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CHAPTER 14

Information science research: what and how?

Research is to see what everybody else has seen, and to think what nobody else has thought.

Albert Szent-Györgi, Hungarian biochemist

There is nothing like looking, if you want to find something. You certainly usually find something, if you look, but it is not always quite the something you were after.

J. R. R. Tolkien (*The Hobbit*)

This is not a field that produces Wunderkinder, bright young things who make their mark at a precocious age. In fact, some of our sample members have kept their best wine until last. Creativity in academic information science is clearly not the preserve of callow youth . . .

Blaise Cronin and Lokman Meho (2007, 1954)

Avoiding useless results requires openness and transparency about how the data were gathered and a reasonable judgement that does not exaggerate what these data could possibly mean.

Elke Greifeneder and Michael Seadle (2010, 7)

Introduction

In this chapter we will consider the nature and purpose of information research, and the methods used to carry it out. We will give an overview with examples, without trying to go into the detail of any particular aspects.

There are a number of good textbooks covering information research methods. These all cover many of the topics in this chapter in much more detail than we give here. We will mention them now, and refer to them again only when they offer some particularly useful material. They should, however, be considered as valuable references for all of this chapter, offering a fuller treatment to material which we treat briefly here.

Two good texts giving a detailed coverage of the area are Alison Rickard's

information systems and computing (2006). Lawal (2009) gives a guide aimed specifically at library and information practitioners and students considering carrying out research, while Moore (2006) focuses on planning and managing information research. Texts on research methods generally may also be valuable, for example Denscombe's (2010) guide to social research methods. So also may be some texts on particular aspects of the information sciences; Donald Case's books (2007; 2012) on information and use, for example, give a very good overview of the research processes and methods used in this area.

Research is most simply regarded as the creation of new knowledge, though there are many different understandings as to what constitutes 'research'. For our purposes, it is helpful to restrict its meaning to the creation of knowledge which is new to everyone, not just to the researcher, in a form which can be communicated through objective information, and which builds on existing knowledge.

For disciplines with associated professional activities, such as the information sciences, research has two purposes: academic, to improve the discipline's knowledge base; and professional, to improve practice. This is the traditional difference between 'pure' and 'applied' research, but the divide is, in practice, rarely entirely clear.

Information research may be carried out by university professors and researchers, doctoral students, students doing dissertations as part of a taught course, research institutes and consultancies, government agencies, system and service designers and suppliers, and practitioners. An interaction between academics and practitioners is beneficial for both, as we will discuss later. As the opening quote from Cronin and Meho indicates, it can be carried out at any stage of a career, and is certainly not only for young people.

Research has been a part of the information sciences since they emerged as distinguishable disciplines and professions. The chapters on information behaviour, informetrics, information organization and information technology give examples of early research in these topics, and the ways in which the tools and methods of information research have developed.

Styles of information research

All styles of research are based in a philosophical viewpoint or paradigm, as kind discussed in Chapter 3, though this is not always explicitly recognized by researchers. A 'broad brush' distinction can be made between studies conducted from a positivist viewpoint, where it is assumed that an objective reality exists which the researcher may identify and study, and those conducted from a constructivist viewpoint which assumes that reality is subjective, and is constructed or interpreted by the researcher. For information research,

piece of information to a user, or the proper role of an information service, are objective facts which may be determined correctly, while the latter assumes that they are subjective, and created and modified by those involved. While information researchers need not be philosophers, it is important to recognize what assumptions are implicit in the methods used, and what assumptions or viewpoints they themselves hold which may affect their approach; see, for example, Burke (2007) for examples in the context of information management research.

A common distinction is between *quantitative* and *qualitative* research. These describe a difference in general style and ethos: in essence whether the focus is on measuring, counting and testing formally stated hypotheses or on an interpretation of the meaning of events, issues and opinions, in an attempt to gain understanding. In practice there is overlap. Few studies are solely one or the other. Each has its own ways of analysing the data generated in the research process. This may be statistical in nature for quantitative studies, where the research questions may be phrased as hypotheses to be proved or disproved at a certain level of statistical significance. Many information research studies, however, can find answers to their research questions by simpler quantitative methods, using mainly descriptive statistics. It is, of course, essential to plan the research starting with the questions, and working through the kind of results needed to answer them, and then to the data collection and analysis methods which will give those results. Collecting data first, and then wondering how to analyse it, is a recipe for failure, or at best wasted time.

It is sometimes believed that qualitative studies are somehow 'easier' than quantitative, but this is not so. Gorman and Clayton (2005) give a good overview of qualitative methods for information research, emphasizing that they are in no way less rigorous than quantitative methods.

General aspects of research methods

There is a very wide range of research methods and techniques used in our discipline. We consider them later in this chapter in three rough categories – surveys, experimenting, evaluating and observing; and desk research. This reflects the general crude categorization that, to find out about something we can: ask someone who has some insight; observe what happens; or examine relevant documents. In practice, in any real research or evaluation, there is some overlap, and 'mixed method' studies are increasingly common. The term 'triangulation' is used to describe studies which mainly rely on one method, but then use a second method to check the validity of the results; for example, questionnaire surveys may include some interviews. For more discussion and examples of triangulation methods, see Huntington and Gunter (2006) and Fidel (2008). Triangulation is such an important

carried out on a micro level, evaluating, for example, the content of a small set of literature, or a macro level, evaluating systems and services. Powell (2006) gives an overview of evaluation research in information topics. Research embedded in a practice context, where the aim of the research is the improvement of practice rather than an objective study of the situation, may be termed *action research*.

All research of whatever kind will involve an element of *desk research*, in the form of a literature review for context setting, and to establish if similar studies have already been done. For desk research proper, this will form an introduction, for example, a literature review of subject X will begin with a description and analysis of any previous reviews of that subject. 'Literature' here is defined very broadly, as it may include information in sources other than academic and professional literature. We will discuss these points, under the headings of desk research and of finding and evaluating earlier research.

All research which has any element of data collection will need to consider the question of sampling: how to know that an adequate number and range of cases have been included for the results to be valid, and how to know how generalizable to other situations the results will be. The sampling issue can be avoided only when all relevant cases are considered; for example, if one is studying some aspect of national libraries in the British Isles, it is feasible to study all of them. The extreme example of this is the case study, where a single example is studied in great detail. We will discuss sampling in more detail later.

Advances in information and communication technologies, allowing greater increased options for communication between researchers, and for collection, integration and analysis of large amounts of data, are leading to the new style of research, termed 'e-research' or 'e-science', as discussed in Chapter 10. This can affect information research directly, and information specialists may have a role in promoting and facilitating it.

All research, even small-scale and relatively informal studies, require careful planning; in particular, to ensure that all the resources needed, including access to people and systems to be studied, are in place, and that everything happens in the right order. All research also requires attention to: the analysis of the data collected, which must be planned before the collection stage; ethical issues; and presentation of results.

Research and the practitioner

It has always been considered desirable that information practitioners should carry out research and use research results, and academics in the information sciences should be aware of practice issues in planning and carrying out research.

in research results, still less in carrying out research themselves; the counter-prejudice has been that information researchers undertake 'useless' research, ignoring the needs of practice. Thirty years ago, Alan Blick, a well known information manager in the British pharmaceutical industry, was presenting this as a kind of contest or conflict between practitioners and researchers in information science (Blick, 1983). The debate rumbles on; see, for example, Haddow and Klobas (2004), Greifeneder and Seadle (2010), Powell, Baker and Mika (2002) and Hall (2010).

There is now a greater pressure for practitioners to be more involved in research, and in using its results, and for academics and other researchers to pay greater attention to dissemination of results in a way useful for practice: funders of research are increasingly requiring attention to be given to practical impact. Communication between the two groups is of obvious importance: some publishers are asking for statements of implications for practice to be made in the abstracts of information research articles. However, a study of the extent to which reports of research into information-seeking behaviour addressed the implications for practice found that while a majority did so, they did not do it well; most recommendations for practice were stated only vaguely (McKechnie et al., 2008). Wilson (2008) also comments on an increasing disconnection between the interests of researchers and practitioners in studies of users and user behaviour. There is still a long way to go, in this respect.

From the other side, it is of course necessary that practitioners are reminded of the value of using research in a routine way. A good example of the kind of promotion that would help here is IFLA's guidance on using research to promote literacy and reading (Farmer and Stricevic, 2011). Application of the ideas of *knowledge translation* may help in this respect (Garnett, 2011).

Much practitioner research is an integral part of reflective practice, and usually aimed at service evaluation and improvement. This has led some commentators to argue for library and information service provision to be fully 'evidence-based', or, with practice based explicitly on research results; we are very far from that situation. The idea of 'evidence-based practice' itself has been criticized as too narrow and mechanical an approach, by those who argue for practitioners to have a better understanding of research and theory; see Booth and Brice (2004) and Wilson (2011) for viewpoints.

Research methods for information science

As we have noted, there are many different methods which can be used for information science research, ranging from the experimental to the conceptual (Cronin and Brice, 2007). These may be categorized in various ways; each of the methods has its own categorization.

strategies: historical research; ethnography; surveys; evaluation; case study; action research; experiment; other strategy; mixed strategies. They also define 15 forms of data collection, which to an extent overlap with methods: questionnaire or interview; focus groups; journal entries; observation; inspection; content analysis; protocol analysis; bibliometric analysis; transaction log analysis; task analysis; historical source analysis; dataset construction; use of data collected earlier; other technique; more than one technique. They conclude, from an analysis of the literature and comparison with similar studies in the past, that all of this wide range of methods is important for information research, but that surveys and experiments are the predominant methods.

We will use the simpler three-way classification, justified above, to consider the main forms of information research, and the methods used for each: survey; experimenting, evaluating and observing; and desk research. We will do so only in outline, as full details of each are given in relevant chapters of the textbooks referred to earlier. We will give some examples of each from the literature; we emphasize that these are not intended as the 'best' examples, simply as typical of what is in the literature.

Research methods – surveys

This is, and has always been, the most common method for carrying out research in library and information science. It is the, crudely expressed, 'asking someone' style of research, and usually involves asking for the opinions and experiences of information users (actual and potential) and information providers. It is a method very much in the social science research tradition.

This approach is very commonly used in mixed-methods research, typically combining a survey with some form of observation. A small number of interviews will often be incorporated into research mainly relying on desk research or on some form of observation. Conversely, survey research will usually incorporate some element of desk research, if only for the initial literature survey.

Most library and information surveys are small-scale, rarely involving more than 100 participants, and are usually aimed at a closely defined group of people. They do not therefore usually adopt the rigorous methods of sampling and analysis used for purposes such as public opinion polling or large-scale market research. The main methods used for library and information surveys are questionnaires and interviews.

Questionnaires are usually regarded as being in the positivist/objective mode of research, since they assume that the researcher and those surveyed have a common perspective of the situation. A series of short, structured questions with prescribed answers (yes/no, Lickert scale, multiple choice) is generally used, with limited opportunity for expressing extra information, going beyond

responses quickly and simply, and for giving results which can be analysed quantitatively. However, the value of the results relies on the researcher having understood all the relevant factors, and expressed them in a way which the participants can understand.

Questionnaires are increasingly likely to be administered electronically, using software such as SurveyMonkey, rather than in printed form. This is convenient, and gives greater 'reach', but may mean that the population sampled, the response rate, and any bias in response, is unknown. If such a survey is placed on a website, for example, all that can be known is those who replied to it; the number who saw it, and did not respond, cannot usually be established, nor can whether there is anything different about those who responded and those who did not.

Interviews are regarded as appropriate for getting a greater, and richer, amount of information from a smaller number of participants. There are several forms of interview. *Structured interviews* resemble questionnaires, in that a pre-defined set of questions is asked, often requiring a choice of answer from a list. At the opposite extreme *unstructured interviews* have no predefined structure, and resemble a free-flowing conversation; they are most appropriately used in an exploratory way, in situations where the interviewer does not have a good understanding of the issues or context. An intermediate form, and often regarded as most appropriate for most library and information research is the *semi-structured interview*, where a number of predefined questions are always asked, but subsequent questioning will depend on the responses given. Interviews are sometimes referred to as *research conversations*, if the intention is to reach a consensus with the interviewee, or even to affect their views, rather than simply to gain information from them.

There are a number of issues around the conduct of interviews, which must be decided for each study, and often will be determined by practicality rather than theoretical considerations. They include:

- whether it is carried out face to face, or by telephone, internet chat, e-mail, or other means. In general, all other things being equal, those methods which allow tone of voice, facial expression, etc., to be noted will give richer information than others.

- the location of face-to-face interviews; interviewees are usually more relaxed and forthcoming in their own space.

- whether interviews are recorded, videoed, or taken down verbatim, or whether the interviewer takes notes; unless it is essential to have the exact words used, or to have a permanent record of the interview to ensure research quality or to allow

immediate feedback to be given to the interviewee on what the interviewer understands them to have said.

Interviews are usually carried out one-to-one, but may involve an interviewer with a group of interviewees. This may be useful on grounds of practicality and time saving, and also in allowing interviewees to discuss issues, reach consensus and spark ideas off each other; but equally they run the risk of being dominated by a small number of senior, or noisy, participants, so that other views are not heard. The terms *group interview* and *focus group* are used for this method; the latter more commonly when the motive is obtaining a 'group viewpoint' rather than just interviewing several people at once for convenience.

A tool specifically designed for reaching consensus within a group is a *Delphi study*. This brings a virtual group of participants together, typically by e-mail. They are asked individually to state their views on some topic. The researcher writes a summary of their responses, and sends it out to them for further comment; this process is repeated as many times as necessary. Usually two or three 'rounds' are enough to reach consensus, or to establish that there are two or more incompatible viewpoints.

An approach which may be used with any of the above methods is the *critical incident* technique. This asks participants to specify one particular occurrence of what is under investigation; for example, one occasion when use of a particular information source made a difference to their work. This approach avoids very general and bland responses, and is particularly useful in assessing impact of information systems and services.

When a survey is begun, the researchers may not be sure that the survey instrument (interview schedule, questionnaire, etc.) is quite right. A *pilot study* may therefore be carried out, with a small number of participants, to check the validity of the survey, and allow for changes to be made for the main survey. In a large-scale study, particularly if it is analysed quantitatively, the results of the pilot study would not be included, though in smaller surveys they are sometimes included.

The following list gives a selection of information research articles based on various forms of survey method.

Examples of surveys in information research

Please note that these are not recommended as 'best practice', simply as recent relevant examples.

Questionnaires

Attfield, S. I., Adams, A. and Blandford, A. (2006) Patient information...

- Bennett, R. (2007) Sources and use of marketing information by marketing managers, *Journal of Documentation*, 63(5), 702–26.
- Pálsdóttir, Á. (2010) The connection between purposive information seeking and information encountering: a study of Icelanders' health and lifestyle information seeking, *Journal of Documentation*, 66(2), 224–44.

Interviews

- Savolainen, R. (2010) Source preference criteria in the context of everyday projects: relevance judgements made by prospective home buyers, *Journal of Documentation*, 66(1), 70–92.
- Marcella, R. et al. (2007) The information needs and information-seeking behaviour of the users of the European Parliamentary Documentation Centre: a customer knowledge survey, *Journal of Documentation*, 63(6), 920–34.
- Mansourian, Y. and Ford, N. (2007) Web searchers' attributions of success and failure: an empirical study, *Journal of Documentation*, 63(5), 659–79.

Focus groups

- White, M. D., Matteson, M. and Abels, E. G. (2008) Beyond dictionaries: understanding information behaviour of professional translators, *Journal of Documentation*, 64(4), 576–601.
- Zuccala, A. (2010) Open access and civic scientific information literacy, *Information Research*, 15(1), paper 426, available from <http://InformationR.net/ir/15-1/paper426.html>.
- Burhanna, K. J. et al. (2009) No natives here: a focus group study of student perceptions of Web 2.0 and the academic library, *Journal of Academic Librarianship*, 35(6), 523–32.

Delphi studies

- Zhang, Y. and Salaba, A. (2009) What is next for Functional Requirements for Bibliographic Records? A Delphi study, *Library Quarterly*, 79(2), 233–55.
- Swanders, L. (2009) The future of information literacy in academic libraries: a Delphi study, *Portal: Libraries and the Academy*, 9(1), 99–114.
- Bois, C. (2007) Conceptions of information science, *Journal of the American Society for Information Science and Technology*, 58(3), 335–50.

Critical incidents

- Bois, C. et al. (2009) Electronic journals and...

immediate feedback to be given to the interviewee on what the interviewer understands them to have said.

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- Bennett, R. (2007) Sources and use of marketing information by marketing managers, *Journal of Documentation*, 63(5), 702–26.
- Pálsdóttir, Á. (2010) The connection between purposive information seeking and information encountering: a study of Icelanders' health and lifestyle information seeking, *Journal of Documentation*, 66(2), 224–44.

Interviews

- Savolainen, R. (2010) Source preference criteria in the context of everyday projects: relevance judgements made by prospective home buyers, *Journal of Documentation*, 66(1), 70–92.
- Marcella, R. et al. (2007) The information needs and information-seeking behaviour of the users of the European Parliamentary Documentation Centre: a customer knowledge survey, *Journal of Documentation*, 63(6), 920–34.
- Mansourian, Y. and Ford, N. (2007) Web searchers' attributions of success and failure: an empirical study, *Journal of Documentation*, 63(5), 659–79.

Focus groups

- White, M. D., Matteson, M. and Abels, E. G. (2008) Beyond dictionaries: understanding information behaviour of professional translators, *Journal of Documentation*, 64(4), 576–601.
- Zuccala, A. (2010) Open access and civic scientific information literacy, *Information Research*, 15(1), paper 426, available from <http://InformationR.net/ir/15-1/paper426.html>.
- Burhanna, K. J. et al. (2009) No natives here: a focus group study of student perceptions of Web 2.0 and the academic library, *Journal of Academic Librarianship*, 35(6), 523–32.

Delphi studies

- Zhang, Y. and Salaba, A. (2009) What is next for Functional Requirements for Bibliographic Records? A Delphi study, *Library Quarterly*, 79(2), 233–55.
- Swanders, L. (2009) The future of information literacy in academic libraries: a Delphi study, *Portal: Libraries and the Academy*, 9(1), 99–114.
- Bois, C. (2007) Conceptions of information science, *Journal of the American Society for Information Science and Technology*, 58(3), 335–50.

Critical incidents

- Attfield, S. I. et al. (2009) Electronic journals and...

- Kraaijenbrink, J. (2007) Engineers and the web: an analysis of real life gaps in information usage, *Information Processing and Management*, 43(5), 1368–82.
- Weightman, A., Urquhart, C., Spink, S. and Thomas, R. (2009) The value and impact of information provided through library services for patient care: developing guidance for best practice, *Health Information and Libraries Journal*, 26(1), 63–71.

Mixed methods

- Nicholas, D., Rowlands, I. and Jamali, H. R. (2010) e-textbook use, information seeking behaviour and its impact: case study – business and management, *Aslib Proceedings*, 36(2), 263–80 [questionnaires, focus groups, web log analysis, analysis of sales and library circulation data].
- Craven, J., Johnson, F. and Butters, G. (2010) The usability and functionality of an online catalogue, *Aslib Proceedings*, 62(1), 70–84 [interviews, focus group, observation with ‘think aloud’].
- Wilson, K. and Corral, S. (2008) Developing public library managers as leaders: evaluation of a national leadership development programme, *Library Management*, 29(6–7), 473–88 [Interviews, focus groups, questionnaires, observation].

Research methods – experimenting, evaluating and observing

This category of research covers a variety of methods. At one end of the spectrum are those described as *experimental*, based in a positivist, scientific world-view. At the other are methods of *observation* and interpretation, based in the traditions of ethnography and similar disciplines. They often have a common set of purposes, however, in being used to understand information behaviour, to evaluate the use and performance of information systems and services, and to give a basis for the improvement of such systems and services, and the design of new ones.

The experimental style of research in library and information science derives from the methods of the experimental sciences. The topic to be studied is isolated, so far as possible, from the complexities of the ‘real world’, so that all the variable factors in the situation can be held constant, apart from the ones being studied. Its opposite is *operation evaluation*, analysing the totality of an information service, and including all the ‘messiness’ of the real-world context. Experiment is an approach used particularly often in research into information retrieval and human-computer interaction, typically comparing algorithms and interfaces. Where users are involved, data on their success at using the system may be augmented by data gathered from special equipment, such as eye-

by conventional interview, or by ‘talk/think aloud’ or ‘talk/think after’ features of the experiment.

At the other extreme, observation is usually regarded as a technique for understanding a real-world situation, without affecting or controlling it at all (Baker, 2006); hence a phrase commonly used in the past, *unobtrusive observation*. The use of the so-called *mystery shopper* or *mystery visitor* is a modern variant.

The current trend is for observation, often used in conjunction with other data gathering methods, to be used in a way which draws from subjects and approaches such as anthropology, ethnography, and phenomenology or phenomenography, which emphasize a detailed interpretation of the situation from the viewpoint of those observed, and understanding as much of the context of their situation as possible. For overviews, in addition to chapters in the research methods textbooks, see Goodman (2011) and Bruce (1999).

The more unstructured ways of gathering qualitative data, typically based around observation, are sometimes referred to as *grounded theory*, often incorrectly, since this involves precisely specified and rigorous forms of analysis, see relevant chapters in the research method textbooks, and the article by Tan (2010) for details. Grounded theory can be a valid and valuable method, as shown by the information research examples given below; however, it should only be used with an understanding of its nature.

A new form of observation has become possible with the move to a largely digital information environment; the ability to analyse the logs of websites and search engines, to establish exactly what a very large number of users are doing, in a way not possible with printed information. However, such log analysis cannot give any explanation for why users are doing what they do, nor how satisfied they are; it is therefore often combined with other methods, typically interviews.

Research studies of the kinds noted above can be used for the very practical purpose of the *evaluation* of the performance of information systems and services. Here, research overlaps very much with practice, since the monitoring of performance should be a routine activity for information providers, using tools such as standard sets of performance indicators, user-satisfaction surveys and cost-benefit analyses. ‘Research’, in the context of the evaluation of operational systems, tends to mean particular exercises or projects, such as an *information audit*, whose purpose is to enumerate and evaluate all the available information resources (Buchanan and Gibb, 2008), or an *impact study*, aiming to show the ‘real benefit’ to the users. Impact studies were discussed in Chapter 12 in the context of attempts to measure the value of information.

Similarly, they may lead to the equally practical issues of the design and implementation of new systems and services, or new features within existing

for the practitioner; they are typically regarded as 'research' when there is some novelty in the new system or feature, or when an established feature is introduced into a new context. Research into information needs and behaviour is also needed in order to develop or extend systems to go beyond incremental improvement of what is already available.

The next list gives a selection of information research articles based on various forms of experiment, evaluation and observation methods.

Examples of experiment, evaluation and observation in information research

Please note that these are not recommended as 'best practice', simply as recent relevant examples.

Experiment

- Vilar, P. and Žumer, M. (2011) Information searching behaviour of young Slovenian researchers, *Program*, 45(3), 279–93.
- Makri, S., Blandford, A. and Cox, A. L. (2010) This is what I'm doing and why: methodological reflections on a naturalistic think-aloud study of interactive information behaviour, *Information Processing and Management*, 47(3), 336–48.
- Boryung, J. (2007) Does domain knowledge matter: mapping users' expertise to their information interactions, *Journal of the American Society for Information Science and Technology*, 58(13), 2007–20.

Observation

- Reddy, M. C. and Spence, P. R. (2008) Collaborative information seeking: a field study of a multidisciplinary patient care team, *Information Processing and Management*, 44(1), 242–55.
- Ulvik, S. (2010) 'Why should the library collect immigrants' memories?': a study of a multicultural memory group at a public library in Oslo, *New Library World*, 111(3–4), 154–60.
- Allard, S., Levine, K. J. and Tenopir, C. (2009) Design engineers and technical professionals at work: observing information usage in the workplace, *Journal of the American Society for Information Science and Technology*, 60(3), 443–54.

Log analyses

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- Boon, S., Johnson, B. and Webber, S. (2007) A phenomenographic study of English faculty's conceptions of information literacy, *Journal of Documentation*, 63(2), 204–28.
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Ahmed, S. M. Z., McKnight, C. and Oppenheim, C. (2006) A user-centred design and evaluation of IR interfaces, *Journal of Librarianship and Information Science*, 38(3), 157–72.

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Research methods – desk research

The term ‘desk research’ covers the varied forms of research carried out by some kind of analysis of documents. This is a part of all research, in the form of a literature search to establish the context and to identify previous relevant work. It may provide the methods for studies in their own right, which are just as much valid research as any other, in as much as they have the potential to provide new knowledge and insights. Such studies will themselves be preceded by a literature review. See the section on ‘Finding and evaluating research’ below for more on the process.

Desk research is sometimes referred to as ‘literature research’ or, increasingly, ‘internet research’, although both these terms are too narrow to cover all forms of desk research. Several styles can be distinguished, although the distinctions are not sharp, and the terms are often loosely used; some studies cross the boundaries between styles.

Literature reviews are the most common form of desk research, and may form a study in their own right as well being a precursor to other research methods. They may be designated as *comprehensive* or *selective*, according to whether an attempt is made to cover all relevant material or only a subset which the reviewer finds significant. A *systematic review*, more common in subjects such as healthcare than library and information science, carefully defines and justifies the sources, search strategies and relevance criteria to be used, before material is identified. A review may be objective, in simply reporting what is in the literature, or subjective, in that the reviewer gives a judgement on the quality of the material and its content; the latter may be called a *critical review*. Reviews focused on an emergent or developing technology, and its prospects, may be termed *technology assessments*.

Meta-analysis and *meta-synthesis* are specific forms of literature review, in which a number of sources, typically individual research reports, are combined together, hopefully giving a more reliable and informative result than from any of the sources considered alone (Fink, 2010; Urquhart, 2010; Saxton, 2006). Meta-analysis deals with quantitative data by statistical analysis. It is difficult to

information papers are unhelpfully termed meta-analyses, when they are in fact ‘only’ qualitative, or semi-quantitative, literature reviews. Meta-synthesis is an equivalent process, but aimed at combining the results of qualitative studies.

Conceptual or philosophical analysis, perhaps the most theoretical form of desk research, sets out to analyse and clarify terms, concepts and issues within the information sciences.

Historical analysis analyses the historical development of issues within the library and information disciplines and professions. The most common form of this has been the description of the development of libraries and information institutions. These have been joined by analyses of the development of systems, services, processes, and concepts, and by studies of information phenomena in society.

Content analysis is a diverse form of analysis, always involving some kind of quantitative assessment of the content of a set of documents, to assess the extent to which concepts and issues are mentioned, or not (White and Marsh, 2006). It may include a qualitative dimension, to record *how* concepts and issues are described.

Discourse analysis is a form of content analysis, focusing on ‘discourse’; the way in which spoken or written language is used (Budd, 2006). It is used to analyse, often in detail, the way in which concepts and issues are mentioned, and what this shows about how they are understood.

Bibliometrics and *webliometrics* are quantitative methods for describing and analysing patterns of recorded communication. They are used to carry out research into such topics as: size and growth of information within disciplines; significant sources, authors, institutions and countries; linkages and influence between information producers; and changes in communication patterns. Results may be presented as simple counts or graphs, or complex maps. These methods have been discussed in more detail in the chapter dealing with informetrics.

The following list gives a selection of information research articles based on various forms of desk research.

Examples of desk research methods in information research

Please note that these are not recommended as ‘best practice’, simply as recent relevant examples.

Literature analysis

Davies, K. (2007) The information-seeking behaviour of doctors: a review of the evidence, *Health Information and Libraries Journal*, 24(2), 78–94.

Liew, C. L. (2009) Digital library research 1997–2007: organisational and people issues, *Journal of Documentation*, 65(2), 245–66.

information behaviour in assigned learning tasks, *Journal of Documentation*, 64(6), 893–914.

Meta-analysis

- Aabo, S. (2009) Libraries and return on investment (ROI): a meta-analysis, *New Library World*, 110(7–8), 311–24.
- Julien, C., Leide, J. E. and Bouthillier, F. (2008) Controlled user evaluations of information visualization interfaces for text retrieval: literature review and meta-analysis, *Journal of the American Society for Information Science and Technology*, 59(6), 1012–24.
- Webb, T. L. et al. (2010) Using the Internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behaviour change techniques, and mode of delivery on efficacy, *Journal of Medical Internet Research*, 12(1), available from <http://www.jmir.org/2010/1/e4/>.

Content analysis

- Cummins, J. and Bawden, D. (2010) Accounting for information: information and knowledge in the annual reports of FTSE 100 companies, *Journal of Information Science*, 36(3), 283–305.
- Park, J., Lu, C. and Marion, L. (2009) Cataloging professionals in the digital environment: a content analysis of job descriptions, *Journal of the American Society for Information Science and Technology*, 60(4), 844–57.
- Manzuch, Z. (2009) Archives, libraries and museums as communicators of memory in the European Union projects, *Information Research*, 14(2), paper 400, available from <http://informationr.net/ir/14-2/paper400.html>.

Discourse analysis

- Kouper, I. (2010) Information about the synthesis of life-forms: a document-oriented approach, *Journal of Documentation*, 66(3), 348–69.
- Haider, J. and Bawden, D. (2007) Conceptions of ‘information poverty’ in LIS: a discourse analysis, *Journal of Documentation*, 63(4), 534–57.
- Foster, J. (2009) Understanding interaction in information seeking and use as a discourse: a dialogic approach, *Journal of Documentation*, 65(1), 83–105.

Philosophical/conceptual analysis

- Robinson, L. and Maguire, M. (2010) The rhizome and the tree: changing metaphors for information organisation, *Journal of Documentation*, 66(4), 604–13.
- Exner, J. (2009) Interrogating ‘identity’: a philosophical approach to an enduring

Thornely, C. and Gibb, F. (2009) Meaning in philosophy and meaning in information retrieval (IR), *Journal of Documentation*, 65(1), 133–50.

Historical analysis

- Weller, T. and Bawden, D. (2005) The social and technological origins of the information society: an analysis of the crisis of control in England, 1830–1890, *Journal of Documentation*, 61(6), 777–802.
- Bowman, J. H. (2006) The development of description in cataloguing prior to ISBD, *Aslib Proceedings*, 58(1–2), 34–48.
- Muddiman, D. (2005) A new history of ASLIB, 1924–1959, *Journal of Documentation*, 61(3), 402–28.

Bibliometrics

- Frandsen, T. F. (2009) Attracted to open access journals: a bibliometric author analysis in the field of biology, *Journal of Documentation*, 65(1), 58–82.
- Robinson, L. (2007) Impact of digital information resources in the toxicology literature, *Aslib Proceedings*, 59(4–5), 342–51.
- Ying, D. (2010) Semantic web: who is who in the field – a bibliometric analysis, *Journal of Information Science*, 36(3), 335–56.

Having briefly examined the main methods of information research, we will look at some more general issues: sampling; research ethics; and identifying and evaluating research findings.

Sampling

‘Sampling’ is the procedure by which we choose a selection of entities (people, organizations, documents, etc.) to study, when there are too many possibilities for us to study them all. The aim of sampling is to choose them so that they are representative of the larger population from which they are drawn, so that the results obtained have a more general validity beyond the particular entities which were studied.

The issue of sampling very often arises in information research, regardless of the method used. It is often thought of in the context of surveys – how should we choose our participants? – but is equally applicable in, for example, the choice of documents for content or discourse analysis, or the choice of place and time for observations. It raises two questions: what kind of sample is to be used; and how to know when it is enough. These issues often cause angst to novice researchers. This is a very complex subject, and only some simple points are made here. The research methods textbooks cover it more thoroughly; Denscombe (2010) gives a particularly clear account.

Four general kinds of sample may be taken:

- 1 A *complete sample*, where we include all examples of the population. For instance, if we were studying archiving policies in local government in London, we might choose to interview the archivist in each of the London boroughs.
- 2 A *random sample* of our population. This has to be done formally, typically using tables of pseudo-random numbers. Many samples described as 'random' are no such thing, having simply been picked arbitrarily.
- 3 A *purposive sample*, chosen to include examples of different types within our population. For example, to get a sample of users of a website, we might choose to select by age, gender, nationality, education level, place of residence, occupation, etc. Having chosen these groups, we might then select individuals within them randomly. This is a complex process, and needs to be done carefully according to the nature of the research.
- 4 A *convenience sample*, where a set of appropriate participants is selected because they are available: family, friends, fellow students, regular users of an information service, etc. This may be an appropriate method for small-scale and exploratory studies, provided that (a) it is declared as such, and (b) no attempt is made to generalize the results, or to claim statistical validity; both of the latter would need a more formal sampling process.

The question 'how big a sample do I need' is very often asked, but is difficult to answer exactly. A numerical answer can only be given in rather specific cases; when we are comparing two circumstances, know the magnitude of the difference we are looking for and the level of statistical confidence we require for the answer, and where we are able to make assumptions about the underlying distributions of the variable. For example, if our study set out to decide whether students who use the library get better grades, if we were able to say that by 'better' we meant a difference of 5%, that we would take the question as settled if the difference we saw would occur by chance only once in a hundred times, and that we knew that the distributions of marks and of use of the library both observed certain statistical distributions: then we would be able to calculate that a sample of so many students would be enough. Denscombe (2010) gives a clear account of these issues.

In most information research, we know little about the underlying distributions, and have no particular reason to fix the other parameters. We have to judge whether the sample we have allows us to give a reasonably confident answer to our research questions. Usually this means two things: does my sample include all groups of the population I am studying; and do I have enough cases

by common sense in each case; usually, in small-scale studies, by doing as many cases as is feasible and – in the case of qualitative studies – stopping when no new information is being found. There are a number of 'rules of thumb' for this. Lawal (2009), for example, suggests that a sample of 100 items or people is enough; if groups are being compared, then 30 in each group. Another often quoted 'rule' is that adequate insight into a topic is gained from 5 in-depth interviews or 50 questionnaire responses. These 'rules' are based purely on 'custom and practice', and common sense, rather than any methodological validity.

Information research ethics

Information ethics in general were discussed in Chapter 11, and the basic principles hold good here. For information research, ethical issues and dilemmas will be much the same as for research in similar social and computing disciplines. Two standard texts of information research methods (Pickard, 2007 and Oates, 2006) mention as the main issues:

- gaining access – being open and honest about the purpose and nature of the research, who is funding it, how the results will be disseminated, etc.
- informed consent – making sure that everyone being studied in any way is aware of the research, and has the chance to refuse to take part, and to withdraw from the study
- ensuring anonymity and/or confidentiality of results, as necessary
- protecting participants' rights – particularly for 'vulnerable' people, such as children or sick people
- online and internet research – particularly with its possibilities for anonymous observation and interaction
- researcher integrity – for example, observing relevant codes of conduct, and collecting only those data which are really needed for the research.

Finding and evaluating research

Research does not consist of a collection of isolated studies and findings; it is a process of cumulative growth of knowledge, each study building on and extending earlier work. An essential first step is therefore to identify and evaluate previous studies.

This is the process generally referred to as *literature searching* or *desk research*, as we have seen above, it may form a research study in itself, as well as being the starting point for all research activity. 'Literature' has to be understood quite widely. As well as the journal articles, research reports and monographs which are the traditional ways in which research is reported, we must now consider

research. Resources for identifying such materials include bibliographic databases, web search engines, web portals and specialized searching tools for particular subjects and formats. Search strategies and tactics may need to be adapted to the sources used, as described in the information technology chapter. A selection of useful sources for identifying information research is given in the list of additional resources. Detailed advice on finding, analysing and organizing literature material is given in the research methods textbooks, and in Fink (2010), Rumsey (2008) and Ridley (2008).

Once identified, the material must be evaluated, to assess whether it is relevant and useful, and organized, so that it may be used. Information evaluation, of particular relevance to the meta-analysis, meta-synthesis and systematic reviewing mentioned earlier as examples of desk research, is also necessary as a starting point for all research. The formal methods of the systematic review, and of *critical thinking*, which has some similarities, are not usually necessary here. Rather, a checklist of issues can be applied to decide the quality and usefulness of material. This will typically include criteria such as: authority; coverage; accuracy; reliability; bias; timeliness; accessibility; language; and uniqueness.

More specifically, if we are evaluating a typical research report or journal article, we will ask a series of questions such as those in the box here.

Information evaluation by information professionals has been pioneered in the healthcare sector: two useful resources from that sector are a paper by Booth (2007) and a short book by Greenhalgh (2010). Although both refer to the healthcare context specifically, the points they make are much more widely applicable to critical appraisal of any form of literature.

If the studies being evaluated involve quantitative data, then an assessment of the statistics used is necessary. This can be complex, and specialist advice may be necessary: basic guidance is given in the research methods textbooks, in Greenhalgh (2010), and in a variety of guides to statistics: good examples of the latter are Campbell (2009) and Hand (2008).

Summary

Research is fundamental to the information disciplines and professions. Without it, the academic knowledge base will stagnate, and enhancements and improvements in practice will be made more difficult. Academics and practitioners have a joint duty to carry out appropriate research, to be aware of – and make use of – existing research findings, and to communicate across the academic-practitioner divide on these issues. The UK's Library and Information Science Research Coalition, set up in 2009, is one approach to addressing these matters (Hall, 2010).

The range of methods available for, and used in, information research has

Evaluating a research article or report

- Who are the authors, and what are their qualifications? Who published the study?
- Is the purpose of the research clearly stated? Are there clear research questions?
- What are the background assumptions, presuppositions, and theoretical positions? Are they stated clearly?
- Is the context of the research stated clearly?
- Is there an appropriate literature review?
- Is the review claimed to be comprehensive or systematic? If so, is it?
- Do the references listed give a fair representation of the available evidence? Have the authors interpreted the evidence from the references correctly?
- Are the research methods clearly described and justified?
- Are the methods appropriate to answer the research questions?
- If questionnaires, interviews or similar data collection methods are used, are they fully described, and have they been validated?
- Are the results presented fully and clearly; are the original data given, or is it stated where they can be found?
- If it is a quantitative study, are appropriate statistical techniques used? Are the data presented in appropriate tabular and graphical forms, with appropriate levels of precision?
- If it is a qualitative study, are the methods for collecting and analysing data explained fully? Are they careful and rigorous enough? Are the data set out clearly?
- Is there any evidence of bias, or undue subjectivity, on the part of the authors?
- Do the authors draw appropriate conclusions from the findings? Do they answer the questions that the study was designed to answer?
- Are the findings integrated with previous work?
- Is any practical relevance of the findings made clear?
- Are there any ethical issues; is it clear how the work has been funded, and does this matter?
- Is the style and presentation appropriate for the intended audience?

methods still arise. Research is likely to be even more important in the future, to help deal with the dramatic changes in the information landscape that we are seeing, in response to a variety of factors, most particularly new technologies. In the next, and final, chapter, we will look at the future research agenda for information science.

- Research is essential for the future of the information disciplines and professions.
- Practitioners and academic researchers have a joint responsibility to carry out appropriate research and to make use of existing research.
- A wide variety of methods is available for information research, but these must be chosen and applied correctly in each study.

Key readings

- A. J. Pickard, *Research methods in information*, London: Facet Publishing, 2007.
- B. J. Oates, *Researching information systems and computing*, London: Sage, 2006.
[Two good textbooks, giving detailed coverage of the material in this chapter.]
- P. Hider and B. Pymm, Empirical research methods reported in high-profile LIS journal literature, *Library and Information Science Research*, 2008, 30(2), 108–14.
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CHAPTER 15

The future of the information sciences

Prediction is very difficult, especially about the future.

Robert Storm Petersen, Danish poet and philosopher –
also attributed to the physicist Niels Bohr

If we have learned one thing from the history of invention and discovery, it is that, in the long run and often in the short one, the most daring prophecies seem laughably conservative.

Sir Arthur C. Clarke

Librarianship has become preoccupied, perhaps to a point of obsession, with its own future. There seems to be a growing sense that change is now moving at such a rate that steering may have ceased to be an option.

Ross Atkinson (2001, 3)

Neither a wise man nor a brave man lies down on the tracks of history to wait for the train of the future to run over him.

Dwight D. Eisenhower

Introduction

In this final chapter, we give an overview of some ideas about the discipline and profession of information science. As the opening quotation from Ross Atkinson indicates, some of the information professions are very concerned about this, perhaps seeing signs of their own demise, overwhelmed by changing technical and social environments.

This is by no means a new concern. During the 1970s, Dennis Lewis, an information manager in the British chemical industry who later headed the professional association ASLIB, became well known for propounding the idea that 'There won't be an information profession by the year 2000' (Lewis, 1980). This became known as the 'Doomsday Scenario', and Lewis rather revelled in the nickname of Doomsday Den. This focused on the