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‘TRACKING GREY LITERATURE ACROSS DISCIPLINES’

GreyNet

The Grey Journal

An International Journal on Grey Literature

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About TGJ

The Grey Journal is a flagship journal for the international grey literature community. It crosses continents, disciplines, and sectors both public and private.

The Grey Journal not only deals with the topic of grey literature but is itself a document type classified as grey literature. It is akin to other grey serial publications, such as conference proceedings, reports, working papers, etc.



The Grey Journal is geared to Colleges and Schools of Library and Information Studies, as well as, information professionals, who produce, publish, process, manage, disseminate, and use grey literature e.g. researchers, editors, librarians, documentalists, archivists, journalists, intermediaries, etc.

About GreyNet

The Grey Literature Network Services was established in order to facilitate dialog, research, and communication between persons and organizations in the field of grey literature. GreyNet further seeks to identify and distribute information on and about grey literature in networked environments. Its main activities include the International Conference Series on Grey Literature, the creation and maintenance of web-based resources, a moderated Listserv, and The Grey Journal. GreyNet is also engaged in the development of distance learning courses for graduate and post-graduate students, as well as workshops and seminars for practitioners.

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Editor's Note

GreyGuide Project

The GreyGuide, Guide to Good Practice in Grey Literature, is a community driven open resource project. The goal of this project is to develop an open source repository of good practices in the field of grey literature. That which originated in monographic form¹ will now open and expand to include content from the global grey literature community. Such practices will range from the production and processing of grey literature through to its distribution, uses, and preservation. The repository will contain guidelines such as those in handling theses and dissertations, how to write research reports, metadata required for working papers as well as good practices in the subject areas of agriculture, health, education, energy, environment, et cetera. The purpose of an online repository of good practice in grey literature will provide the many stakeholders in government, academics, business and industry with the benefits of experience, sustained management, and proven results.

The procedure initially applied in this project deals with the design and development of a template that will capture data and information about published as well as proposed good practices within a standard format. While the metadata captured in the template are indeed standardized, their accompanying full-text documents need not be. Furthermore, the template seeks to identify intended users of a good practice, as well as metadata that will facilitate the search and retrieval of records in the repository.

Technical developments related to the design and construction of the repository, its eventual platform as well as its maintenance are other related issues addressed in the project. It is expected that the initial phase in acquiring records for the repository will rely on channels available through the Grey Literature Network Service. The GreyGuide will provide a unique resource in the field of grey literature that is long awaited and which responds to the information needs of a diverse, international grey literature community.

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¹ Farace, D. and J. Schöpfel (eds.), *Grey Literature in Library and Information Studies*. – Berlin : Walter de Gruyter | Saur, 2010 – 282 pp. – ISBN 978-3-598-11793-0

Tracking the Influence of Grey Literature in Public Policy Contexts: The Necessity and Benefits of Interdisciplinary Researchⁱ

Bertrum H. MacDonald, Elizabeth M. De Santo,
Kevin Quigley, Suzuette S. Soomai, and Peter G. Wells (Canada)

Abstract

Scientific information (much of it published as grey literature) can play a pivotal role in the search for solutions to serious global environmental problems. This fact is receiving growing attention by a diversity of researchers. How information functions within the interface between science and policy is only weakly understood, in part because most studies have been conducted through single disciplinary lenses. Moreover, determining the life cycles of scientific information and developing an understanding of the use and influence of this information are not trivial tasks. We believe that an appreciable increase in understanding can be achieved through an interdisciplinary perspective and a comparative approach employing a suite of research methodologies to document information pathways. In our research particularly (see www.eiui.ca), we contend that interdisciplinary research, drawing on "information science and management," "marine environmental science," "marine policy development," "fisheries science and management," and "public policy," can substantially increase understanding of the processes by which scientific information is incorporated into environmental policy decisions. This innovative, evolving interdisciplinary perspective enables addressing the question "what role and influence does grey literature have in marine environmental policy and decision-making processes" in an informative, holistic manner, which may be otherwise unfeasible. This paper shows that multidimensional thinking and analysis stimulated by an interdisciplinary perspective is essential for further understanding of the role of information at the science-policy interface in marine disciplines.

Introduction

In 2008, in his book entitled *Environmental Reform in the Information Age: The Contours of Informational Governance*, Arthur P. J. Mol, professor of environmental policy at Wageningen University in the Netherlands, stated forthrightly that "it is the production, the processing, the use and the flow of, as well as the access to and the control over, information that is increasingly becoming vital in environmental governance practices....and the motivations and sources for changing unsustainable behaviour are increasingly informational" (Mol, 2008). Environmental degradation has been recognized for decades as a serious global problem. September 2012, for example, marked the fiftieth anniversary of Rachel Carson's iconic *Silent Spring* (Carson, 1962), one of the most influential books of the twentieth century (McKie, 2012). Earlier in 2012, the United Nations Conference on Sustainable Development (the "Rio+20" conference) held in Rio de Janeiro, Brazil, forcefully highlighted the level of international commitment needed to halt environmental breakdown.

In the lead-up to the Rio+20 meeting, the Planet Under Pressure conference, held in London, England on 26-29 March 2012, stressed the severity of the matter:

Research now demonstrates that the continued functioning of the Earth system as it has supported the well-being of human civilization in recent centuries is at risk. Without urgent action, we could face threats to water, food, biodiversity and other critical resources: these threats risk intensifying economic, ecological and social crises, creating the potential for a humanitarian emergency on a global scale. (Planet Under Pressure, 2012, p. 1)

Alarmist as this statement may seem, the London conference, attended by nearly 3,000 leading experts and decision-makers, sought a way forward while recognizing that new solutions would inevitably be required. The *State of the Planet Declaration*, approved at the conference, boldly proclaimed:

The challenges facing a planet under pressure demand a new approach to research that is more integrative, international and solutions-oriented. We need to link high-quality focused scientific research to new policy-relevant interdisciplinary efforts for global sustainability. This research must integrate across existing research programmes and disciplines, across all domains of research as well as local knowledge systems, across the North and South, and must be co-designed and implemented with input from governments, civil society, research funders, and the private sector. (Planet Under Pressure, 2012, p. 3)

ⁱ First published in the GL14 Conference Proceedings, February 2013.

Vast quantities of relevant scientific information have been generated, many solutions have been proposed, and some implemented in recent decades to address environmental problems. However, solutions can be slow in coming, limited in scope, or may even be thwarted by competing, sometimes opposing and fragmented views and an overemphasis on uncertainty rather than a need for precaution. Vociferous debate over the reality and effects of global climate change is one example, although increased understanding and acceptance are winning out.

Delay in pursuit of solutions is no longer a tolerable strategy even though the hurdles are challenging. A new approach that links “high quality focused scientific research to new policy-relevant interdisciplinary efforts” may, in fact, achieve desirable results. Interdisciplinary collaboration and research, which encompass *all* relevant disciplines, is needed. *The State of the Planet Declaration* noted, “The Earth system is a complex, interconnected system that includes the global economy and society, which are themselves highly **interconnected and interdependent**” (Planet Under Pressure, 2012, p. 2, emphasis in original); such a system requires a holistic approach to research and understanding.

Interdisciplinary effort is already witnessed in global initiatives such as the Intergovernmental Panel on Climate Change (IPCC). Founded in 1988 by the World Meteorological Organization and the United Nations Environment Programme and later endorsed by the General Assembly of the United Nations, the IPCC produces comprehensive scientific assessments of current scientific, technical, and socio-economic information related to the risk of climate change (Bolin, 2007). The IPCC also played an instrumental role in the creation of the United Nations Framework Convention on Climate Change (UNFCCC), the main international treaty on the causes and consequences of climate change. Drawing on the assistance of thousands of scientists and other experts, and obtaining the consensus of the more than 120 country signatories, the IPCC has produced four major climate assessment reports with the fifth planned for publication at the end of 2014 (IPCC, 2012a). These intergovernmental, grey literature reports are the result of the review of a massive number of both primary and grey research literature publications. In addition to these periodic assessments, the IPCC also publishes special reports on subjects related to the implementation of the UN Framework Convention on Climate Change, the most recent of which is an almost 1,100 page report on *Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2012b) released in advance of the Conference of the Parties held in Doha, Qatar in December 2012. During the preparation of this report, over 24,000 (24,766) comments were received as the text was being reviewed and finalized. This number alone highlights the extent of the effort to produce authoritative environmental assessment reports. Even though some aspects of the IPCC’s work was controversial for a time, including its use of some grey literature to support some conclusions (see, Meyers & Petersen, 2010; Ravindranath, 2010), this impressive international initiative highlights the immense value and influence of interdisciplinarity in a key environmental field (Björström & Polk, 2011a; 2011b).

Commitment to an interdisciplinary perspective, however, does not guarantee that all relevant disciplines have been brought to bear in the search for understanding and solutions. Information science (information studies, information management, informatics) is sometimes overlooked or is not at the table in some research initiatives. A case in point is the recent report of the Committee on the Use of Social Science Knowledge in Public Policy of the National Research Council in the United States, *Using Science as Evidence in Public Policy*, published by The National Academies Press (Prewitt, Schandt, & Straf, 2012). This report proposes “a framework for research on how policy makers make use of scientific knowledge and how the results of that research might lead to improved policy making and improved preparation of students in policy schools for careers in the policy world” (p. vii). The report makes no mention of the field of information behaviour, the knowledge and tools of which are surely important for developing an understanding of how people become aware of, use, and are influenced by information. The same argument can be made in the field of ocean management, hence our interest in this topic.

While an information studies perspective may be explicitly missing from some interdisciplinary undertakings, its absence may be more a matter of language or oversight than actual failure to recognize the contribution of this discipline. For example, the recent book, *Knowledge and Environmental Policy: Re-imagining the Boundaries of Science and Politics*, draws on research based in political science, and environmental and natural resource policy, and employs the term “knowledge” rather than “information” to convey research perspectives that govern information studies points of view (Ascher, Steelman, & Healy, 2010). An explanation of why some disciplines such as information science are overlooked or entirely missing from interdisciplinary research initiatives may be attributed to stereotypical misunderstanding of the potential contributions of such disciplines to such collaborations. Moreover, information specialists may overlook the benefits of working with researchers in other disciplines whose appreciation of the role of information (primary and/or grey literature) will

likely be quite different from their own. These challenges notwithstanding, all of us need to seize opportunities for interdisciplinary research along the lines of the urgent appeal of the 2012 *State of the Planet Declaration*.

Interdisciplinarity

Interdisciplinary thinking is not new and has increasingly characterized some areas of scientific research for the past half century or more (e.g., toxicology, oceanography, ecology, biomedical sciences, and environmental sciences). Some might argue that twenty-first century interest in interdisciplinarity is a return to the perspective of Renaissance or Victorian scholars (see, for example, Lightman, 2012). The difference is that today the vast and growing quantity of information and highly specialized techniques, methods and instrumentation, and knowledge have demanded specialization and left “most scholars and artists stranded in ever-shrinking islands of competence” (Nissani, 1997). Even though research funding bodies in North America and Europe have given greater prominence to interdisciplinary research and interdisciplinary programs and administrative units have been established within universities (e.g., the Canadian Mountain Studies Initiative at the University of Alberta - www.mountains.ualberta.ca/en/ThinkingMountains.aspx), interdisciplinarity generates no shortage of debate. Moreover, many individuals within and outside “the academy” find it difficult to work at the intersections of their disciplinary boundaries with other researchers and practitioners who operate with different but complementary disciplinary points of view. According to Luhmann (1993), a paradox exists in modern society. The more systems evolve and specialize, the more critical it is for communication and coordination between these systems. Yet, at the same time these systems become more self-referential and unable to communicate between themselves.

Some fields of inquiry are inherently interdisciplinary. Take for example, environmental toxicology. This field “takes and assimilates from a variety of disciplines” (Landis & Yu, 2004, p. 1), as Figure 1 illustrates. Terrestrial and aquatic ecologists, chemists, molecular biologists, geneticists, and mathematicians all contribute to the evaluation of impacts of chemicals on biological systems (Landis & Yu, 2004). As the authors note in their *Introduction to Environmental Toxicology*, “biometrics...provides the tools for data analysis and hypothesis testing. Mathematical and computer modeling enables the researcher to predict effects and to increase the rigor of a hypothesis. Evolutionary biology provides the data for establishing comparisons from species to species and describes the adaptation of species to environmental change” (pp. 1-2). Even though this field is decidedly multi- and interdisciplinary, some disciplines are notably absent in Figure 1. Chemical toxicity can trigger far reaching effects in human society with health, social, economic, and/or political implications (e.g., the use of Agent Orange in Vietnam in the 1960s). As a consequence, health and social science disciplines could quite easily be included in the sizeable suite of largely natural and physical science disciplines populating this diagram. Although this is only one example, it is likely that even established and highly interdisciplinary fields of research and practice can benefit from broadening and illustrating the scope of their disciplinary perspectives.

Figure 1. Environmental Toxicology and Some of Its Components



As researchers have pursued interdisciplinary work over recent decades, they have generated an extensive body of literature on the subject of interdisciplinarity and the flow of publications continues (e.g., Huutoniemi, Klein, Bruun, & Jukkinen, 2010). Since interdisciplinarity can be difficult to achieve in some contexts, interdisciplinary research or knowledge can be misunderstood or undervalued. This perspective emphasizes pitfalls to interdisciplinary study, and there are some; nonetheless, the potential and achievable benefits can be measurable (see Campbell, 2005; Elfner, et al., 2011; MacMynowski, 2007; Nuijten, 2011; Pickett, Burch, & Grove, 1999; Strang, 2009; Turner & Carpenter, 1999).

In the words of one scholar, “interdisciplinarity is best seen as bringing together distinctive components of two or more disciplines” (Nissani, 1997, p. 203). He states: “In academic discourse, interdisciplinarity typically applies to four realms: knowledge, research, education, and theory.”

Interdisciplinary knowledge involves familiarity with components of two or more disciplines. *Interdisciplinary research* combines components of two or more disciplines in the search or creation of new knowledge, operations, or artistic expression. *Interdisciplinary education* merges components of two or more disciplines in a single program of instruction. *Interdisciplinary theory* takes interdisciplinary knowledge, research, or education as its main objects of study. (Nissani, 1997, p. 203)

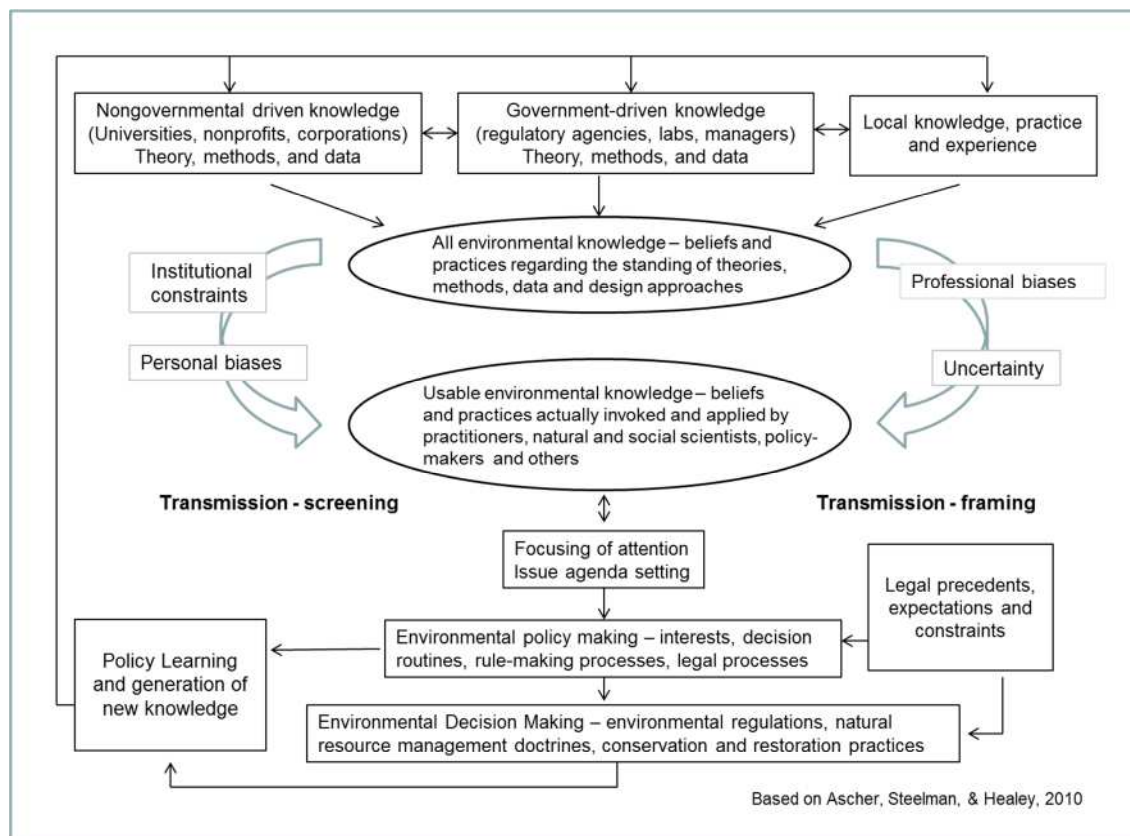
While we are interested in each of the four realms in this suite of options, we have chosen to collaborate and focus primarily on interdisciplinary research for the benefits that arise when considering the multiple dimensions of the information-communication-policy interface or, more simply, the science-policy interface. We recognize that interdisciplinary research will result in unique and hopefully important interdisciplinary knowledge. Our research also flows into our educational work, especially a new graduate course, “The Role of Information in Public Policy and Decision Making,” offered in 2013 at Dalhousie University.

The Challenge – Exploring the Science-Policy Interface

The necessity of interdisciplinary investigation becomes clear when the complexity of the science-policy interface is described. Tracking the movement and use of grey literature in this context poses challenges in framing research questions, determining what data to collect, deciding which methodologies or suite of methodologies must be developed or adopted, and gaining access and establishing the trust of numerous stakeholders to undertake research within the ambit of governmental organizations. All the while, there is appreciation that many dimensions of personality, culture, economics, politics, and social factors contribute to the processes of decision making and policy development. The magnitude and variation of these components outstrip the capacity of expert understanding of any single discipline. Quite simply, interdisciplinary is required.

Figure 2 attempts to capture many of these dimensions, beginning with knowledge generation through to policy formulation, decisions, and generation of new knowledge. This figure illustrates the complexity of the processes in which information is used (or not) in the activities within the science-policy interface. Two features should be noted. First, information comes from a variety of sources – non-governmental driven sources, governmental sources, and local knowledge. These interact in interesting and complex ways to contribute to environmental knowledge. Second, filters are typically applied to this body of environmental knowledge resulting in usable knowledge. Those filters may be institutional cultural factors or individual biases, or they may involve professional biases and the uncertainty around scientific measurements and observations. This knowledge is then filtered even further due to attention and focus of particular agendas. This information may inform policy making in a context that is influenced by legal precedents and other constraints. Ultimately, policy and decision making can stimulate new questions and new knowledge and a feedback loop will occur. This summation, which has simplified a complex amalgam of activities, shows that the scenarios encapsulated by the diagram are not trivial processes (Nutley, Walter, & Davies, 2010).

Figure 2. Generation, Transmission, and Use of Environmental Information

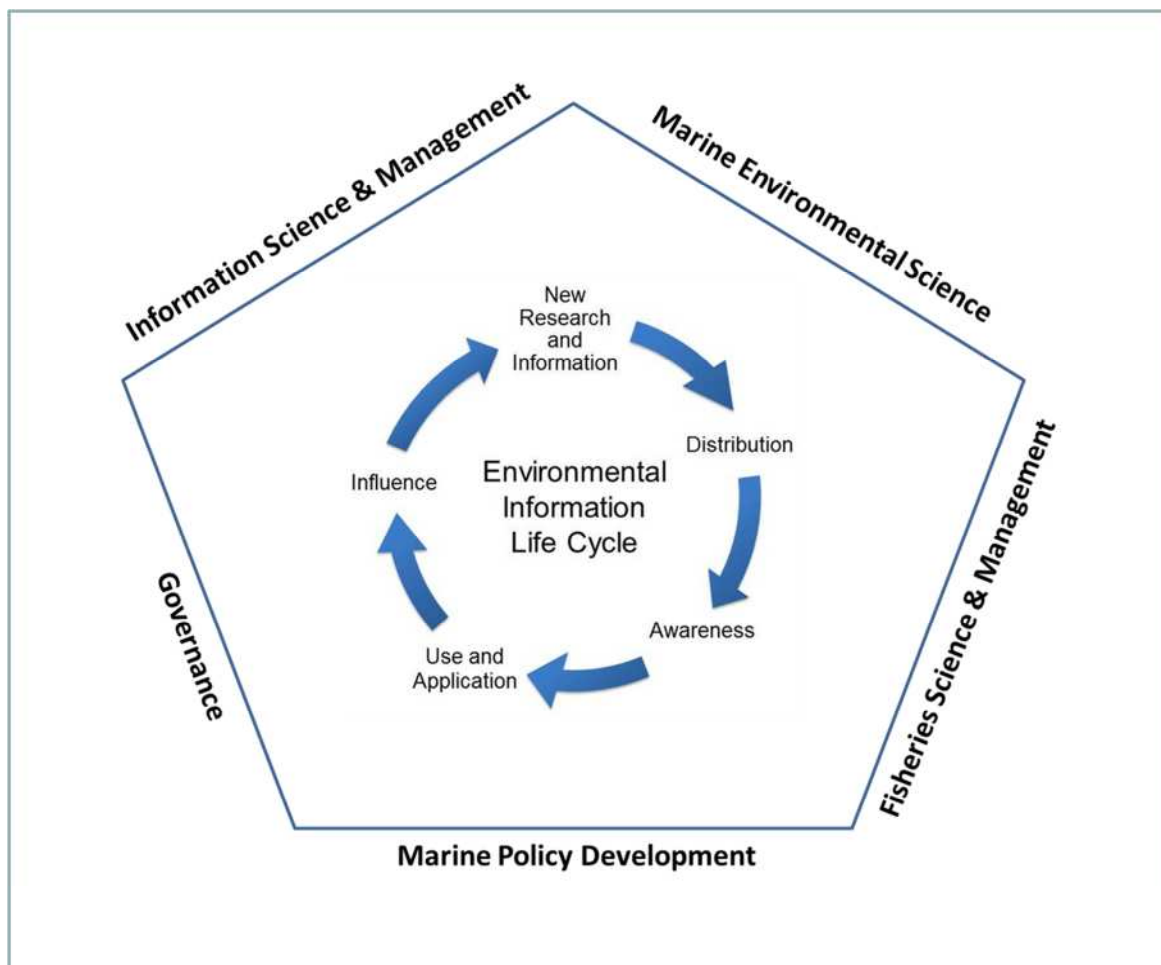


Environmental Information: Use and Influence (EIUI) Initiative as an Example of Interdisciplinary Research

In a paper entitled, "From research to policy and back," Aletha C. Huston stated that "policymakers are influenced by politics, ideology, interest groups, and the institutional rewards and pressures in governmental agencies. They sometimes appear indifferent to empirical evidence" (Huston, 2008, p.1). Some governments may ignore or discourage evidence-based policy making (Grisé, 2013). As a result, the "unpredictable and volatile world of ... policy has led some researchers to renounce efforts to inform it because they believe that decisions are entirely political and that data are invoked at best only to support a position that someone has already decided to endorse" (Huston, 2008, p. 1). Such pessimism, while understandable, may reflect understanding of the activities of the science-policy interface through a single disciplinary lens, an approach that is bound to falter in gaining a meaningful appreciation of both visible and underlying dynamics of decision making.

We are fortunate to be an interdisciplinary team that is opening new avenues of research on the use and influence of information published as grey literature in governmental and intergovernmental arenas. The composition of this team has been achieved in part because our multidisciplinary academic unit at Dalhousie University is staffed by faculty members of diverse disciplinary backgrounds, with interests in various aspects of management that demand and benefit from collaboration. Our team began with specialists in Information Management and Marine Environmental Science and expanded to include Governance and Public Administration, Marine Policy Development, and Fisheries Science and Management (Figure 3). More recently, additional expertise in Information Management, namely Social Network and Social Media Analysis, has been included and research students at the Master's and Doctoral levels complement the team. Individually, each of these disciplines tend to be outward looking, i.e., they draw on theories and methodologies from a variety of disciplines; this may contribute to a greater understanding of the life cycle of environmental and fisheries information in policy development and decision making contexts (e.g., MacDonald, Cordes, & Wells, 2007; Soomai, Wells, & MacDonald, 2011; Soomai, MacDonald, & Wells, 2013).

Figure 3. Environmental Information: Use and Influence Interdisciplinary Research (from www.eiui.ca)



Benefits of Interdisciplinary Research

In his 1997 paper, Moti Nissani suggested that the rewards of interdisciplinary knowledge and research fall into three overlapping categories: 1) growth of knowledge, 2) social benefits, and 3) personal rewards. Including the personal rewards, which are genuine and motivating, our EIUI research (see www.eiui.ca) has demonstrated the potential of substantial contributions to growth of knowledge with related social implications (Table 1). It is hoped that our efforts will have practical value in a world not demarcated by single disciplines.

Table 1 – Some Benefits of Interdisciplinary Research Identified by the EIUI Researchers*

Category**	Benefits
# 1 - Growth of Knowledge	- Important questions have many dimensions, requiring enquiry from multiple perspectives. - Creativity in problem solving is facilitated and extends beyond the comfort zone(s) of disciplines. - Greater capacity exists for determining core questions. - New methods are developed since measuring use and influence of information is complex.
# 2 - Social benefits	- Increased understanding occurs regarding different institutional cultures at the science-policy interface. - Many types of stakeholders are involved as the interdisciplinary perspective requires more comprehensive approaches and understanding. - Trust among the researchers translates into enhanced trust by stakeholder organizations
# 3 - Personal rewards	- Credibility is increased with funding sources and partner organizations. - Important societal issues are resolved.

*See www.eiui.ca; ** Based on Nissani (1997)

Concluding Remarks

The influence of scientific information (much of which is published as grey literature) in the complex social contexts in which information is used can only be well understood if that context is comprehensively studied. Environmental problems and related policy decisions are multidimensional, as the *State of the Planet Declaration* emphasized (Planet under Pressure, 2012). "In one lifetime," the declaration stated, "our increasingly interconnected and interdependent economic, social, cultural, and political systems have come to place pressures on the environment that cause fundamental changes in the Earth system....But the same interconnectedness provides the potential for solutions: new ideas form and spread quickly, creating the momentum for the major transformation required for a truly sustainable planet." Information published as grey literature will have an instrumental role to play in facilitating these solutions, as shown by the IPCC work on climate change. Thus, development of a clearer understanding of the function of this information and literature and its exchange at the science-policy interface, where these solutions will play out, is urgently needed.

One challenge is that even if greater information exchange between communities is possible, problems may persist. A cybernetic understanding of control points to three components in a control system, namely, information gathering, standard setting, and behaviour modification. Information exchange in the absence of common standards and behaviour modification will leave a system uncontrolled. In some respects, information sharing can be a "light touch" form of regulation. Problem solvers may assume that, by sharing information, standards and behaviour modification will occur. Without an appropriate incentive structure, this scenario might be wishful thinking.

The core challenge, therefore, will be to move beyond information exchange and into the role of establishing standards and changing behavior. These stages will be much harder to achieve. They requires power-sharing between disciplines and communities. In many respects, the result will be a flat, leaderless approach to problem solving. Egalitarian structures, however, tend to be risk-averse; they strive towards consensus and in so doing potentially neglect and even undermine innovation and risk-taking. In this regard, grey literature may provide a half-way house: an opportunity for different communities to negotiate research findings, take risks, and propose alternatives. In some respects, this form of publication increases opportunities for something more innovative to emerge since the specialized academic standards of individual disciplines may be less constraining at the interface of disciplines. An interdisciplinary research perspective, as we have discussed, is vital to achieve this outcome.

Solutions to serious global environmental problems are more likely to be found by using holistic approaches that draw on the knowledge and capabilities of various disciplines (O'Brien, Marzano, & White, 2013). Interdisciplinarity increases the potential to find comprehensive solutions and broader understanding will promote attitudinal and behavioural changes needed to resolve important problems.

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Data sharing in environmental sciences: A survey of CNR researchers *

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Abstract

The paper presents the results of a survey on researchers' attitudes and practices of data sharing in the area of Environmental sciences. It is based on an online questionnaire submitted to CNR researchers active in this disciplinary field, that has proved to be data intensive, collaborative and multidisciplinary. The study lies within the framework of other international analyses that consider this complex process exploring different aspects that may influence the propensity of a consistent and effective data release. Therefore, motivations, perceived barriers and enablers to data sharing are analysed together with the outline of research context and practices in this field.

1. Introduction

Today the free availability of research data is considered an important driver of innovation and of new scientific insights. Due to the increasing amount of data collected as well as to the variety of purposes, process of acquisition and formats this is not an easy task. It implies the development of policies that promote data curation and preservation, the recognition of the value of research data as "first-class publication", the enforcement of clear rules for open access, copyright and ownership. It is also necessary that the scientific community agree on the development and use of common interoperability standards related to data models, format and exchange protocols. Last but not least, it requires that suitable infrastructures be developed at national and international level considering discipline specificity.

There is now a vast literature devoted to the definition and importance of research data [Borgman, 2012, Kowalczyk & Shankar 2011]. Many studies consider the technical aspects of preservation and management [Tjalsma & Rombouts, 2010, Graaf et al. 2011], while official documents and whitepapers outline current changes in the research process and propose policies and infrastructure that can promote data sharing [Hey et al. 2009, NSF, 2005]. Moreover, various surveys have been carried out to explore researchers' practices and perceptions towards data acquisition, curation and preservation, focusing in particular on perceived barriers and enablers of data sharing. Some surveys conducted within European projects, have analysed attitudes and opinions of different stakeholders: researchers, data managers, publishers, funding organisations [PARSE.Insight, 2009, Dallmeier-Tiessen et al, 2012], as well as libraries, national and local governments [EU Directorate, 2012]. They rely on different methods in the collection of results: questionnaires, interviews, desk research. They gained insight into differences between disciplinary fields across various countries with the aim of developing roadmaps or setting up a participatory process for the construction of international e-Science infrastructures [Tenopir et al. 2011]. Among the surveys that were particularly focused on specific research areas (Pinowar, 2011, Milia et al. 2012), it is also worth mentioning the studies related to biodiversity that combine the analysis of researchers' attitude (Enke et. al., 2012) with the evaluation of technical and information resources available in this multidisciplinary field [Bach et al., 2012, Bendix et al. 2012].

Most of these studies have a common vision on data lifecycle as closely connected with the research process, where data sharing "begins with good data practices carried out in all phases of the data lifecycle" (Tenopir et al., 2011). Moreover, researchers' propensity to data sharing largely depends on the research context, synthesized by Kim as the combination of technological infrastructure, institutional support and interpersonal interactions (Kim & Stanton 2012).

Based on this view our survey intends to analyse researchers' attitude in data sharing posing a particular emphasis on the exploration of research practices and context within the broad multidisciplinary field of Environmental sciences. In our vision the understanding of the complexity of data sharing embedded in a specific research environment can bring to the fore opinions, beliefs, concerns and practices that may contribute to the development of suitable information systems tailored on researchers' needs as well as to the introduction of policies that may promote their consistent and long-term diffusion.

2. Methods

Among the different CNR departments devoted to different disciplinary fields, we choose to analyse attitudes of researchers belonging to the Institutes of the Department of Earth and Environment

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because this research field has proved to be data intensive and multidisciplinary in nature. Moreover, in this area there are several initiatives both at international and CNR level that are promoting and setting up infrastructures for data sharing.

The survey makes use of a semi-structured questionnaire of 40 questions that consists of two main parts. Reflecting the survey hypotheses, the first one aims to gain insight into research practices that may influence data sharing. Based on the chosen target group we identified *ad hoc* questions to explore in particular:

- The general research context (research lines, types of funds, types of collaboration);
- Data acquisition (type or research carried out, data used, modes of data acquisitions and instrumentation);
- Data management (availability of standards, use of descriptive metadata, adoption of preservation procedures, presence of dedicated personnel for data management);
- Data re-use and availability (propensity of using data produced by others and related evaluation of its reliability; available resource to store own data, practices in data sharing).

The second part is specifically focused on capturing perceived barriers to as well as conditions that may motivate data sharing. This part contains a selection of questions submitted in large-scale international surveys (PARSE.Insight, 2009, Tenopir et al., 2011, Enke et. al., 2012) in order to explore commonality and differences in attitudes.

Additionally, respondents were asked for information on gender, age, length of CNR service and occupational position. Most of the questions are multiple choice, while two plain text answers were also included in the questionnaire to collect researchers' free opinion on this topic. Both questionnaire and survey data are available at: <https://easy.dans.knaw.nl/ui/datasets/id/easy-dataset:53292>.

The survey was Internet-based and the link was sent out via e-mail using LimeSurvey open source software that also supports invitations, reminders, and makes answers anonymous. The survey period was June-September 2012.

3. The sample

1087 questionnaires were sent to all researchers affiliated to the 13 CNR Institutes belonging to the Department of Earth and Environment. We included researchers with both permanent and temporary contracts and also external collaborators, who are generally researchers coming from universities that closely collaborate with CNR Institutes. The response rate was 48% (i.e. 523 responses) that can be considered satisfactory given the voluntary basis of the survey.

There are 13 CNR Institutes that belong to the Earth and Environment Department. These institutes are different in size, ranging from 40 researchers to more than 100 and are organised in various research units located all over Italy. Their area of interest ranges from land and water ecosystems to climate change, from the use of resources to the monitoring of anthropogenic risks, from biodiversity to the development of methods and technologies for environment protection.

The distribution of responses by Institute (tab 1) shows that five Institutes out of 13 reach a response rate higher than 50%. Most of them are in the area of marine sciences and water resources.

Table 1 - Distribution of responses by Institute

<i>Institutes</i>	<i>Questionnaires sent (No.)</i>	<i>Questionnaires received (No.)</i>	<i>%</i>
IAMC - Institute for coastal marine environment	93	53	57.0
IBAF - Institute of agro-environmental and forest biology	53	27	50.9
IDPA - Institute for the dynamics of environmental processes	58	25	43.1
IGAG - Institute of environmental geology and geo-engineering	103	36	35.0
IGG - Institute of geosciences and earth resources	132	63	47.7
IIA - Institute for atmospheric pollution research	67	29	43.3
IMAA - Institute of methodologies for environmental analysis	83	31	37.3
IRPI - Research institute for geo-hydrological protection	88	40	45.5
IRSA - Water research institute	69	40	58.0
ISAC - Institute of atmospheric sciences and climate	94	46	48.9
ISE - Institute of ecosystem study	55	35	63.6
ISMAR - Institute of Marine sciences	149	80	53.7
IVALSA Tree and timber institute	43	18	41.9
Total	1,087	523	

3.1. Respondents' profiles

An overview of the respondents' profile is given in table 2. The majority of respondents to the survey are male. They fall mainly into two age groups (from 41 to 50 and over 50 years old). The length of service at CNR is concentrated in two groups: from 11 to 20 years and over 20 years of CNR service. The majority of respondents have a permanent contract.

Table 2. - Respondents' profile

<i>Respondents' profile</i>		
	No.	%
Gender		
F	204	39.4
M	314	60.6
	518	
Age		
< 30	31	5.9
30 - 40	139	26.6
41 - 50	170	32.5
> 50	177	33.8
	517	
Length of service		
> 5 years	117	22.4
6-10 years	107	20.5
11-20 years	144	27.5
> 20 years	142	27.2
	510	
Position		
Permanent	327	62.5
Temporary	129	24.7
Training	9	1.7
External collaboration	56	10.7
Other	2	0.4
	523	

4. Research context

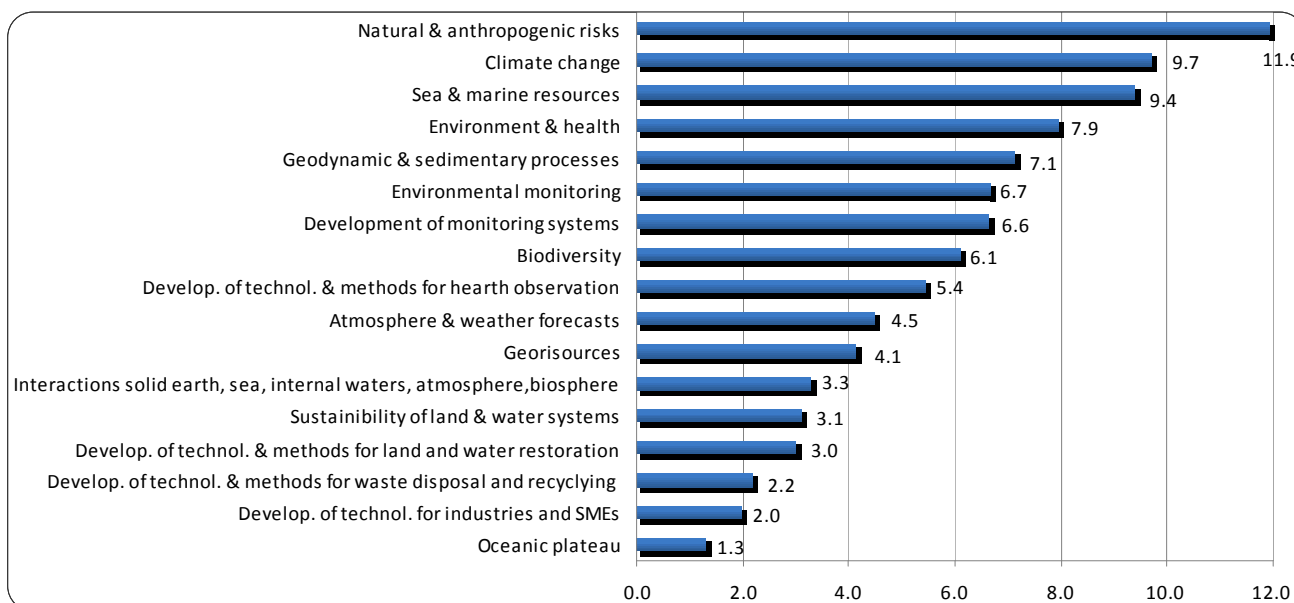
Data sharing does not simply represent an individual propensity, but it is influenced by socio-cultural, contextual and institutional factors. It has proved to vary from discipline to discipline and within disciplines, it depends on different factors: types of research and collaboration setting, types of data, modes of acquisition and handling strategies as well as human, technical and institutional support for long-term preservation, to mention but a few.

Therefore, the first part of the questionnaire is devoted to exploring general features of research practices to obtain a more detailed framework on how research activities are carried out in this area.

4.1. Research lines

Researchers were asked to provide a percentage of time dedicated to a set of research lines described in the website of the CNR Department of Earth and Environmental Sciences. Figure 1 shows the topics on which researchers concentrate their work (multiple answers were allowed). Researchers are generally involved in more than one research line, a relevant percentage on them deals with Natural and anthropogenic risks (11.9%), Climate change (9.7%) and Sea and marine resources (9.4%).

Fig. 1. - Distribution of the research lines carried out by CNR researchers



4.2. Funds

When asked to provide a percentage of funds received in carrying out their research activities, the majority of researchers (47.8%) reported that they receive national funds, 28.9% rely on EU and/or international projects and 14.9% on national and international private funds. On average, only 4.4% of researchers reported that their work is directly funded by CNR.

4.3. Collaboration

Two questions in the survey were focused on researchers' collaboration habits. The first one asked, whether they usually work as a single researcher, in small (max 3 persons), medium (from 3 to 7 persons) or in large groups (more than 8 persons). The majority of researchers work in a medium size (47.7%) group.

When asked how often and on which occasions they collaborate with multidisciplinary groups, 42% reported that they always do so in international projects and with colleagues of the same Institute (36.9%). Working in multidisciplinary groups occurs sometimes with other CNR institutes (56.2%) and with other Italian institutions and/or Universities (61.6%).

4.4. Data acquisition

As data sharing is part of data lifecycle, a set of questions was devoted to exploring types of data used, how they are acquired and managed. A prerequisite of data sharing is that data are acquired following defined procedures, is associated with proper metadata, so that data are interpretable and properly reusable. Therefore a set of questions was focused on the type of research carried out, types of data used, how data are acquired, as well as information on measurements and instrumentation.

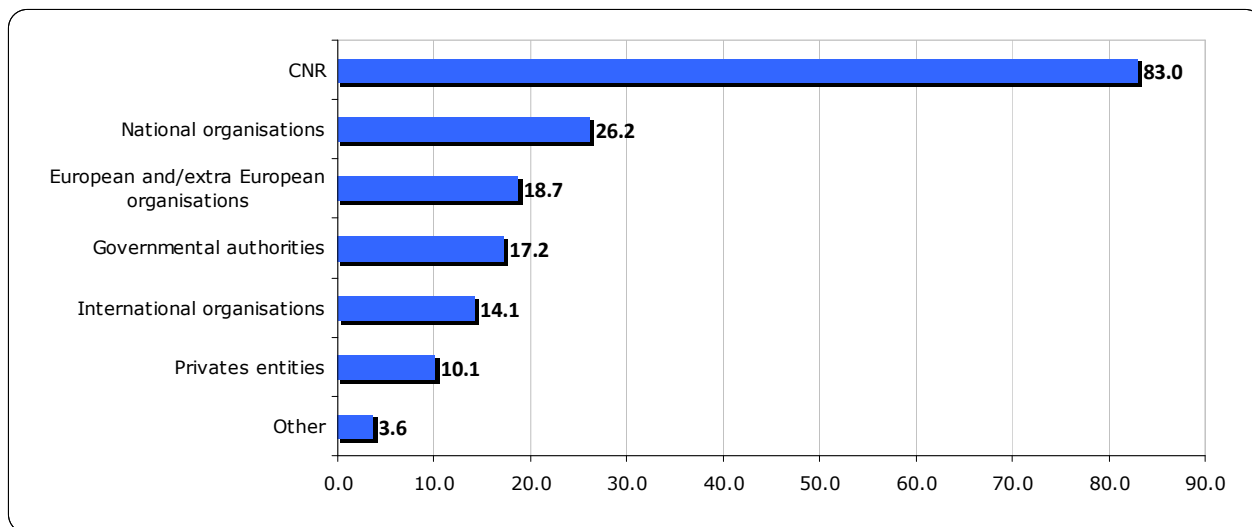
We first asked researchers to provide a percentage of time dedicated to theoretical and/or experimental research in order to gain insights into the type of research most frequently carried out in this field. On average the majority of CNR researchers (77%) carry out experimental research that generally implies the collection as well as an intensive use of data.

Tab. 3. - Type of data used in the analysis of land, sea, internal waters, atmosphere and biosphere

	<i>Biological</i>	<i>Chemical</i>	<i>Physical</i>	<i>Geological</i>
Land	18.5	31.0	31.9	45.1
Sea	27.0	30.0	30.8	26.2
Internal waters	22.6	36.5	30.2	27.3
Atmosphere	6.5	27.3	42.4	13.4
Biosphere	28.3	24.3	21.2	16.4

Researchers were asked to indicate the type of data used when they analyse phenomena related to land, sea, internal waters, atmosphere and biosphere. Multiple answers were allowed. Table 3 shows that CNR researchers more frequently use geological data related to the study of land (45.1%) as well as physical data related to the Atmosphere. Data gathered in the analysis of sea, internal waters and biosphere tend to be almost equally distributed among biological, chemical, physical and geological data. This multidisciplinary approach is confirmed by some researchers, who specified in the variable “other” that they use biogeochemical, geo-morphological, geophysical or geo-mechanical data. A small percentage of researchers (0.6%) indicate in “others” that they use remote sensing data. Moreover, 21% of researchers also use demographic data to carry out their research activities.

**Fig. 2. - Distribution of respondents to the question:
“The data you are working on come mainly from instrumentation managed directly by ...”**



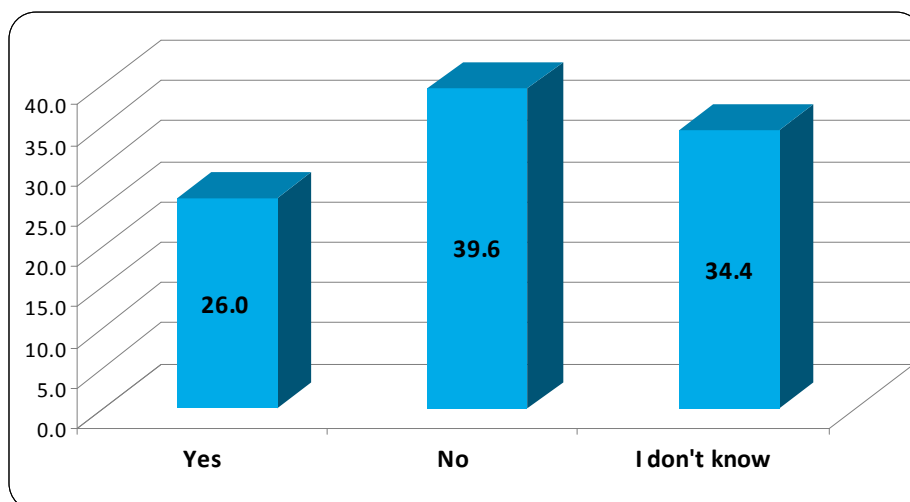
When asked whether they take measurements directly by themselves, or use measurements taken by others or alternatively use both, the majority of CNR researchers (53%) reported that they use measurements directly taken by themselves and/or by their research group, while 8.2% use measurements taken by others and 38.8% use both. Moreover, data are mainly acquired from both laboratory work and in the field (53.8%), while 32.5% of CNR researchers collect data from fieldwork alone.

A multiple answer was allowed to indicate who manages the instrumentation used. Figure 2 shows that an overwhelming majority of CNR researchers (83%) obtain data from instrumentation directly managed by CNR, while 26.2% of them also use data taken from instrumentation managed on the basis of agreements with other national organisations.

4.5. Data management

The use of standards facilitates data sharing, while re-use and evaluation of data also depends on the metadata associated to the data acquired. Therefore, a set of questions aimed to explore different aspects of data management, such as the availability of standard of researchers' community of reference, use of descriptive metadata in their current research practice, data management plan in place in their Institutes and presence of trained staff that may support data curation.

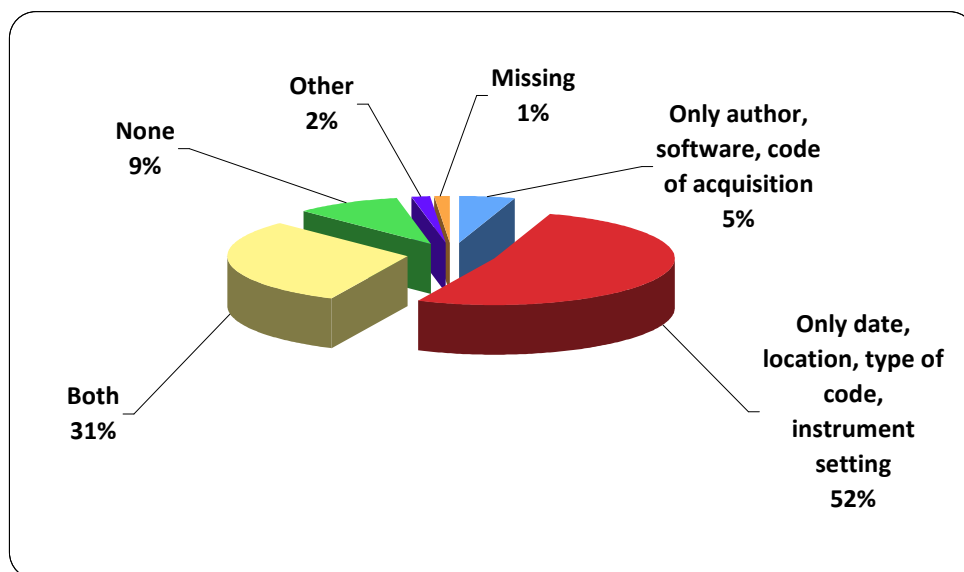
**Fig. 3. - Distribution of respondents to the question:
“Does your community of reference use standards to manage data?”**



When asked about the use of standards, a high percentage of researchers reported that their community of reference doesn't use standards (39.6%), while 26% of them don't know about the use of standards in their research field (fig. 3).

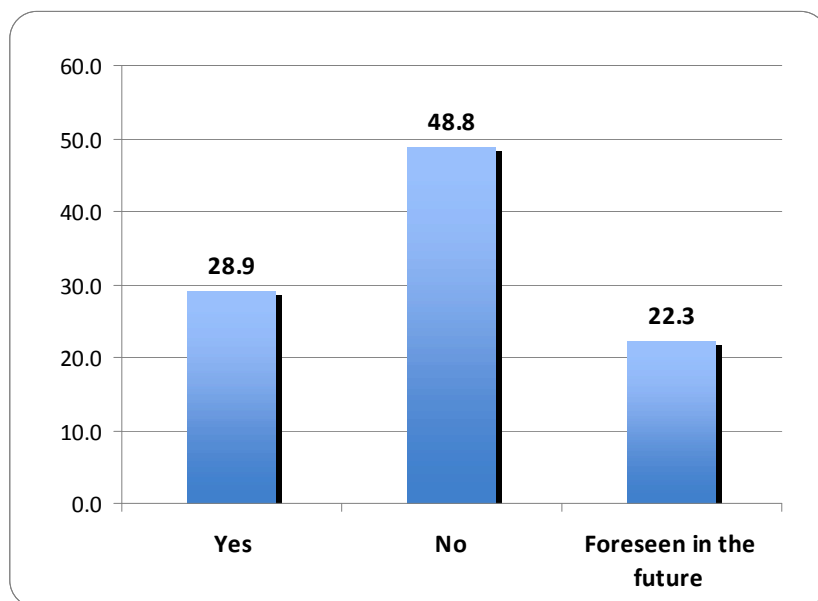
The remaining 26% of researchers that answered positively to this question also specified the standard they more frequently use. Many of them use a set of standards specific to the type of data and infrastructure of reference for their work. Here a brief overview of the standard more frequently indicated. Many mention the European initiative INSPIRE (Infrastructure for Spatial Information in the European Community) that established a general framework for Spatial Data Infrastructure (SDI) together with ISO19115 (Geospatial metadata) as well as the standard developed by the Open Geospatial Consortium (OGC). Others rely on the SEG Y standard file format developed by the Society of Exploration Geophysicists for storing geophysical data, or on NetCDF (Network Common Data Form), an open standard for sharing array-oriented scientific data, and/or on ISO/WMM (World Meteorological Organization) to standardize meteorological data.

Fig. 4. - Distribution of respondents to the question: “What type of additional information do you generally associate with data you have collected/analysed?”



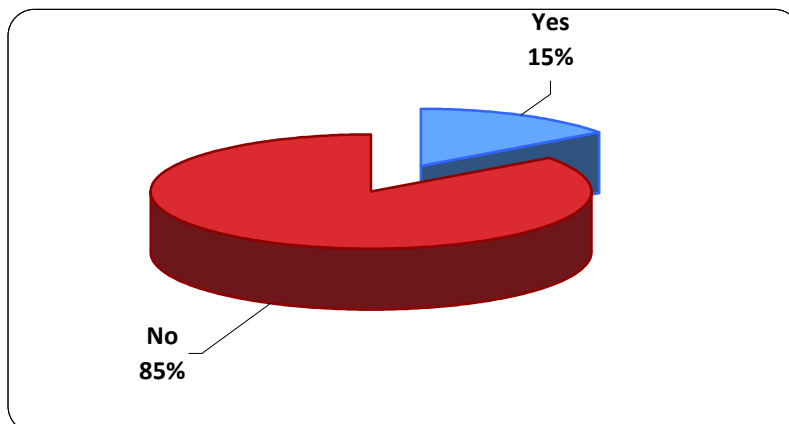
When data are collected and/or analysed, 52% of CNR researchers provide metadata related to the date of collection, information on location, type of code used and instrument setting. 9.4% of researchers associate data with additional information on the author, software, code of acquisition, while 30.6% associate both types of the above-mentioned metadata. Only 9.4% do not associate any type of metadata to data gathered or analysed (fig. 4). The addition of descriptive metadata is an encouraging result as it makes research data more easily interpretable and reusable, thus more accessible and better suited for preservation.

Fig. 5. - Distribution of respondents to the question:
“Does your Institute have specific procedures for data preservation in place?”



When asked whether specific procedures for preservation are set up by their institute, 28,9% of researchers reported that these procedures are in place in their institutes, while 22,3% reported that these procedures are going to be set up in the future (fig. 5).

Fig. 6. - Distribution of respondents to the question:
“Is there anyone in your Institute who is specifically trained to manage data?”



The presence of personnel specifically trained to manage data is reported by 15.4% of researchers, while the majority of them answered that there is no one in their institute that is in charge of this task (fig. 6). Out of 79 researchers that reported on the presence of personnel dedicated to data preservation, 60 indicated the type of personnel that carry out this task. Generally they are IT experts that manage local databases, GIS, digital images. Many researchers mention technicians or researchers that carry out this task, and only in few cases do respondents refer to a data manager, that is the emerging professional skill often mentioned in official documents on data management and preservation. One respondent reports that data preservation is carried out by the same person who manages the Institutes' publications, probably a librarian.

4.6. Data re-use and availability

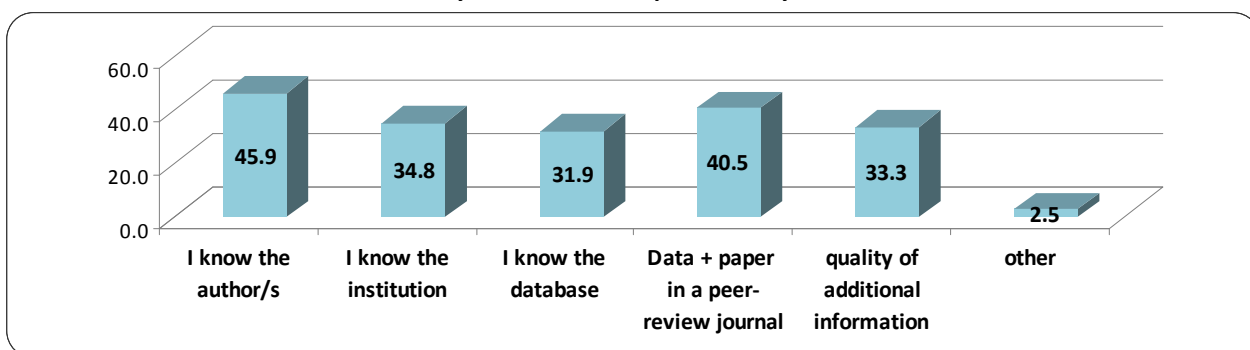
This group of questions aims to ascertain whether researchers use data produced by others, in which field, along with the criteria they apply to consider data reliable. Generally the use of data generated by others is associated with the propensity of sharing researchers' own data, in the hypothesis that this could represent a mutually coherent behaviour. Results of other surveys (PARSE.Insight, 2009, Tenopir

et al., 2011, Enke et. al., 2012) generally showed a lower percentage of data sharing when compared with the re-use of data generated by other researchers.

59% (= 307) of researchers indicate that they use data produced by others. Among them, 43% re-uses data in the same disciplinary field, while a similar percentage of researchers re-use data coming both from the same disciplinary and from cross-disciplinary fields.

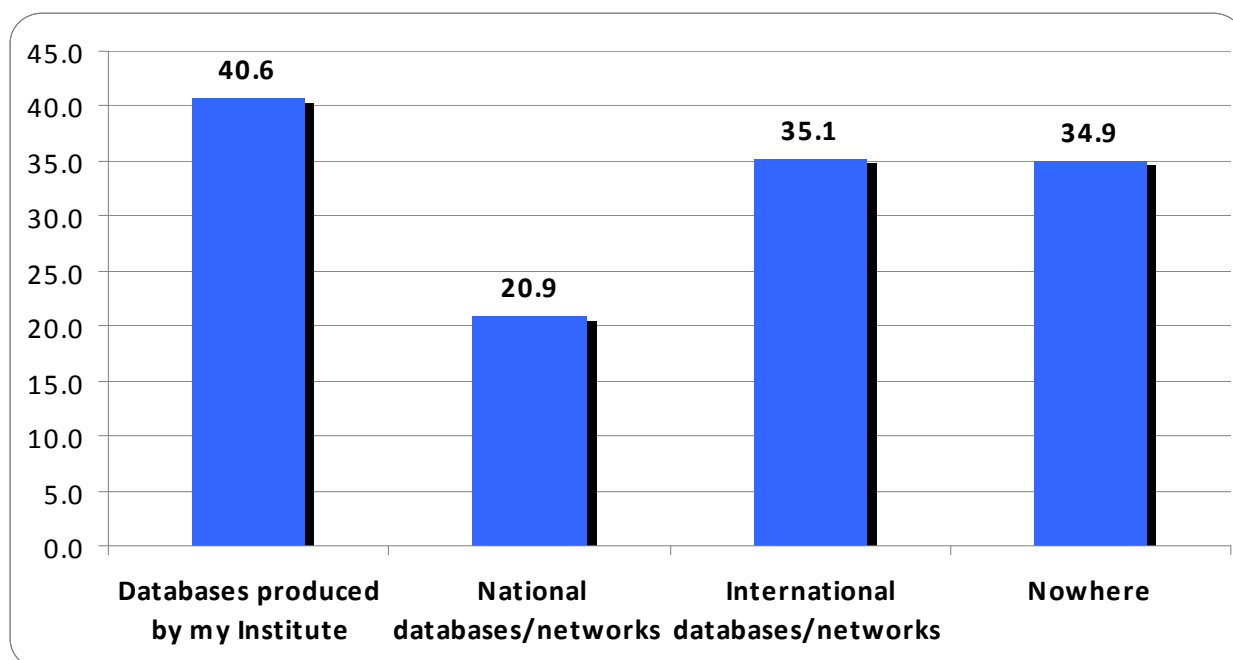
When researchers are re-using data produced by others they consider data reliable if they know the authors (45.9%) and when data are associated with peer-reviewed journals (40%) (fig. 7). Answers reported in the variable "Other" help to give a more complex picture of data reuse. Some researchers reported that they apply procedures of quality control and validation; others consider the experimental method adopted as well as methods and instrumentation used to collect data. This highlights that data reuse may not always be a straightforward process.

Fig. 7. - Distribution of respondents to the question:
"What reassures you that the data produced by others is reliable?"



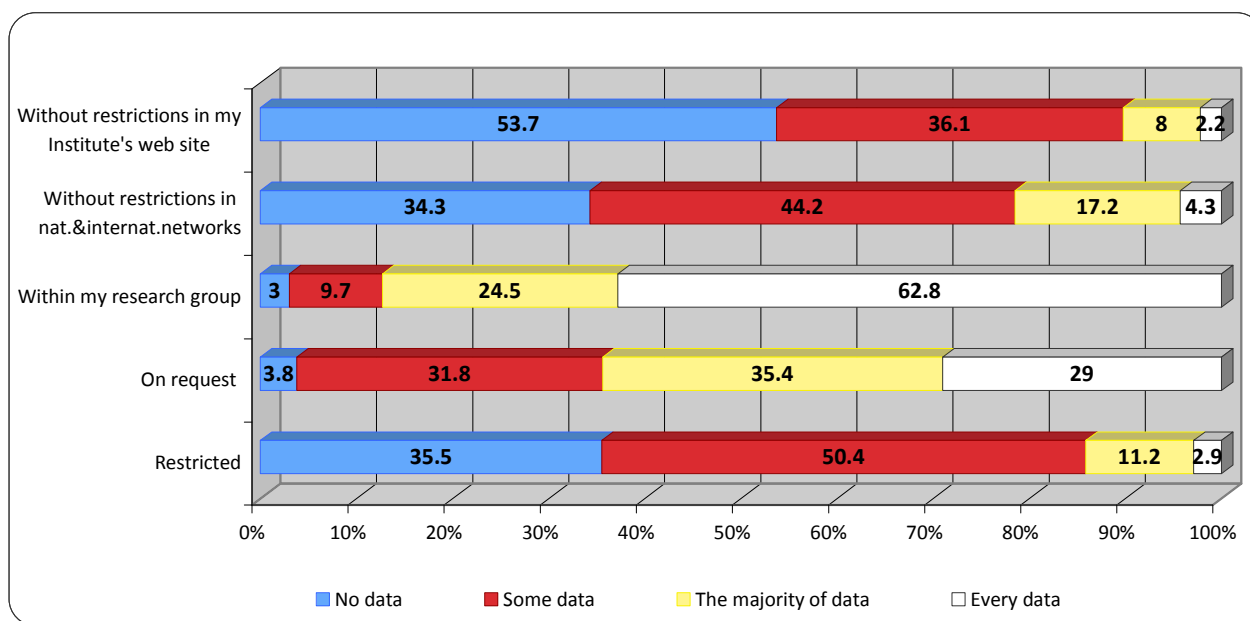
The willingness to share data also depends on the availability of databases or infrastructures where researchers can deposit their research data. For this reasons we asked whether there are databases or networks where they can deposit their data in their disciplinary field.

Fig. 8. - Distribution of respondents to the question:
"In your disciplinary field are there archives where your research data can be stored?"



More than 40% of researchers store their data in databases produced by their institutes, 35% in international databases and 20% in national databases, while for 34% of researchers there are no databases where their data can be submitted (fig. 8).

Fig. 9. - Distribution of respondents to the question:
“Data from your current research is available to everyone without restrictions “



Turning to data made available by CNR researchers, we can generally say that they make a selection of the data that they share (fig. 9). At least some data are available without restriction in the Institute's website (36.1%), or in national and international networks (44.2%). Of course all data are available within their research groups (62.8%). It is interesting to note that when data are requested, CNR researchers declare they do make them available, only 3.8% of them report that no data are available on request. A small percentage of researchers report that either all their data or the majority are restricted (2.8% and 11,2).

5. Researchers' attitude

This part of the questionnaire intends to explore researchers' opinions on the role played by research data, perceived obstacles and enablers to data sharing. As previously mentioned this part of the questionnaire is also based on other surveys carried out at international level, so that differences and communalities with the international context can be compared.

Before asking on data sharing practices and perceptions, we considered it important to let researchers express their opinions on reasons for the availability and preservation of data. We proposed a list of nine well-known statements (7 of which were taken from the Parse Insight survey) and asked whether they consider these reasons very important, important, slightly important or not important.

Almost all assertions of this self-evident list of reasons are considered very important or important by the majority of researchers. If we analyse how they ranked their importance, it emerges that researchers find that data availability and preservation foster the process of science (56.8%) and that it also enhances the transparency of research (53.9% very important and 40.7% important).

Table 3 - Distribution of respondents to the question:
"In your opinion for which reasons is it important to make research data available and preserve it?"

	<i>Very important</i>	<i>Important</i>	<i>Not very important</i>	<i>Not important at all</i>	<i>Missing</i>
The availability of data enhances the transparency of research results	53.9	40.7	3.8	0.6	1.0
When research is publicly funded, data should be available to anyone	50.7	38.6	7.5	2.1	1.1
The availability of data fosters the progress of science (new research is based on pre-existing knowledge)	56.8	38.2	3.6	0.4	1.0
It is a means to validate the results obtained	40.2	43.6	12.6	1.1	2.5
Existing results can be re examined	34.6	46.3	14.5	2.7	1.9
It can promote collaboration among different fields	39.6	45.5	12.8	0.8	1.3
It has a potential economic value	19.1	39.8	34.2	4.2	2.7
Research data are unique	19.9	40.0	26.8	9.8	3.6
The availability of data reduces the duplication of research efforts	36.9	35.9	18.9	6.3	1.9

Another reason to make data available and preserve them is that research is publicly funded and therefore should be made available to everyone (50.7% very important and 38.6% important). The economic value of data (4.2% not important at all) together with the assertion that data are unique (9.8%) is regarded as the least important reasons for availability and preservation. These two values are not surprising, as also in the Parse Insight project the survey obtained the same results. In the case of CNR researchers these values are balanced against the rate given as important (respectively 39.8% and 40%). Moreover, the Parse Insight survey found out that opinions on the very important and important reasons depended on the disciplinary field of the respondents. CNR researchers consider that data availability and preservation can stimulate the advancement of science like researchers in Humanities, Life sciences, Physical Sciences and Socio-cultural sciences.

5.1. Obstacles to data sharing

When asked on the obstacles of data sharing (table 4), we obtained a more homogenous distribution of responses, especially if we compare this question with the previous one. If we consider both the very important and important values we can notice a common agreement on some obstacles felt by the majority of CNR researchers (where sometimes the important value prevails on the very important one). These are: lack of technical support (41.9% important, 31.4% very important) lack of standards (46.3% important, 25.8% very important), but also the fact that data are not evaluated like papers in scientific journals (37.5% very important, 31.5% important).

**Table 4. - Distribution of respondents to the question:
“In your opinion what are the main obstacles to data sharing?”**

	<i>Very important</i>	<i>Important</i>	<i>Not very important</i>	<i>Not important of all</i>	<i>Missing</i>
Lack of funds	31.4	30.6	27.9	5.4	4.8
Lack of standards	25.8	46.3	18.9	3.1	5.9
It requires too much time	16.1	38.0	32.7	7.8	5.4
Difficulties in adoption of standard	13.0	38.4	33.7	8.4	6.5
No technical support	31.4	41.9	16.4	3.6	6.7
There are no archives to submit to	23.3	37.3	23.9	9.2	6.3
Procedures of data sharing are too complicated	10.7	33.8	38.4	10.7	6.3
Loss of data control	19.9	31.4	30.4	12.6	5.7
Data may be misused and/or misinterpreted	22.8	35.6	25.4	10.5	5.7
Data are not evaluated like papers in scientific journals	37.5	31.5	20.8	5.0	5.2
Loss of exclusivity of the work	26.4	29.4	30.0	8.6	5.5

When we look at the least important perceived barriers, the statement related to the too complicated procedures receives the majority of responses, but the differences with the researchers that consider it important are not so high. At this stage of the analysis we could say that CNR researchers perceive a relevant number of different barriers as being rather important. It would be interesting to further analyse these perceptions combining these results with other variables of the questionnaire.

5.2. Enablers of data sharing

The last multiple-structured question summarizes some of the issues already investigated, but specifically asked on the conditions required to submit data to an open archive. A major consensus on very important facilitators of data deposit is evident here (table 5). The majority of researchers find very important to have the possibility to update data after submission (60.2%), to know who is using them, when and for which purpose (53.5%), to be contacted if data are used (52%). All these responses are related with a clear wish to keep control over their own data also after submission. Another very important factor that may encourage researchers to deposit is the availability of simple procedures for submission (52.6%) as well as receiving the same evaluation as in the case of publications.

**Table 5. - Distribution of respondents to the question:
“What condition would you require to submit your research data to an open archive?”**

	<i>Very important</i>	<i>Important</i>	<i>Not very important</i>	<i>Not important at all</i>	<i>Missing</i>
I will be able to update data after submission	60.2	30.8	4.2	1.7	3.1
I will be able to delete data	31.2	33.7	22.0	7.3	5.9
I know who is using data, when and for which purpose	53.5	27.5	11.7	3.6	3.6
Be contacted if someone wants to use my data	52.0	30.2	12.0	2.3	3.4
Receive a formal acknowledgment	35.4	36.1	20.3	4.0	4.2
Be reassured about long-term data preservation	38.6	39.8	13.4	3.3	5.0
Simple procedures to deposit data	52.6	37.1	5.5	0.6	4.2
Receive additional funds	24.7	39.2	27.5	4.4	4.2
Receive the same evaluation received for publications	41.1	37.5	13.0	3.8	4.6

6. Conclusions

Summarising some of the main results of the survey, CNR researchers in the field of environmental sciences tend to work in collaboration, often involved in multidisciplinary projects within the same institutes and with external organisations. They mainly carry out experimental research, use different types of data, gathered directly by themselves or by their research group in both laboratory and field work, using instrumentation directly managed by CNR.

There is not a diffuse use of standards, but researchers who use them apply different types of them, according to the data they are working on. Nevertheless, data collection is often associated with descriptive metadata that represent a pre-requisite for data reusability and interpretation as well as for preservation. It is also encouraging that a relevant number of researchers rely on procedures for data preservation already set up in their institutes or foreseen in the future. This process is generally carried out by the researchers themselves, as the majority of them do not have any support from specifically trained data managers.

Despite the use of data produced by others, CNR researchers tend to share only a fraction of data they produce. Generally they are more willing to share data on request, keeping control on whom is using their data and for which purposes.

A relevant number of obstacles are perceived by CNR researchers as rather important: lack of technical support, lack of standards, no formal recognition of practices of data sharing, but also lack of funds, fear of losing the exclusivity of their work. These perceptions are worth further analysis, combining these results with other variables of the questionnaire. Conditions required to submit research data to open archives concern both technical and policy-related aspects that confirm a clear wish to keep control over research data even after submission as well as the provision of simple procedures for submitting them. Doubtless a further motivation is that data sharing is evaluated the same way as publications are.

Generally the high rate of responses received to the questionnaire as well as researchers' opinions on the importance of research data indicate a high level of awareness and an encouraging willingness to share data that should be further strengthened by the introduction of policies and the development of infrastructures tailored to researchers' needs.

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What goes up must come down: Publications from developing countries in the Aquatic Commons *

Maria Kalentsits and Armand Gribling (Italy)

Abstract

During 2010-2012, the Fisheries and Aquaculture Branch Library (FBL) of the Food and Agriculture Organization of the United Nations (FAO) was involved in a project that included the selection, digitizing, web-optimization, creation of metadata, and uploading into the Aquatic Commons (AC) digital repository of grey literature published by, amongst others, issuing agencies in several African countries, and a regional project in Asia - the STREAM Initiative. Furthermore, links to these full text online versions have been added to the Aquatic Sciences and Fisheries Abstracts (ASFA) bibliographic database.

The AC is a thematic digital repository covering the marine, estuarine, brackish and freshwater environments. This repository is directed by the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) and hosted by the UNESCO/IOC International Oceanographic Data and Information Exchange (IODE) project office in Belgium.

The AC repository is built on Eprints software. In addition, it uses the related Interoperable Repository Statistics (IRS) software for usage statistics. The paper presents the results of the analysis of the access to the grey literature from selected issuing agencies in developing countries, whereby it focuses specifically on the Technical Documents, published by the Lake Victoria Fisheries Research Project and those published by the Support to Regional Aquatic Resources Management (STREAM), which was based in Bangkok, Thailand.

Examples of digital preservation and repatriation to countries of origin, two of the main objectives for FAO's participation in the repository, are discussed.

By using the IRS software the paper seeks to evaluate FAO's contribution to the content development of the repository and it finds a confirmation of the increasing visibility of and access to some baseline information in the field of fisheries and aquaculture published by institutions and/or projects in developing countries. Finally, the paper describes some of the utilities and limitations of the software.

1. Introduction

As is mentioned in one of the publications by Jean Collins, former FAO Fisheries Librarian,

One of the characteristics of the literature of fisheries and aquaculture – in particular the practical and management rather than the scientific aspects – is that it does not easily find its way into commercial journals. The results of research and the development lessons learned are often lost because of inadequate opportunities to publish, especially but not only in developing countries.¹

So, often scientific and practical knowledge generated in fisheries and aquaculture is presented in multiple formats of grey literature. The amount of information available as grey literature, which includes project reports and technical documents, training manuals and practical guides, workshop and conference materials, thesis, etc., is rather high and widely spread through marine and fisheries institutions in both developed and developing world. The value of grey literature is recognized and it is widely used in fisheries and aquaculture management.

Aquatic grey literature originating from developing countries can be often considered documents at high-risk of getting damaged due to frequent natural disasters and improper storage conditions or lost due to various human reasons. Access to these documents that are of limited distribution, often remains fragmented and inconsistent not only for the international community but also for internal users.

In the years 2010-2012, FAO's Fisheries and Aquaculture Branch Library (FBL) has been involved in a project that included the selection, digitizing, web-optimization, creation of metadata and uploading into Aquatic Commons (AC) repository of grey literature published by, amongst others, issuing agencies in several African countries and a regional project in Asia, the STREAM Initiative. Links to these full text online versions have been added to the Aquatic Sciences and Fisheries Abstracts (ASFA) bibliographic database.

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In speaking about digital information sharing with countries of origin, we use the term “repatriation”. By retrospective scanning and uploading of grey literature from developing countries we are carrying out a digital repatriation of information.

Besides thematic repositories like Aquatic Commons and OceanDocs, there are several other open access digital archives related to fisheries and aquaculture which have been developed. Relevant examples from developing countries are the institutional repositories from the Central Marine Fisheries Research Institute in India, the Kenya Marine and Fisheries Research Institute, the Aquaculture Department from Southeast Asian Fisheries Development Center, based in the Philippines, and the Digital Library from the Fisheries, Aquaculture and Marine Ecosystems Division (Secretariat of the Pacific Community), based in New Caledonia. Furthermore, there are multidisciplinary full text resources which include aquatic sciences, like Global Agricultural Research Archive (GARA), related to CAB Abstracts.

The paper presents the results of usage analysis performed with the Interoperable Repository Statistics (IRS) software. The focus is on the access to the grey literature from selected issuing agencies, specifically the Technical Documents published by the Lake Victoria Fisheries Research Project and the documents published by the Support to Regional Aquatic Resources Management (STREAM), which was based in Bangkok, Thailand.

2. Resource Sharing

Information resource sharing is a way to increase availability of documents through optimizing collections’ usage while minimizing expenses. With regards to grey literature, the cost of the document is often a secondary issue to limited availability which becomes a determinative and negative factor in the dissemination of fisheries grey literature. Resource sharing programmes, such as traditional interlibrary loans or innovative repositories of digital collections such as the AC, are required to overcome this challenge.

Shared use of available resources is a concept that has been implemented into marine information management several decades ago by establishing national, regional and international resource-sharing networks as well as through facilitating sharing of marine and aquatic information by several UN organizations and programs.

2.1 IAMSILIC

The International Association of Aquatic and Marine Science Libraries and Information Centres (IAMSILIC), which consists of more than 300 members, plays an important role in aquatic and marine information resource sharing.² More than 90 participating libraries from more than 25 countries offer their local holdings to other member libraries through *IAMSILIC Z39.50 Distributed Library*. The libraries that do not have online catalogs that can be searched via Z39.50 can add selected serials holding information to *The Union List of Marine and Aquatic Serials*. The Union List provides access to several thousand titles including a large number of report series originating from developing countries. The program was implemented in 2002 and since its inception more than 38,000 requests have been submitted through the system. In 2011/2012, 124 IAMSILIC libraries in 45 countries used the service; whereas the volume of activity was continuously high for Latin America and increased significantly for African countries while remaining moderate in the Pacific Region. The IAMSILIC Resource Sharing Program includes *duplicate exchange*. Members of the Association use the IAMSILIC Discussion List to share information about duplicates available to be sent free of charge or for the cost of mailing to other libraries on their request.

The Resource Sharing Program took a new approach with the development of the Aquatic Commons digital repository, which is complementary to the OceanDocs repository project in which many IAMSILIC members also participate.

2.2 IODE

The program "International Oceanographic Data and Information Exchange" (IODE) of the Intergovernmental Oceanographic Commission (IOC) of UNESCO was established in 1961 with the objective to stimulate the management and exchange of data and information on a regional and international scale in the area of marine science and oceanography.³

In addressing its mission, IODE has developed a number of marine information projects, two of which can be mentioned as examples of aquatic resource sharing efforts:

OceanDocs is an electronic repository developed to collect, preserve and facilitate access to research outputs from members of Ocean Data and Information Networks (ODINs). In addition to IODE working documents (525 items), the repository currently includes eight Latin America country collections (1855 documents) and 16 African country and program collections (1618 documents).⁴

The Open Science Directory IOC/IODE has been developed by EBSCO and the Hasselt University Library; it provides users in developing countries with a comprehensive search tool for all open access and research program serial titles. The Directory offers open access to about 13,000 scientific and scholarly journals. Among the main collections available through the Directory are DOAJ, BioMed Central, HighWire Press and PubMed Central as well as the special programs HINARI, AGORA and OARE.⁵ In 2011, IODE and IAMSILIC signed a Memorandum of Agreement on cooperation in the field of marine information management which, among other objectives, aims at “promoting the capacity of libraries and information centers to disseminate and provide access to marine scientific literature for the benefit for marine scientists and other relevant users”.⁶ As part of the Agreement, the Aquatic Commons is hosted by the IOC Project Office for IODE in Oostende, Belgium.

2.3 FAO Fisheries and Aquaculture Branch Library (FBL)

The Library has a mission of providing specialized, high quality library and information services to FAO staff, particularly in support of the activities of the Fisheries and Aquaculture Department, and to stakeholders involved in fisheries and aquaculture, especially those in developing countries, and to disseminate globally FAO information to fisheries and aquaculture organizations.⁷

Resource sharing and library networking is one of the core activities of FBL, which includes an interlibrary loan service (ILL) and retrospective digitization of documents for inclusion into the FAO Corporate Document Repository.

ILL services. The FBL fisheries and aquaculture serials collection (including all FAO fisheries and aquaculture report series as well as over 600 serials from developing countries) is available to aquatic science libraries worldwide through the IAMSILIC Resource Sharing Program.

The FAO Corporate Document Repository contains FAO documents and publications in electronic format. Currently, there are more than 6,000 digital documents on fisheries and aquaculture in the repository; this collection represents slightly more than 25% of all documents published by FAO Fisheries and Aquaculture Department over the years.

Selective Retrospective Digitization of regular FAO fisheries and aquaculture series, project reports as well as papers presented at many FAO technical meetings, which collect and analyse unique information and data, is an important library activity. Many of these documents are published in limited numbers, have narrow distribution and are not readily available in electronic format, although frequently requested by specialists in fisheries and aquaculture around the world. The Library makes every effort to identify, acquire and digitize FAO project documents. Selections of these documents have also been published on CD-ROM.

FAO and IAMSILIC signed a Memorandum of Understanding (MoU) on fisheries information systems and services in 2005. Within the framework of the MoU, FAO and IAMSILIC collaborate to enhance aquatic information resource sharing through improving coverage and access to fisheries and aquaculture publications from developing countries. The IAMSILIC Z39.50 Distributed Library and the Aquatic Sciences and Fisheries Abstracts (ASFA) database, as well as promoting the development and use of the Aquatic Commons e-repository and improving linkages from ASFA to full text open access resources, e.g. FAO fisheries documents and records in Aquatic Commons, are the tools and techniques used to achieve this goal.

2.4 Aquatic Sciences and Fisheries Abstracts (ASFA)

The Aquatic Sciences and Fisheries Information System (ASFIS) is engaged in the collection and dissemination, of information covering the science, technology and management of marine, brackish water, and freshwater environments.⁸ The ASFA bibliographic database is the main product of ASFIS. Input to ASFA is provided by international network of co-operating institutions and organizations. ASFA partnership is composed of 66 co-sponsoring, national and international partners responsible for monitoring, selecting, abstracting and indexing publications for inclusion in the ASFA bibliographic database. The database includes more than 1.6 million bibliographic records (Oct. 2012), covering a large number of grey literature, which is one of its important comparative advantages with respect to other information sources. The Secretariat, provided by FAO, develops and maintains the ASFIS system. ASFA, through its Trust Fund, which is the collective property of ASFA partners, supports the projects initiated by partners and aimed at digitization of grey literature published in their countries. The ASFA partners deposit these documents in open access repositories such as Aquatic Commons and link them to the relevant records in the ASFA database, which increases the utility and value of the database.⁹

The ASFA Thesaurus is a freely available indexing and searching tool. It contains the subject descriptors used to index the records which are contained in the Aquatic Sciences and Fisheries Abstracts (ASFA) bibliographic database.

3. Aquatic Commons

The Aquatic Commons repository, established by IAMSILIC in 2007, is a subject based, thematic digital repository covering the natural marine, estuarine, brackish, and freshwater environments. It includes the science, technology, management, and conservation of these environments, their organisms and resources, and the economic, sociological and legal aspects.¹⁰ It contains a growing collection of published and unpublished research, organizational publications, and other materials, including an increasing number of (grey) literature from developing countries.

The repository is funded and directed by IAMSILIC, through a Board of IAMSILIC members and representatives of the UNESCO/IOC project Office for IODE, which is hosting the repository. It is powered by EPrints software. Its multi-language interfaces are available in English, French and Spanish. Aquatic Commons supports self-submittal of digital resources by authors or issuing agencies, or deposits are done by third parties, with permission from the copyright owners. The repository offers archiving of digital copies where local information and communication technologies (ICT) are lacking or inadequate. Three-quarters of the uploaded documents are published before the year 2000; therefore, the major part of the repository is the result of retrospective scanning. The more than 90 issuing agencies give proof of the international focus of the repository. Examples are the following national and international organizations:

From the USA:

- California Department of Fish and Game (594 uploaded documents)
- United States National Marine Fisheries Service (539)
- United States National Ocean Service (127)
- Florida Cooperative Fish and Wildlife Research Unit (84)

From Latin America:

- Facultad de Ciencias Naturales y Museo, Univ. Nacional de La Plata, Argentina (112)
- *From Africa:*
- Fisheries Society of Nigeria (431)
- Centre de Recherches Océanographiques, Côte d'Ivoire (128)

From Europe:

- Freshwater Biological Association, United Kingdom (552)
- Environment Agency, UK (Freshwater Biological Association) (102)
- German Federal Research Centre for Fisheries (2158)

From international projects and organizations:

- Charles Darwin Foundation (353)
- Inter-American Tropical Tuna Commission (233)
- Support to Regional Aquatic Resources Management (126) (Asia)
- Aquatic Plant Management Society (101)
- North Pacific Marine Science Organization (PICES) (93)
- Lake Victoria Fisheries Organization (77) (Africa)

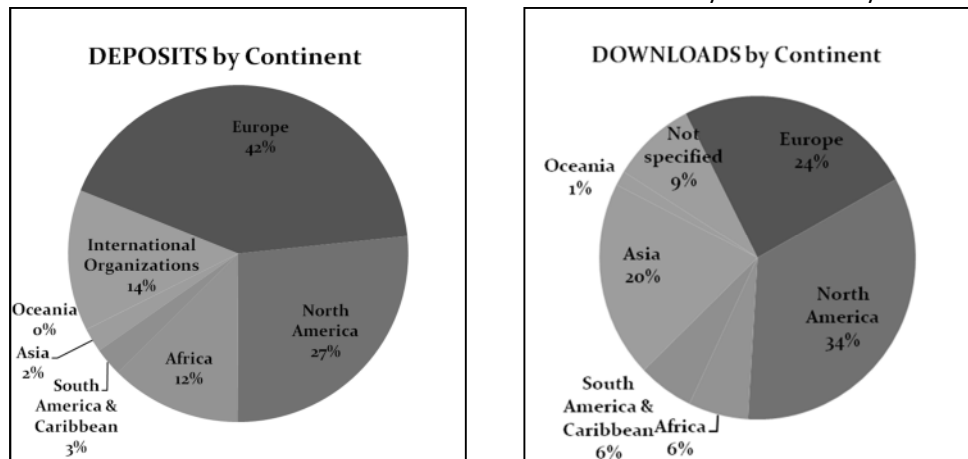
The German Federal Research Centre for Fisheries has uploaded 2158 documents: this is one third of the total repository. This Research Centre has no plans to create its own repository with long-term storage, but has preferred to use the AC as its home repository. One of its main contributions is the deposit of articles of their magazine, *Informationen aus der Fischereiforschung* (Information on Fishery Research). The AC is the primary source of their online journal and the URLs will be linked in the DOI of each publication.

The number of uploads in the AC is increasing from a monthly average of 48 additions in the first year (2007) to 215 monthly deposits in 2012. The usage of the repository has also been growing over the years, with an average number of 13.5 thousands of downloads per month in 2012. By the end of October there were 575,306 downloads from a total of 7973 deposits. The IRS allows for presentation and interpretation of these statistics.

The IRS (Interoperable Repository Statistics) software was implemented in 2008 and permits ongoing monitoring of the repository. The advantage of the software is in its presentation possibilities, offering various kinds of graphs and tables. IRS creates raw data and other usage statistics, for the whole repository as well as for individual papers and authors. Unfortunately, it is not yet possible to get detailed statistics for a particular issuing agency and these calculations have to be done "manually" which can be rather time-consuming.

The majority of AC users are directed to the repository from a Google search (Google 47% and Google Scholar 8%); a number of searches was performed using simple or advanced option provided by the AC search engine, which shows name recognition among users.

Avano has been the sole marine and aquatic sciences OAI harvester. Developed by IFREMER, the French Research Institute for Exploration of the Sea, it gives access to more than 200 open archives. With the increasing importance of Google and Google Scholar, it seems now that the efforts of Avano have been superseded and the harvester will cease in the near future after five years of activity.¹¹



A large majority of deposits are from Europe, Canada and the USA, while the usage statistics show a broader, more varied picture with higher representation of developing countries. For example, Asian and South American deposits constitute subsequently 2% and 3% of a total number, while downloads by users in these regions are 20% in Asia and 6 % in South America. Downloads by African countries still remain moderate with only 6 percent of a total number for the period 2007-2012.

4. ASFA Trust Fund Project on Grey Literature for AC

ASFA Trust Fund provides funding for small projects that aim to increase visibility of grey literature from partner institutions through filling gaps in the ASFA bibliographic database as well as by digitization of documents and adding full text links to ASFA records.

For FAO, a long-term goal of its participation in Aquatic Commons is to assist in providing access to legacy collections from institutions and projects in developing countries that have never been easily accessible. FAO's support for the Aquatic Commons is primarily aimed at content development and mainly intended to assist institutions in developing countries to improve visibility and access, sharing and preservation of fisheries and aquaculture management publications.

The ASFA Trust Fund Project "Published and Grey Literature of African Aquatic/Fisheries Institutions for Aquatic Commons" aimed to retrospectively digitize grey literature from developing countries, and to provide links to the full text for those documents already cited on the ASFA Database or to create new ASFA records where they are not yet available. The project was executed by FAO's Fisheries and Aquaculture Branch Library between 2010 and 2012. In total, almost 15,000 pages have been scanned, compressed and web optimized, metadata of the documents have been created and 754 PDF files were uploaded and links to the ASFA Database have been added. Several participating issuing agencies have also received CD-ROM's of digitized documents for offline consultation, both in TIFF and PDF format.

Seven issuing agencies participated in the project: Fisheries Society of Nigeria (FISON); Institute of Marine Biology & Oceanography (IMBO), Sierra Leone; Nigerian-German Kainji Lake Fisheries Promotion Project (NGKLFP), Nigeria; Centre de Recherches Océanologiques (CRO), Côte d'Ivoire; Instituto de Investigação Pesqueira (IIP), Mozambique; Lake Kariba Fisheries Research Institute (LKRFRI), Zimbabwe; and Lake Victoria Fisheries Research Project (LVFRP- now Lake Victoria Fisheries Organization, LVFO), Kenya-Uganda-Tanzania.

5. Statistics and Usage Analysis: Examples of Repatriation

A lifetime of uploaded documents is still too short to conduct valid citation analysis for evaluation of the documents impact. Also, knowing that many of the project documents (for example, those from STREAM) are of technical rather than scientific nature, it can be assumed that those documents have their main impact in the area of practical application of knowledge, for example, in implementing new technologies in aquaculture. Other documents are related to fisheries management and will be of importance to managers and other stakeholders.

By applying IRS software for the usage analysis of the grey literature from selected issuing agencies in developing countries, the paper seeks to address a further evaluation of FAO's contribution to the content development of the repository, confirming the increasing visibility of and access to some baseline information in the field of fisheries and aquaculture published by institutions and projects in developing countries.

Firstly, we focus on the Technical Documents published between 1998 and 2001 by the Lake Victoria Fisheries Research Project, a regional project on the African lake.

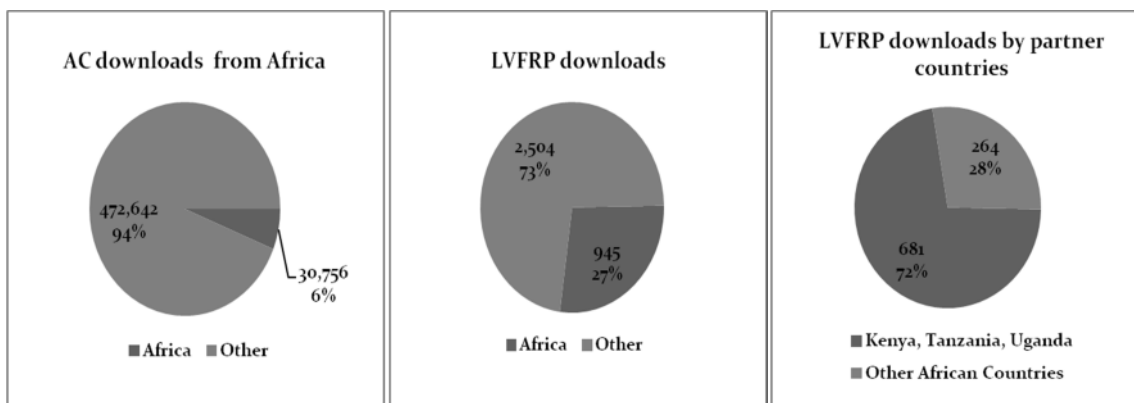
Secondly, we analyze the usage of the documents published by the Support to Regional Aquatic Resources Management (STREAM) during 2000-2009, which was based in Bangkok, Thailand.

These project documents are examples of digital preservation and repatriation to the countries of origin, two of the main objectives for FAO's participation in the AC repository.

Downloads of all project documents were analyzed for geographic origin. Whereas downloads that originated from the project region were paid closer attention than downloads that originated from other areas, in order to evaluate impact of the project documents for the whole region and for the country of their origin in particular. Raw data analysis allowed conclusions to be drawn regarding user search strategies and dynamics of uploading and downloading activities, as well underpinning some assumptions on the repository name recognition and web crawlers downloads. The analysis shows that significant number of downloads for the period 2010-2012 comes from a range of IP addresses in France: these are most probably web crawlers. Starting with 3,2 % in 2009, at present every 10th download is done by a robot. In order to maintain the reliability of the analysis of LVFRP and STREAM documents, and taking into account that 87% of all French downloads are from this IP range, downloads originated from French IP addresses were excluded from our analysis.

5.1. Lake Victoria Fisheries Research Project

The Lake Victoria Fisheries Research Project (LVFRP) aimed at creating a framework for the management of the Lake's fisheries, with the objective of improving the management of its resources. The Lake Victoria Fisheries Management Plan, published in 2001, is based on the concept of co-management, which includes stakeholders at local, regional, national and international level; the Plan has been adopted by the Council of Ministers of the Lake Victoria Fisheries Organization (LVFO). The LVFRP Technical Documents have been digitized by the Trust Fund project and in total 75 records have been added to the repository.



Statistics show a correlation between download activity and national involvement into specific regional projects by the riparian countries - Kenya, Tanzania and Uganda. While indicating a comparatively low download activity for the entire repository by the African continent (6 % of the total number of downloads), the statistics indicates higher usage (27 %) of the repository by African users for the Lake Victoria regional project based in Africa. A close look into this project statistics reveals a high interest towards those documents by countries involved in the project. 72 percent of the total number of project document downloads comes from the countries bordering Lake Victoria - Kenya, Tanzania and Uganda. Some of the project documents were quite intensively downloaded by users in developed countries. For example, tracking one of the referring IP addresses for a document on ownership and co-management of Lake Victoria, we discovered that this document was included in the list of compulsory reading for university students in the Netherlands; 47 % of all downloads were presumably done by students between September-December 2011.

5.2 Support to Regional Aquatic Resources Management Project

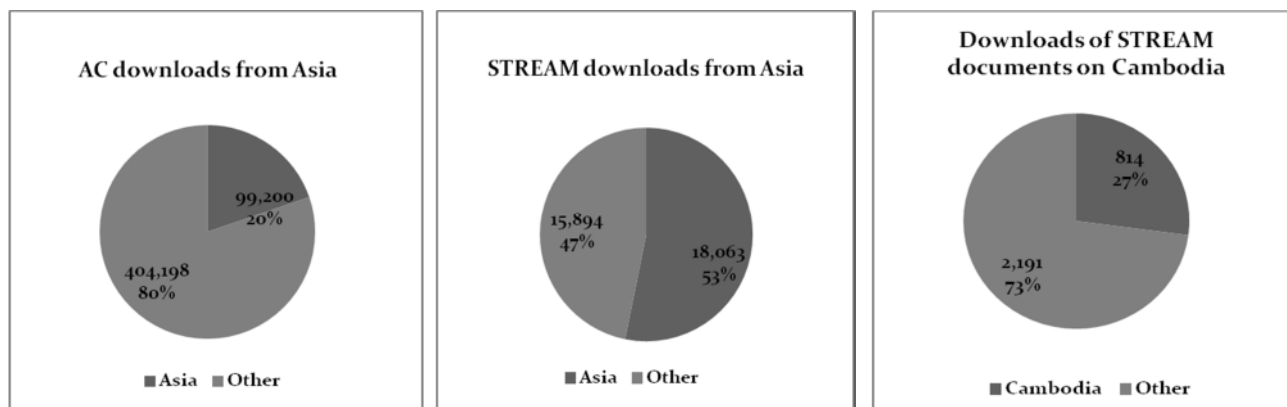
STREAM, the project “Support to Regional Aquatic Resources Management” was an initiative executed within the framework of the Network of Aquaculture Centres in Asia-Pacific (NACA). Besides NACA, partners included FAO, the Department for International Development of the UK (DFID), the Voluntary Service Organization (VSO) from the United Kingdom, and the Australian Government Overseas Aid Program (AusAID). The project aimed to support agencies and institutions to: 1) utilize existing and emerging information more effectively, 2) better understand poor people's livelihoods, 3) enable poor people to exert greater influence over policies and processes that impact on their lives, and 4) develop policies and processes of mediating institutions and capacity building. It adopted an approach where stakeholders engaged in aquatic resources management participated actively in the development of the Initiative.

The STREAM Initiative was based at the NACA Secretariat in Bangkok, but operated in several Asian-Pacific countries, including Cambodia, India, Indonesia, Lao PDR, Myanmar, Nepal, Philippines, Vietnam and China.

A large part of the published outputs of the project have been added by FAO to the AC between 2008 and 2010. All 126 uploaded documents were so-called “born digital” and were originally available on the STREAM Web site.

The website of the STREAM Initiative had a short lifespan and was only up from July 2002 to June 2008. Since then electronic copies of the documents produced by STREAM have been hard or even impossible to find, if it were not for the AC. Documents from the STREAM Initiative are good examples of preservation; without the AC, hardly any of the documents would still be available on the Internet.

The usage statistics for the STREAM documents show a similar picture as that of the documents of the Lake Victoria project. Although one-fifth of all downloads from the repository are from the Asian continent, more than half of all downloads of the STREAM project documents come from users in Asia. Once again a high percentage of downloads comes from the “country of origin” or the country covered by the documents.



6. Conclusions

Based on the results of the usage analysis of the repository it can be concluded that the digitization of grey literature published by fisheries and aquaculture institutions in developing countries increases overall **access and sharing** of information, contributes to **preservation** and enables **repatriation** to the countries of origin.

By participating in the AC, institutions in developing countries are challenging some of the information constraints, outlined in FAO Technical Guidelines for Responsible Fisheries 12, such as lack of awareness of and access to historical and baseline information, poor opportunities to publish and disseminate the results of research as well as dispersion of information between various government agencies, scientific and academic institutions and industry.¹² Through the Aquatic Commons, fisheries and aquaculture grey literature has found a new and much wider audience, and is integrated into the international information exchange.

Providing access to, and sharing of this historical and baseline information through the AC further enables issuing agencies to solve a problem of inadequate ICT support as well as to avoid costly and wasteful duplication of effort.

Destructive natural disasters which heavily affect tropic and sub-tropic coastal areas in developing countries may cause serious damage to grey literature print collections. Also, damage caused by human factor, such as lack of or poor knowledge transfer, short-sighted managerial decisions, language barriers,

can be a reason of a permanent loss of the only available hard copy of the document. Digital preservation of grey literature on fisheries and aquaculture originating from developing countries ensure availability of these unique documents for future generations.

Repatriation of digital documents was carried out in two ways. Firstly, after signing the permission to upload the documents by third party, the issuing agency, retaining its copyright, has access to their documents in the AC repository. Additionally, they receive a CD containing electronic copies of the documents. The agency can create links on their website to the full text of these documents in the AC repository. Secondly, in a broader context we can talk about the repatriation to Internet users in the country of origin.

FAO's Fisheries and Aquaculture Branch Library will continue to promote the participation of institutions in developing countries in the Aquatic Commons and will seek to undertake digitization projects in the future.

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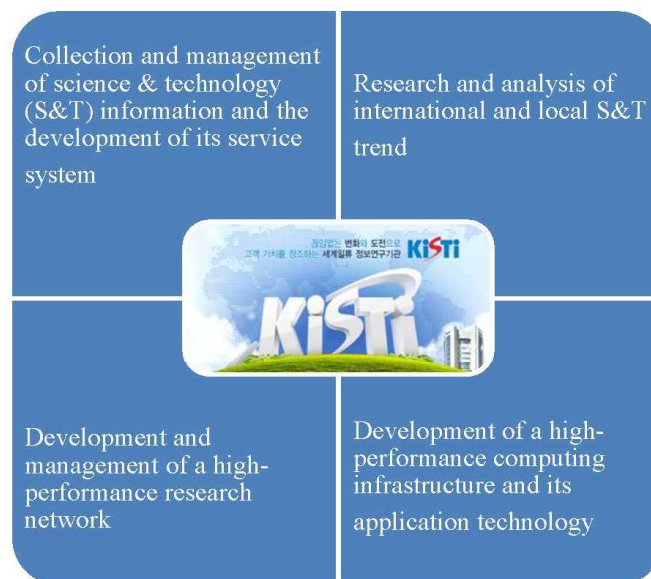
Korea Institute of Science and Technology Information (KISTI)

English version - <http://en.kisti.re.kr/>

* Vision

World-class information research institute creating values for customers

* Main functions



* Management and service of Korean R&D reports

KISTI exclusively manages, preserves, and serves Korean R&D reports for citizens and government officials. It provides Korean R&D reports and their information with National science & Technology Information Service (NTIS) and National Discovery for Science Leaders (NDSL).

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The research life cycle and innovation through grey literature in nanotechnology in Korea *

Seon-Hee Lee and Hye-Sun Kim (Korea)

Abstract

This paper studied the research life cycle of nanotechnology (NT) and its innovation through grey literature in the form of technical reports in Korea. The changes in the numbers of publications of grey literature and white literature in NT show the process of innovation, as technical reports and journal articles contain research results. Numbers of publications of Korean technical reports on National Discovery for Science Leaders (NDSL) and journal articles on Web of Science Science Citation Index Expanded (WoS (SCIE)) are compared year by year. In general, the technical reports were produced at an earlier date than journal articles on the Web of Science. Grey literature contains creative ideas and research output, and reflects the early stage of nanotechnology and thus provides a means of tracing innovation in a specific field of science and technology in Korea.

1. Introduction

Grey literature such as technical reports, conference proceedings, etc. contains creative ideas, suggestions and research results. Researchers in science and technology fields use them for literature reviews and produce them to share their research output in the research life cycle. Scientists and researchers conduct R&D and write technical reports and then publish the research output in domestic and overseas journals. In this process, innovation in a certain field can be traced through an analysis of grey literature. The process of nanotechnology development can be revealed through comparison of literature publications such as grey literature and white literature.

Nanotechnology emerged in the 1980's and has become one of the six technologies funded by the Korean government. Nanotechnology in Korea reflects the nation's innovation in science and technology. A similar situation can be seen in other developed countries. MIT selected 'nanopore sequencing' as one of 10 emerging technologies for 2012 and the World Economic Forum chose 'nanoscale design of materials' as one of the top 10 emerging technologies for the same year. Nanotechnology became one of leading technologies to change world.

This paper verified that the grey literature has contributed innovation of nanotechnology in Korea through case study. The goal of this study is to analyze the research life cycle of nanotechnology (NT) and trace innovation in Korea through grey literature in Korea. First, the Korea Institute of Science and Technology Information (KISTI) conducted in-depth interviews and close observations of 24 researchers working in NT to analyze the NT research life cycle. Second, to trace innovation through grey literature, the numbers of publications of Korean technical reports in NT appearing on National NDSL and journal articles on Web of Science Science Citation Index Expanded (WoS (SCIE)) were countered and compared. The numbers of technical reports funded by Korean government on NDSL and journal articles written by Korean researchers on WoS (SCIE) from 1980 to 2011 were counted and compared. I assumed that the changes of numbers of publications of grey literature and white literature in nanotechnology show the process of innovation, because technical reports and journal articles contain research results. Research output is often evaluated by numbers of publications in renowned journals listed on Web of Science, Scopus, etc. The research output in the literature can be read, highly cited, and developed by other researchers.

2. The Research Life Cycle in Nanotechnology in Korea

2.1. Needs of analysis of the research life cycle in Korea

As a national information center for science and technology, KISTI should be aware of the information environment of domestic researchers and provide a stable system. To prepare for the changeable information environment, recognition of the R&D research life cycle is important. The R&D research life cycle in nanotechnology is to reveal the Korean situation.

According to Encyclopedia Britannica, 'nanotechnology' is the manipulation and manufacture of materials and devices on the scale of atoms or small groups of atoms. The 'nanoscale' is typically measured in nanometers, or billionths of a meter (*nanos*, the Greek word for "dwarf," being the source

* First published in the GL14 Conference Proceedings, February 2013.

of the prefix), and materials built at this scale often exhibit distinctive physical and chemical properties due to quantum mechanical effects. Although usable devices this small may be decades away (microelectromechanical system), techniques for working at the nanoscale have become essential to electronic engineering, and nanoengineered materials have begun to appear in consumer products such as nano-silver toothbrush, nano laundry detergent, etc. The field of nanotechnology and nanoscience covers a broad area of expertise. Classical fields of physics, chemistry, material science, electrical/mechanical/chemical engineering, and medicine, are all involved in the new field of nanoscience. Furthermore research and development in this area is naturally multi-disciplinary. Nanotechnology includes nanoelectronics, nanomechanics, nanomaterials, nanomedicine, bionanotechnology, etc.

2.2 Conducting in-depth interviews and close observations

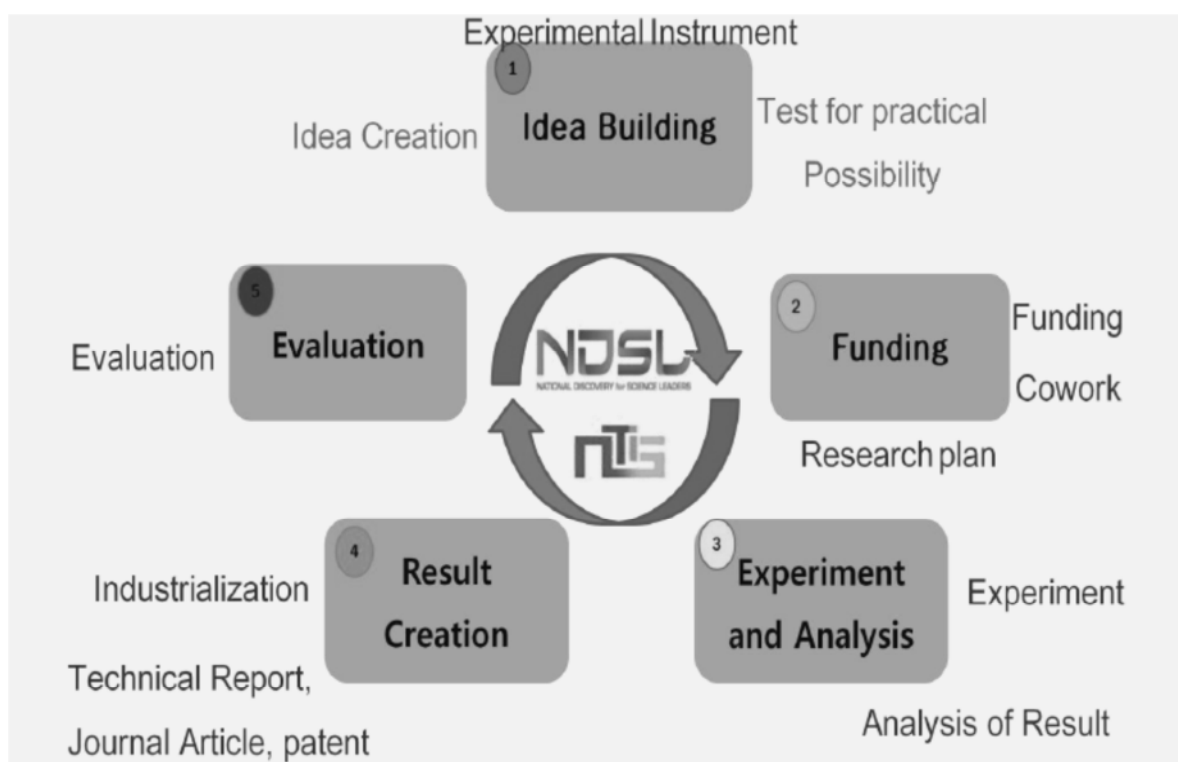
In-depth interviews and close observations were conducted in 2011 to shed light on the R&D research life cycle in nanotechnology. Twenty-four researchers working in the field of nanotechnology at the universities and research institutes were interviewed. The interviews were conducted from March to April 2011 for a month.

2.3. Analysis of research life cycle

According to the study, the research life cycle in nanotechnology can be divided into 5 stages (Fig. 1): idea building, funding, experiment and analysis, result creation, and evaluation. In idea building stage, researchers create idea, design experiment with instruments, and then test for practical possibility. In funding stage, researchers look for funding, write research plan and proposal, and seek out coworkers. In experiment and analysis stage, researchers conduct experiment and analyze research results. The results of creation appeared in technical reports, journal articles, and patents and became industrialized. The last stage of the research life cycle is the evaluation. In evaluation stage, research results are evaluated by funding agencies or other researchers. The stage doesn't end in the evaluation but it is influencing the new idea building stage for new projects. Therefore new research life cycle will begin. Research drives innovation in science and technology as well as human life. Research is undergoing revolution.

Needs are different in every stage of the research life cycle but needs for literature reviews through technical reports, patents, trends, and journal articles are evident in every stage of the research life cycle. The researchers use grey literature and white literature in every stage of the research life cycle and also produce both forms of literature.

<Fig. 1> the Research Life Cycle in NT

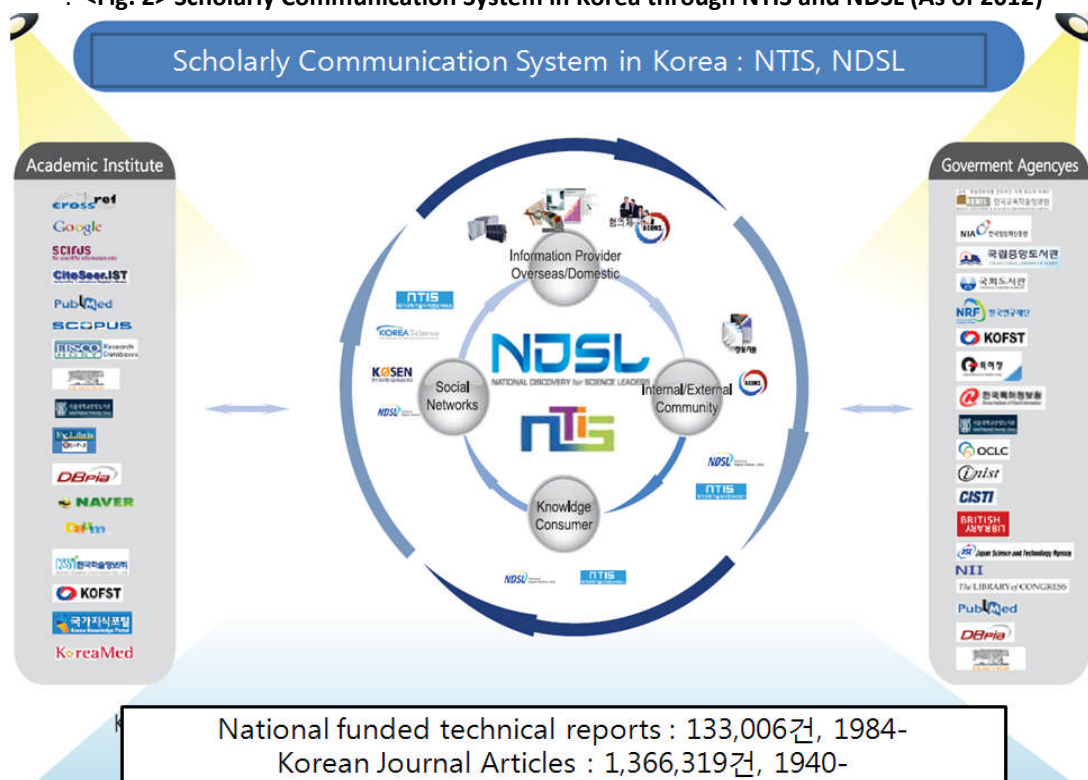


3. Tracing innovation through grey literature

3.1 Scholarly Communication System based on NDSL and NTIS in Korea

The scholarly communication system in Korea is based on National Science and Technology Information System (NTIS) and National Discovery for Science Leaders (NDSL). The research results by scholars and researchers are collected in the forms of technical reports of national research and development projects through NTIS and journal articles are archived through the Article Contribution Management System (ACOMS). Researchers are should upload their technical reports and journal articles on the systems via the internet directly. The grey literature and white literature uploaded then provided to the public through the NDSL portal system. NDSL provides 133,006 titles of technical reports funded by the Korean government since the 1980'- and 1,366,319 Korean journal articles since 1940'-. NDSL also provides other domestic and overseas science and technology information such as patents, standards, fact data, etc. Researchers are both knowledge creators and consumers for NDSL, NTIS, and other domestic and overseas networks. They also communicate through internal and external communities and social networks in the research life cycle to share ideas and new discovery.

. <Fig. 2> Scholarly Communication System in Korea through NTIS and NDSL (As of 2012)

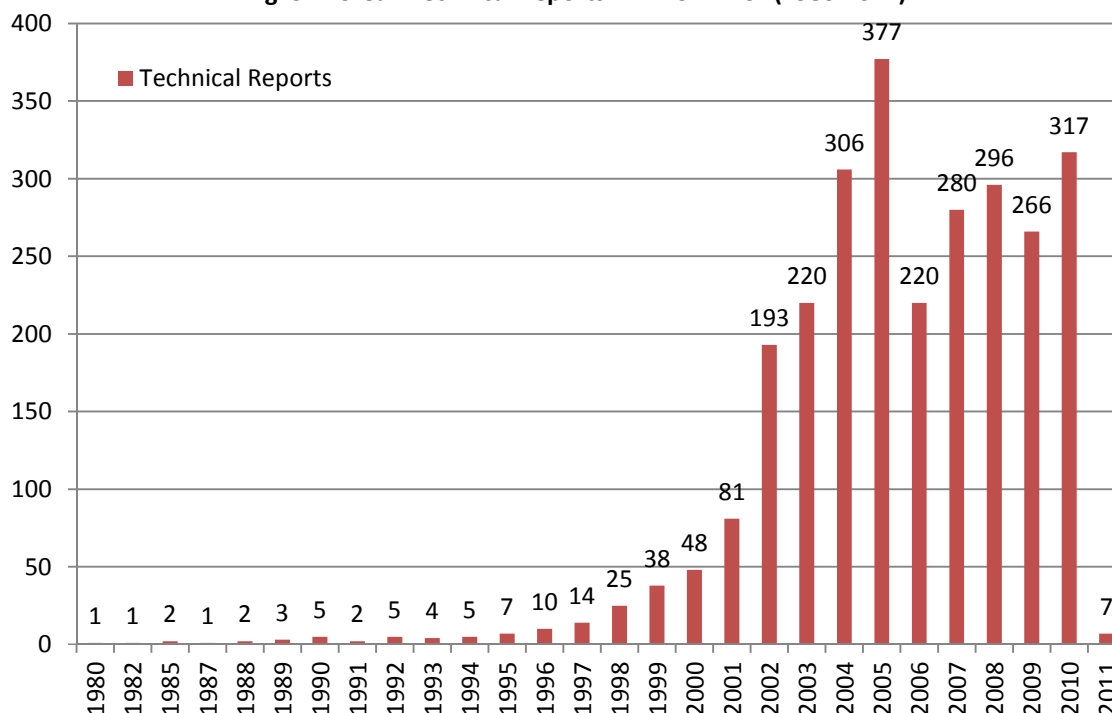


3.2 Comparison of Technical Reports on NDSL and Journal Articles written by Koreans on WoS (SCIE)

3.2.1 Data of Technical reports on NDSL and Journal Articles on WoS (SCIE)

- Data: technical reports funded by Korean government in nanotechnology on NDSL Technical reports on nanotechnology funded by the Korean government have been published since 1980'-. Technical reports published by private enterprises were not included in this study. To extract records of technical reports on nanotechnology on NDSL, key word searching was used. The keywords were 'nano*' or '나노*'. The total numbers of technical reports was 2,736. The peak year of publication of technical reports was 2005. 377 titles were published in 2005. The number fell to 7 in 2011 (Fig. 3). The early stage of research development of NT appears in the grey literature in the form of technical reports.

<Fig. 3> Korean Technical Reports in NT on NDSL (1980-2011)



As a multidisciplinary field, nanotechnology is related to numerous subjects such as applied physics, engineering and allied operations, chemical engineering and related technologies, metalworking processes and primary metal products, physics, ceramics and allied technologies, organic chemistry, precision instruments and other devices, etc. (Table 1).

<Table 1> Subjects of technical reports related to NT on NDSL

No	Subjects	Records
1	Applied physics	1,021
2	Engineering and allied operations	423
3	Chemical engineering and related technologies	299
4	Metalworking processes and primary metal products	272
5	Physics	255
6	Ceramic and allied technologies	251
7	Organic chemistry	234
8	Precision instruments and other devices	156
9	Technology applied sciences	111
10	Chemistry and allied sciences	103
11	Sanitary and municipal engineering Environmental protection engineering	85
12	Textiles	76
13	Other branches of engineering	60
14	Miscellaneous branches of medicine Surgery	47
15	Crystallography	44
16	Technology of other organic products	41
17	Physical chemistry	37
18	Elastomers and elastomer products	32
19	Food technology	30
20	Technology of industrial chemicals	29
21	Pharmacology and therapeutics	28
22	Systems	27
23	Heating, ventilating, air-conditioning engineering	22
24	Manufacturing	20
25	Civil engineering	19
26	Cleaning, color, coating, related technologies	19
27	Life sciences, biology	17
28	Inventions and patents	16
29	Light and infrared and ultraviolet phenomena	15
30	The others	

- Data: Journal Articles written by Korean in NT on WoS (SCIE)

In WoS (SCIE), journal articles that are written by Koreans, funded by Korean government and sorted by the subject 'Nanoscience nanotechnology' are selected. The numbers of journal articles on Web of Science (SCIE) are used as evaluation criteria of R&D productivity at institutional, national, and global levels. There were no articles in the 1980's but journal articles written by Koreans have been increasing dramatically since 1990'.

The subjects of journal articles on WoS (SCIE) related to nanoscience and nanotechnology include materials science multidisciplinary, physics applied, chemistry multidisciplinary, physics condensed matter, chemistry physical, engineering electrical electronic, metallurgy metallurgical engineering, optics, biotechnology applied microbiology, etc (Table 2).

<Table 2> 10 Subjects related to NT Journal Articles on Web of Science

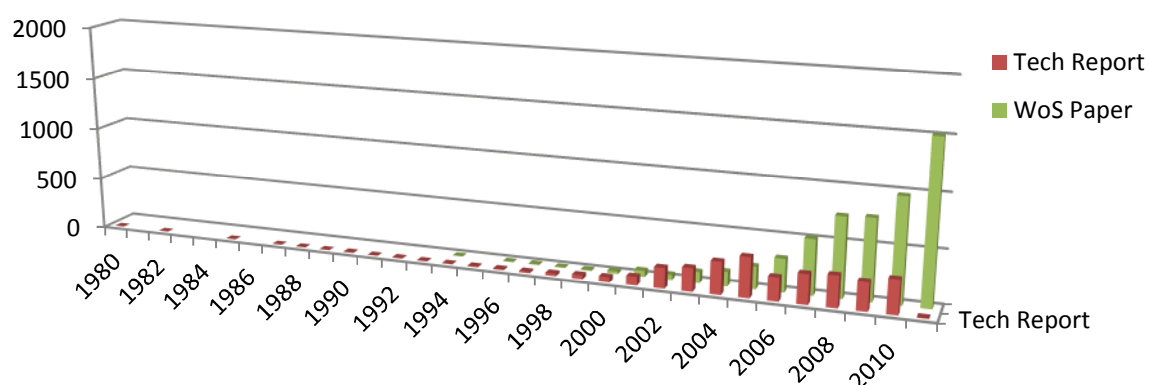
No	Web of Science Categories	records	% of 5428
1	Nanoscience nanotechnology	5428	100
2	Materials science multidisciplinary	4660	85.851
3	Physics applied	3644	67.133
4	Chemistry multidisciplinary	2659	48.987
5	Physics condensed matter	2365	43.57
6	Chemistry physical	1682	30.987
7	Engineering electrical electronic	535	9.856
8	Metallurgy metallurgical engineering	354	6.522
9	Optics	161	2.966
10	Biotechnology applied microbiology	138	2.542

3.2.2 Comparison of Technical Reports on NDSL and Journal Articles on WoS (SCIE)

2006 was the turning point for dominant literature in nanotechnology. The trend moved from grey literature to global level white literature (Fig. 4). The numbers of WoS (SCIE) publications has exceeded those of technical reports since 2006. WoS (SCIE) journal articles written by Korean in NT are still increasing. Nanotechnology became one of six technologies supported by the Korean government and the second most funded technology by the Korean government. In 2011, nanotechnology became the 10th most published subject in WoS journal articles written by Koreans.

However, technical reports fell dramatically in 2011. Technical reports or grey literature provided creative ideas and research results in the early stage of development of NT in Korea. When global level R&D was conducted, the research results appeared in WoS (SCIE). Grey literature was the driving force behind increasing of white literature in NT. These results indicate that innovation in NT has been taking place through grey literature. Grey literature contains the birth and early development of innovation in NT in Korea.

<Fig. 4> Comparison of Publication for White Literature and Grey literature (1980-2011)



Conclusion

The R&D research life cycle in nanotechnology in Korea can be divided into 5 stages. R&D researchers in nanotechnology use grey literature and white literature throughout the research life cycle. In general, researchers produced technical reports when they finished their R&D projects in the research creation stage. Grey literature contains important information, but it is difficult for other researchers to access it due to its method of distribution. The NDSL provides research output in technical reports, paper articles, etc through internet. published in Korea. Grey literature played an important role in the early stage of development of nanotechnology in Korea. Researchers later try to submit and publish their research output in well known journals such as those on the WoS, so that their results can be read and highly cited by other researchers.

Innovation in nanotechnology can be traced through grey literature, especially technical reports on NDSL. Technical reports in nanotechnology emerged the 1980s, peaked in 2005, and then reduced rapidly. 2006 is the turning point of the changing dominant literature in NT from grey literature and white literature. Grey literature contributed development of NT in Korea in early stage of research. Journal articles written by Korean in nanotechnology on the WoS (SCIE) appeared in the 1990's and has increased dramatically until now. NT became the 10th most published subject in WOS (SCIE) papers written by Koreans in 2011. NT became one of six major technologies supported by the Korean government in 2011. NT was the second most funded technology by the Korean government in 2011. NT has influenced to other subjects, created knowledge, and changed human life. Innovation through grey literature is in progress in other area of science and technology.

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Characteristics and use of grey literature in scientific journal articles of Algerian researchers: A case study of the Houari Boumediene University of Sciences and Technology *

Lydia Chalabi (Algeria)

Abstract

This paper examines the use of grey literature in research articles of Algerian teacher-researchers across the STM sciences (Physics, Chemistry & Computer science) at the Algerian University of Science and Technology --USTHB. Each of these disciplines are highly ranked according to the report of the Algerian General Directorate of Scientific Research and Technological Development, which reports on the top emerging disciplines in Algeria. The purpose of the study is to investigate the importance and use of electronic resources, particularly grey literature, in scientific journal papers and to identify the characteristics of these resources. The methodology consists of both quantitative and qualitative components. The quantitative part of our sample consists of five articles per year for each discipline: physics, chemistry, and computer science. One thousand twenty-eight references were examined. These were derived from 60 Algerian teacher-researcher journal articles published in international scientific journals and reflected in Scopus. The study attempts to provide insights into the characteristics of the grey literature used in a range of disciplines.

Keywords: Grey Literature, Open Access, Algerian University of Science and Technology Houari Boumediene (USTHB), Algerian researchers, Algerian teachers, STM, Physics, Chemistry, Computer science.

Introduction

The advent of the Internet, and the World Wide Web in particular, has had a huge impact on the publishing of science where new forms of circulation and access to knowledge have emerged, namely open access. Additionally, a strong need to assess the effectiveness of scientific research has emerged. The latter must be consistent with knowledge of current communication modes and the changing needs of users.

Significant amounts of funds are allocated for electronic resources to be integrated into the academic sphere and for which an analysis on the return on investment is indispensable. Studies that provide this analysis allow for guidance in the offering of services. [1]

However, even with the proliferation of studies of electronic resource usage and open access platforms, it should be noted that few studies in this regard cover developing countries in general, or Algeria in particular.

In fact, the Algerian scientific research makers are aware that the evaluation of scientific research is an absolute necessity [2], in order to create and promote national policies for research and development that include infrastructure and digital services. We also note several incentives for financing scientific research programs and investment in some large commercial scientific publishers (Boukacem, 2010).

While there is a considerable range and variety of grey literature useful to researchers, most of the need is for academic materials. This type of literature is not easily accessible, especially for developing countries. Many studies are made on issues of vital importance to the growth and development of scientific research, but which are not widely distributed and can be difficult to find [3].

In this regard, our study focuses on the analysis of teacher-researcher patterns in physics, chemistry and computer science, at USTHB - the first Algerian university in terms of publications (Thomson Reuters in January 2012) - in terms of information retrieval, characteristics and place of the grey literature in the research activity and the communication of results, in this era of electronic resources and open access.

- What are the habits of Algerian researchers regarding information retrieval?
- How important and what are the characteristics of the grey literature publications cited in scientific research?

* First published in the GL14 Conference Proceedings, February 2013.

Interest and objective of study

This study is the first of its kind and can be seen as a contribution to stimulate interest in an issue that we consider important to Algerian researchers. It is also of interest to research institutions for evaluating how to orient and improve their acquisitions, information policy, and information dissemination. It also contributes to the study of the impact of open access on the publication patterns of Algerian researchers.

Hypothesis

To achieve these objectives, we made two assumptions that formed the basis for our data collection:

- Grey literature is used in the research of Algerian researchers, particularly in scientific articles.
- Algerian researchers use open access grey literature retrieved mostly on the Web.

Methodology

Our case study is the Houari Boumediene Algerian University of Sciences and Technology – USTHB. It is ranked first among the top ten Algerian universities in terms of publications according to the report of the Algerian leadership of research and development [4]. Therefore the discipline choice is focused on physics, chemistry and computer science, which are ranked among the top 10 emerging disciplines in Algeria [5].

Our methodology consists of two parts: quantitative and qualitative.

Quantitative part

Our sample consists of five articles per year for the years 2009 to 2012.

These journal articles are referenced in one of the biggest databases of citations and referencing known worldwide --Scopus [6].

The selection of items is based on the following points:

- Period: 2009-2012
- Most cited journals articles
- First author affiliated to USTHB

1028 references were examined and derived from 60 Algerian teacher - researcher journal articles published in international scientific journals and referenced in Scopus from 2009 to 2012.

Qualitative part

After the quantitative part, it was necessary to find "on the ground" qualitative confirmation of diversity and convergence of practices observed among the researchers interviewed.

In this section we conducted semi-structured interviews with a sample of 12 teachers and researchers - including men and women, PhDs, lecturers and teachers – in the areas of physics, chemistry and computer science, all from the faculties of USTHB.

The interview grid was based on the following:

- research and teaching disciplines
- time devoted to research and teaching
- habits and practices regarding information retrieval
- use and characteristics of grey literature

The interviews lasted between 40 minutes and 1 hour 30 minutes and were conducted during October and November of 2012 in the offices of the faculty, which allowed for access to the material environment, organizational documentation, and resources used.

During these meetings, the teacher-researchers explained their habits and practices related to their information research: sites consulted, characteristics, materials used...etc. [they showed their underlying reasoning, arbitrations, strategies and objectives] (Boukacem, 2010).

This part was useful in that it shed light on the context within which the teacher-researchers work at the university and helped with understanding whether or not it affected the integration of resources in their research.

However the biggest obstacle that we faced was to meet teachers to achieve the interviews. Obtaining the contact details of researchers was very difficult. They were not always visible on directories of researchers and if they existed, were not always up to date.

Results and discussion

The goal of our study was to define the use and to understand the researchers habits while looking for information - how electronic resources are accessed and how important grey literature is in their scientific publications.

1. Patterns in information research

The majority of the interviewed teacher-researchers admit having used the web to find the scientific literature from their homes or internet cafes in particular. This is due to connection problems at the University and when connections exist, it does not necessarily permit good information retrieval and downloading of full text, due to slow speeds. The interviews confirmed the almost exclusive use of Google as a search engine and allowed us to understand that consultation of other electronic resource platforms is limited and insufficient. Contingent access provided by institutions (difficulty, slow connections) is cited as an obstacle to the use of electronic documentation. Also for the Algerian online national system of documentation "SNDL" [7], the interviewees reported shortcomings in terms of supply and services, adding that connection problems drove them most of the time to give up.

Another aspect that emerged from this analysis was that teacher-researchers manage their information research by using Google for the supervision of doctoral theses, through contacts with colleagues or an internship. We noticed random and inefficient information search behaviour, indicating a need for web training, as well as training on additional platforms for electronic resources.

2. Place and characteristics of grey literature

According to the quantitative information as shown below, the use of grey literature differs from one discipline to another. The higher frequency of citation of this kind of literature comes from computer science and the lowest frequency from chemistry. (Table 1)

This difference is due to the characteristics of information research for each discipline. The interviews correlated with what we said earlier, that in some disciplines, researchers prefer simple research, which guarantees broader results, even if they are not well organized.

In other disciplines, such as chemistry, the interviews allowed us to understand that the majority of teacher-researchers prefer to include items that are more highly cited and not difficult to identify.

The teacher-researchers have a limited time to read as they have teaching activities parallel to their research. They have administrative and educational responsibilities and also have to publish regularly in places recognized by the community. The information we have gathered during the interviews shows clearly that this practice is more prevalent among the more experienced users, with scientific and administrative responsibilities, combining the roles of "reader-author-reviewer".

The grey literature used consisted of five documents type: theses, conference papers, working papers, reports and data collections, where the conference papers showed the majority of uses. (Table 2). For accessibility and full text retrieval of grey literature, qualitative and quantitative results revealed that most of the full text could be found freely on the web. (Table 3)

Table 1. Volume of grey literature references

	Physic			Chemistry			Computer science		
	N° of all	N°of grey	Percentage	N° of all	N°of grey	Percentage	N° of all	N°of grey	Percentage
2009	94(100%)	9	9,57 %	62(100%)	1	1,62 %	57(100%)	24	42,06 %
2010	90(100%)	6	6,66 %	68(100%)	4	5,88 %	120(100%)	45	37,5 %
2011	79(100%)	4	5,06 %	99(100%)	1	1,01 %	102(100%)	23	22,54 %
2012	75(100%)	8	10,66 %	68(100%)	0	0 %	114(100%)	50	43,85 %

Table 2. Characteristics of grey literature

Discipline	Year	N° of GL references	N° of conference	N° of thesis	N° of rapports	N°of working papers	N° of data collection
Physic	2009	9(100%)	88,88%	11,11%	0 %	0 %	0 %
	2010	6(100%)	66,66 %	16,66 %	0 %	16,66 %	0 %
	2011	4(100%)	75 %	0 %	25 %	0 %	0 %
	2012	8(100%)	87,5 %	0 %	12,5 %	0 %	0 %
Chemistry	2009	1(100%)	1 %	0 %	0 %	0 %	0 %
	2010	4(100%)	50 %	0 %	25 %	0 %	25 %
	2011	1(100%)	100 %	0 %	0 %	0 %	0 %
	2012	0(100%)	0 %	0 %	0 %	0 %	0 %
Computer science	2009	24(100%)	79,16 %	20,83 %	0 %	0 %	0 %
	2010	45(100%)	77,77 %	11,11 %	6,66 %	4,44 %	0 %
	2011	23(100%)	95,65 %	0 %	4,34 %	0 %	0 %
	2012	50(100%)	82 %	14 %	2 %	2 %	0 %

Table 3. Accessibility of documents

Discipline	Year	N° of references	GL	Accessibility by a pay platform	Open access	unpublished
Physic	2009	9(100%)		3(33,33%)	3(33,33%)	3(33,33%)
	2010	6(100%)		1(12,5 %)	1(12,5 %)	4(66,66%)
	2011	4(100%)		1(25%)	3(75 %)	0 %
	2012	8(100%)		4(50 %)	4(50 %)	0 %
Chemistry	2009	1(100%)		0 %	0 %	1 %
	2010	4(100%)		0 %	3(75 %)	1(25%)
	2011	1(100%)		0 %	0 %	1(100 %)
	2012	0(100%)		0 %	0 %	0 %
Computer science	2009	24(100%)		9(37,5 %)	10(41,66 %)	6(25 %)
	2010	45(100%)		10(22,22%)	20(44,44%)	15(33,33%)
	2011	23(100%)		5(21,74 %)	15(65,21 %)	3(13,04 %)
	2012	50(100%)		13(26 %)	30(60 %)	7(14 %)

Finding

This is an exploratory study that can be considered difficult in this type of work. Even within the limits of these difficulties; this study reveals characteristics of Algerian teacher-researchers practices regarding information research.

The reality is that: Even the quantitative data reveals difficulties in the use of electronic resources by teacher-researchers, showing a marked lack of uniformity due to the environment in which they work and consult electronic resources. Autonomy and isolation lead to developing unproductive practices that are not homogeneous or proactive. This is true, despite the content that is offered, which is not enough.

As was clearly indicated by Schöpfel (2010) and Chalabi (2012), grey literature has found a means of dissemination on the web, especially in open institutional repositories, but its use differs from one discipline to another. More grey literature studies covering other developing African nations are necessary.

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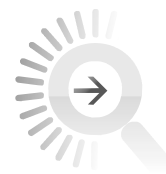
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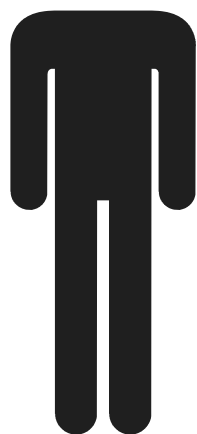
National Technical Library

National Technical Library (hereafter referred to as “NTK”) is a central professional library open to public, which offers a unique collection of 250 thousand publications freely accessible in open circulation. Its holdings form the largest collection of Czech and foreign documents from technology and applied natural sciences as well as associated social sciences. It contains a total of 1,2 Mil. volumes of books, journals and newspapers, theses, reports, standards, and trade literature in both printed and electronic forms. Besides its own collection, parts of Central Library of the CTU in Prague and Central Library of the ICT holdings are accessible in NTK.

For detailed information on the National Technical Library visit <http://www.techlib.cz/en/>

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As corresponds to its statutes, NTK manages – among others – the project of building the **National Repository of Grey Literature**.

The project aims at gathering metadata and possibly full texts of grey documents in the fields of education, science and research. The NTK supports an education in the field of grey literature through annual seminars in the Czech Republic.

For more information on the National Repository of Grey Literature visit our project Web site <http://nrgl.techlib.cz/> and for a search <http://www.nusl.cz/>

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Grey literature in Australian education*

Gerald White, Julian Thomas, Paul Weldon, Amanda Lawrence, Helen Galatis and Jess Tyndall
(Australia)

Abstract

The prevalence of informal publishing or grey literature in education appears to have increased as digital technologies have become main-stream, educators have become more proficient and policies have moved increasingly towards supporting its use. In addition, the take up of social networking technologies and innovative methods of digital publishing have encouraged educators to produce, distribute and share content and commentary. Grey literature may make a substantial contribution to education even though issues such as credibility, access and a lack of standards can pose problems for producers and users. This paper begins by providing a context for the discussion of grey literature within the broader policy and education environment in Australia. An overview of grey literature as it appears in education in Australia introducing evidence of its usage, dissemination and application in Australian education then follows. Evidence about the access, dissemination and use of grey literature is drawn from an examination of the characteristics of a leading social networking and digital publishing service that was used by educators in schools, training institutes and teacher education faculties. This evidence is discussed in the context of influential national, state and institutional policies that address the use of digital technologies in education. As the take up of digital technologies in education increases, there is an expectation that the access to, dissemination of and use of digital publishing by and for educators will increase and have an impact on online professional learning and awareness of education research and practices.

Introduction

Education and training is one of Australia's largest enterprises employing hundreds of thousands of people and engaging millions of students. In schools alone, in 2011, there were 290,854 teachers and 3,541,809 students (ABS, 2011). In the main, education is funded by State Governments of which there are eight (six States and two Territories) and the national Australian Government.

The publication of most materials in education such as reports, policies, curriculum, research, guidelines, surveys, speeches and conference papers is undertaken by governments and educational agencies none of which have commercial publishing as a primary function. Although major policies and resources can be readily located during their time of implementation and prominent public discussion, some may fall into obscurity over time because they have not been commercially published and catalogued or preserved. One such example was a major national initiative called Education Network Australia (EdNA). EdNA and the resources developed during its lifetime will be discussed in some detail in this paper, in order to raise the issues associated with non-commercially published materials.

Non-commercially published resources and materials are often referred to as grey literature. Unlike commercially published materials, grey literature often does not go through a rigorous quality control and production cycle before being made available to its intended audience (Lawrence, 2012, p. 4). This raises a number of practical issues, especially for educators who seek evidence for supporting national projects of innovation, change and improvement.

This paper raises some of the issues associated with grey literature in within an educational context. EdNA is used as an example to demonstrate the impact of such information on education. Two possible solutions that seek to address issues about grey literature in education are then discussed suggesting ways that education might overcome some of the disadvantages of grey literature although issues associated with intellectual property are not canvassed. Finally, the paper advocates further actions for educators to maximise and build on the body of important knowledge published as grey literature in education.

Background

The Australian Research Council (ARC) is a national body that advises the Australian Government on research funding. Its focus is on research and innovation for the benefit of the community and globally (Australian Research Council, 2012). The ARC is responsible for the provision of significant research funding to Australian Universities.

* First published in the GL14 Conference Proceedings, February 2013.

In 2011, Swinburne University of Technology, in collaboration with four industry partners and the University of Victoria, was successful in receiving funding for an ARC research grant to be conducted over three years. The research program titled *Grey literature, innovation and access to knowledge: realizing the value of informal publishing* began in late 2011.

The 'aims of the Grey Literature Strategies project are to:

- Define the role and value of grey literature and establish ways in which its impact and value can be evaluated and measured.
- Improve the way grey literature is produced and published in Australia in order to maximise its quality, impact and use.
- Improve access, retrieval and preservation of grey literature by collecting institutions, universities and other organisations.
- Build networks of collaboration across sectors active in producing and/or managing policy-oriented grey literature in order to build capacity for shared administration and technological development.' (Swinburne University, 2012).

The project will review the production, dissemination and collection of grey literature in Australia and develop best practice guidelines to maximize its benefits and use in public interest research (Swinburne University, 2012).

The partners who have joined with Swinburne University on this project include the National Library of Australia (<http://www.nla.gov.au>); the Eidos Institute (<http://www.eidos.org.au/>), a think-tank that focusses on the work-force, skills and productivity; the State library of Victoria (<http://www.slv.vic.gov.au/>) representing the National and State Libraries Australasia (<http://www.nsla.org.au/>) and the Australian Council for Educational Research (ACER) (<http://acer.edu.au>). ACER is heavily involved in the production and dissemination of grey literature in education and training, including through digital research projects such as the Digital Education Research Network (DERN) (<http://dern2.acer.edu.au>).

Grey literature definitions

There are many definitions of grey literature. The most commonly accepted definitions were originally agreed at the Luxembourg Grey Literature Conference in 1997 and then expanded at the New York conference in 2004. Grey literature was defined as a collective noun to mean, 'information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing i.e. where publishing is the not the primary activity of the producing body' (Farace, 1978; Farace & Frantzen, 2005).

There are those who would describe grey literature as information that is obscure, poorly distributed, of mixed value, ephemeral, of low value, less traded, less monetised and used in limited ways (Whitehead, 2012). Grey literature can be undated, the author not known and the body taking responsibility for the document obscure. In other words, grey literature is seen by some as difficult, disorganised and variable in quality.

The work of education and training in Australia is led and informed by the national and state governments through policies, white papers, discussion papers, inquiries, investigations, evaluations and guidelines all of which is grey literature. As such it is an important body of literature and there is a need for it to be readily locatable, accessible and retrievable from an organised source that has the capacity to manage and preserve electronic resources. Currently, in Australia, this is not the case and grey literature is dispersed, restricted and can give the impression of being hidden from public access. Much grey literature is lost to the education sector due to the discontinuation of services and a lack of policies to ensure its survival.

Australian education

Australian education is organised into a hierarchy of three tiers: schooling, training and higher education. Schooling operates from Kindergarten to year 12, training is vocationally and technically focussed for post-compulsory education, and higher education concentrates on studies for degrees and research.

In the school tier, there are three sectors that are comprised of: the public or state school sector catering for 66% of school students; the Catholic sector which educates 20% of students and the independent school sector with 14% of students (Australian Government, 2011, p. 4). In the training tier the Australian states manage 64 Technical and Further Education (TAFE) institutions on multiple

campuses in parallel with over 400 Registered Training Organisations (RTOs). Australia has 39 universities, 38 of which are publicly funded.

Although the Australian states have a legislative mandate to manage education and training, the Australian Government provides the bulk of the funding from taxation for schooling in the three schooling sectors. Therefore, policies, research, strategies and priorities in education emanate from both the national and the state governments. These documents are usually stored electronically on websites and disseminated by notification, usually from government websites. They are then commented on in the news media, which monitors education and training, and also by bloggers and microbloggers (eg Twitter) involved in education. Therefore, finding, accessing, retrieval and use of documents about education produced by governments and research bodies constitutes an important body of knowledge for educational leaders, teacher educators and practicing teachers as well as researchers.

The proliferation of grey literature is underlined further by research that found that more archeological information is made available via grey literature than printed literature (Houghton, 2012). There is no reason to doubt that this situation is similar in education and training. As broadband is implemented throughout Australia, and particularly in services such as education and training, internet usage will increase. As the use of the internet increases so too will the production and use of blogs (Thomas, 2008) and other forms of grey literature publishing that will be at the forefront of information dissemination about educational change and innovation.

Educational innovation

National education policies, arrived at through cooperation between education Ministers and senior education officers of the national and state governments, drive educational innovation in Australia. Currently, national policy programs such as the supply of a computer to all year 9-12 students, the development of a national curriculum, the implementation of national teacher standards and teacher professional development, and the distribution of funds for special programs to improve equity for Aboriginal students, disabled students and students in poverty are central to educational improvement, innovation and change.

Each of the national programs mentioned above has produced a raft of documents from inquiries, policies, research, reports, speeches, guidelines, articles and scholarly papers. Researchers wishing to locate these documents need to be aware of the national priorities and where documents for these are stored. However, a number of issues associated with this tranche of documents become apparent in their production, dissemination and access. These issues can be seen more clearly by examining one such national project that has now been completed: EdNA¹.

EdNA was a national project that ran for fifteen years from 1995. It was managed by a national agency charged with the responsibility for its maintenance and development, and consulting with the national government and the state governments about its provision of services and strategic direction. The national consultative processes were undertaken through a range of collaborative electronic and physical means such as digital services, websites, blogs, group spaces, listservs, emails, video-conferencing meetings, distribution of papers and the like. Each of these processes produced a vast amount of important educational and technological literature as the project progressed.

The EdNA website in 2009 had a database of 43,368 items that had been evaluated against developed content guidelines and manually added metadata to improve the speed and accuracy of document locations. These items were aimed at supporting the use of digital content and services in education and training. There were three million additional linked resources accessible via a real-time federated search function of significant international databases of educational resources including research. EdNA also supported 35,349 educators engaged with collaborative professional groups and email distribution services. The production of knowledge was substantial by the users of these EdNA services. This knowledge included not only the policies, research and strategies related to the project and the many national high level groups that collaborated on the project but also advice from expert groups, international bodies and teacher support materials.

In 2010 the EdNA service was closed by senior education officials following a stakeholder review which did not take into account or consult with EdNA users. The EdNA users were the people who had engaged with and benefitted from the service. None of the aforementioned electronic resources and materials is officially available today and cannot be accessed. However, a subjective selection of resources including some research and reports were unofficially stored on Australia's electronic archive called Pandora². In addition, the research, strategy, consultation and management documents

associated with the project and developed by the national technology agency responsible for the management of EdNA are also not available. All in all, the pioneering work of a large number of professional educators, educational leaders, researchers and experts has been lost to posterity, research and historical analysis.

The question that then emerges is, 'Why was this information lost?' In a small and limited enterprise losing information may be understandable. However, education and training in Australia is a very large enterprise that in 2011 consumed 7.1% (Australian Bureau of Statistics, 2012) of the national income; that is \$94 billion. An innovative and ground breaking national project such as EdNA can have a lasting impact on future policy and innovation upon which education and training is advanced. Today, the national collaborative physical and online processes that were conceived and tested by EdNA are used in the development of the national curriculum. However, the EdNA resources and materials were lost because they were not archived and preserved. Instead, the EdNA online service was shut down and most of the grey literature information that was in electronic formats vanished.

The capacity to bring important information together into one accessible database or multiple databases connected in real-time, and to archive and preserve important information should be a central function of all online services that produce and disseminate important literature. The next two sections discuss ways in which grey literature can be harnessed to enable searching, accessing, retrieving, usage, archiving and preservation.

Integrators or grey literature curators

A number of online websites provide integration services within a specific field. An integration service can be a web service where a group of discipline experts aggregate and curate information in one place for access by interested users. An example of an integration service is the Digital Education Research Network (DERN) (<http://dern2.acer.edu.au>) managed by the ACER (<http://www.acer.edu.au>). DERN is a research service that concentrates on and specialises in the use of digital technologies in education for the purpose of improving learning. DERN provides a research news and review service that also facilitates access to research archives and a database of digital education research. It is focused on servicing teachers, educators, researchers, policy makers and digital education commentators.

Each week DERN distributes an email notifying users about research news and also a review of a significant research article, paper or report. Predominantly, the news and research reviews that are provided on DERN are about works that have been openly published and are freely accessible for viewing and often for downloading. News and research reviews of articles and papers available in commercially published journals are rarely cited on DERN because they are inaccessible to the general user. DERN is an aggregator and curator of grey literature in the field of learning using digital technologies and digital media.

Of note is the observation that it would appear that the bulk of research, scholarly papers, policy statements and strategic documents about the use of digital technologies in education and training are openly available and published as grey literature. Integration services such as DERN (<http://dern2.acer.edu.au>) support educators and educational researchers to locate, access, disseminate and use grey literature in the field of digital technology. Integrators such as DERN bring highly skilled expertise to concentrate on the provision of a service in a specific field of inquiry that removes many of the barriers inherent in grey literature. However, if web services that contain significant research that has been reviewed by DERN and linked to DERN is not preserved and archived then, it may also be lost to research and knowledge building.

A framework for harnessing grey literature

Another method for systematically harnessing grey literature in a specific field of research or scholarly endeavour was developed by Jessica Tyndall, Medical Librarian at the Flinders University in South Australia. Tyndall (2008) developed a framework in order to systematically collect and evaluate grey literature for use by students, researchers and scholars. Tyndall (2008) listed the types of grey literature that may be encountered by scholars and researchers, and then went on to propose that grey literature could 'be critically appraised for strength and validity using a simple approach ... [by] marrying the concept of "expert opinion/insider knowledge" with the general principles used to evaluate web resources' (p. 5).

Tyndall (2008) identified the essential characteristics of grey literature and argued that the following criteria checklist 'has the flexibility to be applied to the widest range of resources: from models of primary healthcare to dissertations, maps, diaries, podcasts, blogs and so on' (p. 6). The criteria in the Tyndall checklist include:

- Authority,
- Accuracy,
- Coverage,
- Objectivity,
- Date, and
- Significance.

Tyndall (2008) abbreviated these grey literature characteristics as AACODS for brevity and as a memory aide. Each criterion is explained in some detail and the researcher is able to use them to evaluate resources from a grid of inquiry locations based on possible sources of information.

An example using Tyndall's (2008) framework to systemically build a search schema for a discipline can be seen in Table 1. In Table 1, the AACODS criteria have been listed in the centre with the types of possible information sources shown on the left and levels of search on the right. Each located item can then be evaluated by using Tyndall's criteria and sorted for sources and levels of information.

Tyndall AACODS framework			
Possible sources	Criteria for each item	Levels	
Govt policy/strategy reports	<i>Authority</i>	Open	Local
Blogs	<i>Accuracy</i>		National
Projects	<i>Coverage</i>		International
Conferences	<i>Objectivity</i>		
Newsletters	<i>Date</i>		
Web services	<i>Significance</i>		

Table 1: AACODS framework

A researcher can develop a schema for research by adapting the Tyndall (2008) AACODS framework for application in a specified field of inquiry. Although this framework is not exhaustive, it is sufficiently general to be applied to wide variety of disciplines and provides an excellent starting point for locating and evaluating grey literature in a specific discipline.

Conclusion

Grey literature as defined in this paper is being relentlessly produced by a range of government, businesses and research bodies. Education and training in Australia is a large and ever changing enterprise that is dependent on government funding. Change and innovation often occurs in education and training at the national level as a result of policy, strategy and funding shifts. The documentation produced by local, state and national education and training projects in the course of such shifts in policy and priorities is published by governments, national agencies and research institutions. Information about innovations also emerges from conferences, workshops, newsletters and blogs.

The increasing proportion of grey literature emanating from education and training innovations although important is obscure, difficult to locate and access, of mixed value and used in limited ways. However, major national projects have compounded these ephemeral characteristics of educational grey literature through a lack of attention to archiving and systemic preservation. Grey literature that is not archived contributes to the loss of an important body of material on which education could build and advance.

The importance of grey literature in education and training cannot be underestimated. As the take up of digital technologies in education escalates, there is an expectation that the access to, dissemination of and use of digital publishing by educators and for educators will increase and have an impact on online professional learning and awareness of education research and practices.

There are ways in which grey literature can be preserved which include access to expert integration online services such as DERN (<http://dern2.acer.edu.au>) where the searching, curation and aggregation are done for the user. A grey literature search framework is another way that can empower researchers to build a search schema for systematically locating, accessing, retrieving, using and applying open information in a specific scholarly discipline. The Tyndall (2008) AACOD grey literature framework is one such method for developing a schema for systematically researching and evaluating grey literature.

In order to maximise the use of grey literature in education and training, there is a need to systematically collect, store, archive and preserve important information as a body of knowledge for posterity, research and historical analysis. Further research is warranted into the role of grey literature in order to improve access, retrieval and preservation of important information produced as grey literature.

The Australian Council (ARC) Linkage Project 2012-2014 titled *Grey Literature Strategies: Enhancing the value of informally published research and information* led by Swinburne University in collaboration with five partners which includes the Australian Council for Educational Research (ACER) (<http://www.acer.edu.au>) is one such grey literature research effort. Progress on the research project can be seen at <http://grey-lit-strategies.info/>.

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¹ A snapshot of a number of top-level layers of EdNA can be seen at http://apps-new.edna.edu.au/edna_retired/edna/go.html

² Pandora can be accessed at: <http://pandora.nla.gov.au/>

On the News Front

Enhanced Publications Project (EPP), Frequently Asked Questions

Dominic Farace and Jerry Frantzen, GreyNet International, Netherlands

Christiane Stock, OpenGrey Repository, INIST-CNRS, France

Paula Witkamp, Data Archiving and Networked Services, DANS, Netherlands

1. What does EPP stand for?

EPP stands for Enhanced Publications Project, an endeavor to capture and cross link metadata, research data, full-text, and post-publication data related to GreyNet's collection of conference preprints in the OpenGrey Repository <http://www.opengrey.eu/search/request?q=greynet>

2. What is meant by cross-linking?

Because of diverse and varied formats, research data require a robust data archive for storage, retrieval, and preservation. DANS Archive provides such capabilities. Cross-linking takes place when persistent identifiers assigned to GreyNet's records in DANS become part of the metadata in the OpenGrey Repository. In turn, the persistent identifier or handle assigned to GreyNet records in the OpenGrey Repository is included in its corresponding DANS record. Cross-linking thus allows the user to navigate easily among the full range of available data and information contained in an enhanced publication.

3. What are the preferred formats for research data?

Research data is considered first and foremost to be reusable, statistical data in formats such as Excel, SPSS, etc. Also accompanying these primary data files are other accepted files such as audio-visual, text files, spreadsheets, statistical files, databases, and the like. Often such data are too extensive for the page confines on a published article; however they are integrally related to the research. DANS provides online access to a list of preferred and accepted file formats <http://www.dans.knaw.nl/sites/default/files/file/EASY/DANS%20preferred%20formats.pdf>

4. Is DANS the only data archive for GreyNet related research?

The author/researcher may opt to submit his/her research data to another national or resident data archive. If so, the author/researcher is responsible to provide GreyNet with the persistent identifier assigned to the record so that GreyNet can complete the cross-linking.

5. Who is responsible for the input of research data?

The author/researcher can submit his/her data to GreyNet, who in turn will input the research data and carry out the cross linking. Or, the author/researcher can directly input his/her data in DANS or another data archive of choice. In such cases, the full-text paper and accompanying data file(s) should be uploaded at the same time the data record is created. Text entered in the "Description field" should aim to describe the research data. Also the term 'grey literature' should be included in the "Subject field". Further, links to both OpenGrey www.opengrey.eu and GreyNet www.greynet.org should be included in the "Relation field". To facilitate direct data entry in the DANS Archive, visit www.dans.knaw.nl/sites/default/files/file/factsheets/Factsheet%20Your%207%20steps%20to%20sustainable%20data%20DEF.pdf

6. Is retrospective input of research data welcome in the DANS Archive?

Yes, all research data related to GreyNet's collection of conference preprints from 1994 till the present are actively solicited for entry in DANS. Click [here](#) to access GreyNet's collection of research data in the DANS Archive.

7. Who stands to benefit from open access to research data?

First and foremost the authors and researchers, who are then followed by other stakeholders in the information chain. Open access to research data inherently contributes to the review process, visibility of grey literature, and scholarly communication within and among the sectors of government, academics, business and industry. While the author/researcher may opt for restricted access to their data, non-restricted open access is preferred.

Fifteenth International Conference on Grey Literature

The Grey Audit: A Field Assessment in Grey Literature

Slovak Centre of Scientific and Technical Information

CVTI SR, Bratislava, Slovak Republic, 2-3 December 2013



Conference Program - Day One

9:00-10:30

Conference Chair, Ing. Ľubomír Bilský, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia

OPENING SESSION

Welcome Address	Prof. Dr. Ján Turňa, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia
Opening Paper	Mgr. Marta Dušková, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia
Keynote Address	Prof. Dr. Debbie L. Rabina, Pratt Institute, School of Information and Library Science, USA

11:00-12:45

Day Moderator, Dominic Farace, GreyNet International, Netherlands

SESSION 1 – TECHNOLOGY ASSESSMENT

Beyond open source: a technology assessment of open standards and validation tools in the era of Cloud computing and a SaaS case study Panagiotis Stathopoulos, Nikos Houssos, Prodomos Tsiavos, and George Stavrou, National Documentation Centre; National Hellenic Research Foundation, Greece

Digital Preservation at INIS, International Nuclear Information System Dobrica Savic and Germain St-Pierre, Nuclear Information Section, International Atomic Energy Agency, Austria

Effect of Open API, NDSL Open Service (NOS) on Sharing Technical Reports in Korea Seon-Hee Lee and Hyun-Mi Hwan, Korea Institute of Science and Technology Information, KISTI, Korea

Grey literature and development of agricultural research in Cameroon Valère Djidere, Dschang University Library, Cameroon

Collecting Grey Literature from Africa: a case study on the African Section Pamphlet Collection at the Library of Congress Mattye Laverne Page, Library of Congress, African and Middle Eastern Division, USA

13:45-15:30

SESSION 2 – SUSTAINING GOOD PRACTICES

Towards Guidelines for Incorporating the Grey Literature in Systematic Reviews in Management Studies Richard Adams, University of Exeter, United Kingdom

PATLIB Centre: why are we grey? Mária Harachová and Ľubomír Kucka, Slovak Centre of Scientific and Technical Information CVTI SR, Slovakia

Contribution to the improvement of dissemination of grey literature - JAEA Library's efforts for collecting, organizing and disseminating information on nuclear accidents Kiyoshi Ikeda, Takeshi Ohshima, Mayuki Gonda, Shun Nagaya, Misa Hayakawa, Yukinobu Mineo, Minoru Yonezawa, and Keizo Itabashi, Japan Atomic Energy Agency, JAEA, Japan

Guiding the Grey: The Implementation and Evaluation of a Journal Club amongst a Librarian and Clinical Practice Guideline Developers – A Cancer Care Case Study Marcus Vaska, Knowledge Resource Service (KRS), University of Calgary; Xanthoula Kostaras, Elysa Meek, Emily MacLeod, Inderjeet Sahota, Melissa Shea Budgell, Brae Surgeoner, Guideline Utilization Resource Unit, Alberta Health Services, Cancer Care, Canada

GreyGuide - Guide to Good Practice in Grey Literature: A Community Driven Open Resource Project Stefania Biagioni and Carlo Carlesi, ISTI-CNR, Italy; Joachim Schöpfel, University of Lille, France; Dominic Farace and Jerry Frantzen, GreyNet International, Netherlands

16:00-17:00

INTRODUCTION TO CONFERENCE POSTERS

CONFERENCE RECEPTION

17:00-18:30

International Conference Series on Grey Literature celebrating its Twentieth Anniversary, 1993-2013

Fifteenth International Conference on Grey Literature

The Grey Audit: A Field Assessment in Grey Literature

Slovak Centre of Scientific and Technical Information

CVTI SR, Bratislava, Slovak Republic, 2-3 December 2013



Conference Program - Day Two

9:00-11:00
POSTER SESSION AND SPONSOR SHOWCASE SEE LIST OF POSTERS BELOW

The main entrance hall and adjoining rooms will accommodate up to twenty-five conference posters. For information on the availability of space and further guidelines on posters, please contact TextRelease.

11:00-12:45

Day Moderator, Dobrica Savic, Nuclear Information Section, International Atomic Energy Agency, Austria

SESSION 3 – RESEARCH AND DATA

Open academic community in Poland: social aspects of new scholarly communication models as observed during the transformation period Maciej Ostaszewski, Information Processing Center, OPI, Poland

A Challenge of Research Outputs in GL Circuit: From Open Access to Open Use Sergey Parinov, CEMI, Central Economics and Mathematics Institute, RAS Russian Academy of Sciences; Mikhail Kogalovsky, Market Economy Institute of Russian Academy of Sciences; Victor Lyapunov, Institute of Economics and Industrial Engineering Siberian Branch of Russian Academy of Sciences, Russia

Information support of research information interactions of PhD students in Slovakia Jela Steinerová and Andrea Hrková, Comenius University Bratislava, Slovakia

The SK CRIS system as a source of unique information about scientific activities and their outcomes Danica Zendulkova and Juraj Noge, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia

Auditing Grey in a CRIS Environment Keith G. Jeffery, Consultant, United Kingdom and Anne Asserson, University of Bergen, Norway

13:45-15:30

SESSION 4 – TOWARDS INFORMED POLICIES

Understanding the value of grey literature for public policy in Australia: Initial survey results Julian Thomas and Amanda Lawrence, Swinburne University of Technology; John Houghton, Victoria University; Gerald White and Paul Weldon, Australian Council for Educational Research, Australia

Grey Literature in European Commission Projects Sara Goggi and Gabriella Pardelli, Istituto di Linguistica Computazionale; Silvia Giannini and Stefania Biagioni, Istituto di Scienza e Tecnologie dell'Informazione, CNR, Italy

Back to Grey: Disclosure and Concealment of Electronic Theses and Dissertations Joachim Schöpfel, Charles de Gaulle University Lille 3 / ANRT – GERiCO and Hélène Prost, CNRS, France

For better or for worse?: Effects of the Legal Deposit Act no. 20/2002 and e-publishing on access to grey literature in Iceland Stefánía Júlíusdóttir, University of Iceland, School of Social Sciences, Iceland

Scholarly publishing behaviour in Slovakia – Are we ready for repositories? Jana Ilavská, Marcela Kopecká, Miriam Ondrišová, Jaroslav Šušol, Comenius University in Bratislava, Faculty of Philosophy, Slovakia

15:45-16:15

CLOSING SESSION – REPORT CHAIR AND MODERATORS, CONFERENCE HANDOFF, FAREWELL

Conference Chair and Moderators Ľubomír Bilský, CVTI SR; Dominic Farace, GreyNet and Dobrica Savic, NIS-IAEA

POST CONFERENCE TOUR OF CVTI SR

16:15-17:30

Guided by Marta Dušková and Ľudmila Hrková, Slovak Centre of Scientific and Technical Information

Fifteenth International Conference on Grey Literature

The Grey Audit: A Field Assessment in Grey Literature

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CVTI SR, Bratislava, Slovak Republic, 2-3 December 2013



Conference Program - Day Two

POSTER SESSION AND SPONSOR SHOWCASE

9:00-11:00

(Continued)

Technology Transfer Support on National Level *Ľubomír Bilský and Miroslav Kubiš, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia*

The attitudes of a research community between open access publishing and quality assurance: A case study *Maria Castriotta, Italian Workers' Compensation Authority, INAIL; Rosa Di Cesare, Daniela Luzi, and Fabrizio Pecoraro, National Research Council, Institute for Research on Population and Social Policies, IRPPS, Italy*

A Study on the Improvement of Legal System for Collecting and Registering National R&D Reports *Kiseok Choi, Korea Institute of Science & Technology Information, KISTI, Korea*

Industrial Philology: problems and techniques of data and archives preservation for future generations *Alessandra Cinini, Sebastiana Cucurullo, Stefano Sbrulli, Manuela Sassi, Eva Sassolini, Istituto di Linguistica Computazionale, "Antonio Zampolli" CNR, Italy*

Measuring interdisciplinarity within the bio-related scientific areas *Izabela Kijeńska-Dąbrowska, Information Processing Institute, OPI, Poland*

Central Repository of Theses and Dissertations – A Unique Umbrella Solution for a Significant Category of Grey Literature in the Slovak Republic *Juraj Noge and Július Kravjar, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia*

Life after Microfiches: The French National Centre for the Reproduction of PhD Theses, ANRT *Joachim Schöpfel, Charles de Gaulle University Lille 3 ANRT – GERiCO, France*

Data Management & Curation Services: Exploring Stakeholders Opinions *Plato L. Smith, Florida State University, FSU, USA*

PopVaT – Popularisation of Science and Technology in Slovakia *Patricia Stanová, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia*

Federal GL System Input Flow Analysis *Aleksandr V. Starovoitov, Aleksandr M. Bastrykin, Anton I. Borzykh and Leonid P. Pavlov, Centre of Information Technologies and Systems of Executive State Authorities, Russia*

„Gold Value“ Offer to Science and Research in Slovakia – is presented by the NISPEZ project and related activities *Mária Žitňanská, Michal Sliacky, Marián Vaňo, and Eva Králiková, Slovak Centre of Scientific and Technical Information, CVTI SR, Slovakia*

The main entrance hall and adjoining rooms will accommodate up to twenty-five conference posters. For information on the availability of space and further guidelines on posters, please contact TextRelease.

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An International Journal on Grey Literature

'TRACKING GREY LITERATURE ACROSS DISCIPLINES'

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