metadata, which would itself enable sharing of records between services.

Citation metadata is notably absent from Australian STI databases. Although ISI has long monopolised the provision of such data, there is a growing number of alternatives in specialised areas and to deal with Web citation.[46] The cost of creating citation metadata can be reduced if the software used for producing bibliographies in papers can in turn be used to provide the citation metadata for consolidated databases – not just the reverse process, as happens now when searchers download references into bibliographic referencing software.

Utilisation of locally produced citation data would enable greater awareness of the impact of Australian material, particularly in Australian publication not encompassed by ISI's indexes, which are the present source of indication of scientific research performance. The proportion of material not covered by ISI varies from discipline to discipline but is particularly low in engineering and the computing sciences where journal publication takes a back seat to conference publication.

Policy makers have found it beneficial to require, through copyright legislation, the capture of the nation's book publication output and report it through a national bibliography, and this legislation is soon to be reviewed with reference to digital material. Capture of the nation's scholarly output would seem to be similarly justifiable, and a mechanism for coverage of research literature would be welcome.

There were concerted efforts to develop STI services in Australia during the 1960s and 1970s. However, although these efforts led to greater awareness of the issues, national development lacked a strategy which stakeholders could follow to avoid gaps in service and duplication. The situation was exacerbated by funding constraints. Nevertheless, a rapidly developing computing and communications environment, coupled with the efforts of some visionaries working independently in different agencies, saw to it that the country was comparatively well-serviced using a combination of international and local services. This situation is threatened unless there is renewed commitment to resourcing, quality control and development for new user requirements.

Conclusion

This paper has attempted to set the scene for Part II, which looks at the STI services in the context of discipline formation. This first part has provided an overview of the database characteristics along with the context in which they have been developed. The overview has been used to introduce some remarks relating to viability, continued production and further development of the databases

Acknowledgements

This document draws upon a number of case studies to which many people contributed through formal interview or responses to queries. Particular thanks are due to Bev Allen (Geoscience Australia), Lynne Beaumont (ARRB Group), Rob Birtles (CSIRO), Warwick Cathro (NLA), Barry Cheney (VPL), Brenda Gerrie (Infoscan), Lea Giles-Peters (SLQ), Sandra Gorringe (ANSTO), Hans Groenewegen, Sara Hearn (Informit), Sandra Henderson (NLA), Mary Huxlin (ANSTO), Peter Judge, Max Lay, Alison Martin (ARRB Group), Ian McCallum (Libraries Alive!), Russell McCaskie (CSIRO), Sherrey Quinn (Libraries Alive!), Rosa Serratore (ARRB Group), John Shortridge (VBM), Des Tellis, Elena Vvedenskaia (EA), Rolfe Westwood (CSIRO) and Janette Wright (Informit).

Thanks are also due to Christine Bruce and Guy Gable of QUT for comments on work in progress, and to anonymous referees for constructive criticism on structure and content.

Notes

1 T D Wilson 'Information Management' J Feather & R P Sturges (eds) *International Encyclopedia of Information and Library Science* 2nd ed Routledge London 2003 pp263-267

2 E Orna *Practical Information Policies* 2nd ed Gower Aldershot 1999 – this includes evaluations but not with respect to disciplinary principles; S Simmons (ed) *Information*

Insights: Case Studies in Information Management Aslib/IMI London 1999 – comprising interviews with information managers

3 M Middleton 'Scientific and Technological Information Services in Australia II. Discipline Formation in Information Management' *Australian Academic and Research Libraries*, forthcoming

4 H Russell & S L Hartwell (eds) *Guide to Australian Agricultural Information Sources and Services* rev ed Victorian Department of Agriculture Melbourne 1983

5 R K Yin *Case Study Research: Design and Methods* Sage Publications Thousand Oaks 2003

6 M Middleton *Information Management: A Consolidation of Operations, Analysis and Strategy* CSU Centre for Information Studies Wagga Wagga 2002

7 D Abbott 'Australian Indexing Services' D H Borchardt and J Thawley (eds) *Bibliographical Services to the Nation: The Next Decade* proceedings of a conference held in Sydney 26-27 August 1980 NLA Canberra 1981 pp71-86

8 A Byrne 'How to lose a Nation's Literature: Database Coverage of Australian Research' *Database* vol 6 no 3 1983 pp10-17

9 A Byrne 'Overseas Database Coverage of Australian Engineering' L Lane (ed) *Engineering Information and Documentation in Australia: Problems and Solutions* proceedings of a national seminar conducted by the Footscray Institute of Technology 25 November 1983 Footscray Institute of Technology Library Footscray 1984 pp53-62

10 P Royle 'A Citation Analysis of Australian Science and Social Science Journals' *Australian Academic and Research Libraries* vol 25 no 3 1994 pp162-171

11 P Royle & R Over 'The Use of Bibliometric Indicators to measure the Research Productivity of Australian Academics' *Australian Academic and Research Libraries* vol 25 no 2 1994 pp77-88

12 P Bourke & L Butler 'Mapping Australia's Basic Research in the Medical and Health Sciences' *Medical Journal of Australia* vol 167 no11-12 1997 pp610-613

13 P Bourke & L Butler *A Crisis for Australian Science* Performance indicators project monograph series no 1 Australian National University Canberra 1993

14 Based upon fractional counts of authors for collaborative publication by L Butler 'What is behind Australia's Increased Share of ISI Publications?' M Davis & C S Wilson (eds) *8th International Conference on Scientometrics and Informetrics: Proceedings ISSI-2001 Sydney 16-20 July 2001* Sydney UNSW Bibliometric and Informetric Research Group Sydney 2001 pp89-101

15 L Butler *Monitoring Australia's Scientific Research: Partial Indicators of Australia's Research Performance* Australian Academy of Science Canberra 2001

16 M Middleton 'Drops in the Ocean: The Development of Scientific and Technological Information Services in Australia' W B Rayward & M E Bowden (eds) *The History and Heritage of Scientific and Technological Information Systems* Information Today for ASIST & CHF Medford 2004 pp353-360, at http://eprints.qut.edu.au/archive/00000689/ & http://www.chemheritage.org/events/asist2002/proceedings.html

17 Scientific and Technological Information Services Enquiry Committee *The STISEC Report: Report to the Council of the National Library of Australia by the Scientific and Technological Information Services Enquiry Committee, May 1973. Volume 1: Scientific and Technological Information Services in Australia NLA Canberra 1973; Volume 2: Procedures, Evidence examined, Findings and Appendixes* NLA Canberra 1975

18 National Library of Australia *Progress in UNISIST Activity: The First Three Years of the UNISIST Programme in Australia 1974-77* NLA Canberra 1978 pp13

19 A Horton 'Groping toward Information Policy' H Bryan &J Horacek (eds) *Australian Academic Libraries in the Seventies: Essays in Honour of Dietrich Borchardt* University of Queensland Press St Lucia 1984 pp5-32

20 C Garrow 'Keynote Address: The Information Imperative and Australian Agriculture' P Montgomery (ed) *Computerised Information Systems in Agriculture; Proceedings of a National Workshop on Developments in Computerised Information Systems in Agriculture, Melbourne, Victoria, June 22 and 23, 1983* Victorian Department of Agriculture, Melbourne 1983 pp4-12

21 Independent Inquiry into the Commonwealth Scientific and Industrial Research Organisation *Report* AGPS Canberra 1977

22 National Library of Australia *Towards an Australian Industry Information Network* NLA Canberra 1977

23 'National Library has Clear Run says Head' *Australian Financial Review* 3684 2 July 1975 p15

24 M Middleton 'Developments in the Australasian MEDLARS Service' *LASIE Bulletin* vol 7 no 5 1977 pp4-15

25 D Killen 'The National Library's ERIC SDI Service: The First Fifteen Months' *Australian Academic and Research Libraries* vol 7 no 2 1976 pp93-99

26 Australian Science and Technology Council *Science and Technology in Australia, 1977-78: A Report to the Prime Minister* AGPS Canberra 1978-1979 vol 1 pp11-12

27 Australian Department of Science *A National Information Policy for Australia: Discussion Paper* Dept of Science Canberra 1985

28 *Scientific and Technological Information; Proceedings of a Workshop Canberra 20 March 1986* Department of Science Canberra 1986.

29 E Swan 'Australian Clearing Houses and Data Bases: Towards a National Policy' G Peguero (ed) *Australian Clearing Houses and Data Bases: Towards a National Policy* Proceedings of a National Seminar conducted at Footscray Institute of Technology 19 November 1982 Footscray Institute of Technology Library Footscray 1983 pp139-148

30 B Yates 'The Possible Role of the National Library of Australia in the Development of Clearing Houses and Associated Data Bases' G Peguero 1983 *op cit* pp21-33

31 S Quinn (ed) *Directory of Australian and New Zealand Databases* 3rd ed Australian Database Development Association Hawthorn 1988

32 The Defence Information Services Technical Information System, used to index *Australian Defence Index*, *Current Defence Readings* and *Defence Reports*

33 *Informit – Online Australasian Information*, at http://www.informit.com.au/index.asp [accessed 2 February 2006]

34 M Middleton 'Discipline Formation in Information Management: Case Study of Scientific and Technological Information Services' *Journal of Issues in Informing Science and Information Technology* vol 2 2005 pp543-558, at http://2005papers.iisit.org/I45f78Midd.pdf; or http://eprints.qut.edu.au/archive/00001433/

35 E Drynan 'A Review of Australian Online Indexes' *Online Currents* vol 20 no 10 2005 pp17-22

36 American Geological Institute *AusGeoRef* 2003, at http://www.agiweb.org/georef/ausgeoref/index.html [accessed 14 December 2005]

37 National Library of Australia *Introduction to Australasian Medical Index* 2002, at http://www.nla.gov.au/ami/ [accessed 10 January 2005].
38 S Henderson personal communication 24 June 2004
39 *INIS Subject Categories and Scope Descriptions* 8th rev IAEA Vienna 1997; S Quinn *AANRO, Australian Agriculture and Natural Resources Online: Content Policy* 2004, at http://www.aanro.net/document/policy.pdf [accessed 18 January 2006]
40 Peter Judge personal communication 23 June 2004
41 T Klingender 'National Information Policy: The Role of the Information Industry' *Papers presented at the National Information Policy Seminar 7-8 December 1981* LAA Canberra 1981 pp26-30
42 P Judge 'Public Sector/Private Sector Interaction in Australian Information Policy' B J Cheney (ed) *VALA Second National Conference on Library Automation: Information Management 28th November – 1st December 1983 University of Melbourne* VALA Melbourne vol 1 pp56-82
43 H Coxon 'Online Information Services in Australia' B Katz & R Fraley (eds) *International Aspects of Reference and Information Services* Haworth Binghampton 1987 pp143-153
44 E Drynan 2005 *op cit*
45 L Butler 2001 *op cit* p27
46 D L Roth 'The Emergence of Competitors to the Science Citation Index and the Web of Science' *Current Science* vol 89 no 9 2005 pp1531-1536, at http://www.iisc.ernet.in/currsci/ nov102005/1531.pdf [accessed 19 March 2006]