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The case of Swedish archaeology

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Grey literature – grey sources? Nuancing the view on professional documentation The case of Swedish archaeology

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Abstract

Purpose – The purpose of this paper is to nuance the perception about professional documentation (a.k.a. “grey literature”), assuming perception of documentation being a cultural aspect of accessibility.

Design/methodology/approach – The study explores variations within the archaeological report genre through a bibliometric analysis of source use. Source characteristics are explored as well as correlations between report authors and source originators. Statistical frequency distribution is complemented by a correspondence analysis and a *k*-means cluster analysis to explore patterns. The patterns are interpreted as “frames of references” and related to circumstances for archaeological work. The study also discusses source representations.

Findings – The source use patterns reveal a latent variation, not visible in the general analysis: a professional/academic frame of reference (mainly among authors affiliated with incorporated businesses and sole proprietorships) and an administrative frame of reference (mainly among authors affiliated with government agencies, foundations, and member associations) emerge.

Research limitations/implications – The study focuses on Swedish field evaluation reports. Future research could test the results in relation to other types of reports and go beyond the document perspective to explore source use in documentation practices.

Social implications – The results on variations in frames of references among report writers have implication for report readers and user. The results should also be considered in archaeology management and policy-making. On the level of source representation the results call for clarifications of vague representations and possibly omitted sources.

Originality/value – This study contextualizes archaeological information use and focuses on variations in professional archaeology which has received little previous research attention. The bibliometric approach complements previous qualitative studies of archaeological information.

Keywords Public sector organizations, Archaeology, Cluster analysis, Documentation, Private sector organizations, Referencing

Paper type Research paper

1. Introduction

Professional archaeology literature, sometimes called “grey literature”, is a quantitatively significant part of the archaeological literature (Hardman, 2010). Since the introduction and growth of development-led archaeology from the mid-twentieth century and on the portion of professional literature relative to the academic literature has increased (Ambrosiani, 2012). However, this professional (in the sense extra-academic) literature is sometimes criticized for not being sufficiently accessible

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and for not meeting academic standards for structure and content (Seymour, 2010a; Bahn, 2012). The term “grey literature” widely used for unpublished or semi-published reports has in archaeology been coloured by these critical comments, although “grey literature” also has positive connotations (e.g. in the context of the UK “Grey Literature Library”).

Re-use of records produced by professional archaeologists depends on access to the records. Access is no absolute value, but more accessible records are more likely to be considered for re-used. Re-use has an intra-archaeological value as a register of what has already been done, as a knowledge base and as a window into earlier methodologies and interpretations (Lucas, 2012). Re-use also has a substantial societal value because archaeology is central to the conservation of cultural heritage with the “human development and quality of life as a goal” as it is put in the Faro convention on the value of cultural heritage for society (Council of Europe, 2005). Development-led archaeology has evolved differently in different parts of the world. Distinctions have, for example, been made between a “western” and a “central or eastern European” archaeology, between “socialist” and “capitalist” models, and between more or less regulated models for archaeology (Carver, 2009; Harding, 2009; Kristiansen, 2009). In Sweden land developers finance archaeological surveys and excavation. The system is regulated by the Heritage Conservation Act and executed by county administrative boards. Access to, and understanding of, previous archaeological reports are vital to keep costs down, both for developers and the publicly funded bodies involved in heritage management.

The practical, technical aspects of accessibility to professional archaeology literature are gradually being solved. Digitization, semi-automated indexing, and preservation in digital archives improve both access to and the visibility of the professional literature (Hardman, 2010). This literature’s status as a contribution to archaeological knowledge production is still rather uncertain. On the one hand professional literature contributes significantly to the volume of archaeological literature, on the other hand renowned archaeologists have expressed concerns regarding its value for knowledge production (Bahn, 2012; Lucas, 2012; see also special issues of *Archaeologies* and *The Grey Journal* edited by Seymour, 2009, 2010b). The archaeologist Deni J. Seymour has described this uncertainty as a cultural issue: “Issues of access [...] are as much cultural, as they are about indexing and databases” (Seymour, 2010a, p. 229). Seymour does not define “cultural” but from the citation above she appears to mean something more than the comparatively technical aspects indexing and databases (although both indexing and database construction also have significant “cultural” components). Since Seymour writes about “academics” and “non-academicians” in the same text a fair assumption is that she writes about culture as having to do with interactions between people and between groups of people (Seymour, 2010a, p. 230). Research about grey literature can be limited to issues of document production, acquisition and distribution (cf. Farace and Schöpfel, 2009), but if access to archaeological reports is, as Seymour argues, as much cultural as technical, then cultural perspectives need to be included.

The aim of this paper is to nuance the understanding of professional literature in archaeology. Through an analysis and discussion of variations within the professional literature the paper seeks to diminish cultural issues of access. The study examines how professional archaeology reports relate to previous knowledge through an analysis of information source references and source reference patterns in Swedish field evaluation reports. “Information sources” denotes the documents, repositories, and interfaces in report writers’ bibliographical lists (cf. Huvila, 2006, p. 46). Source reference patterns are considered indications of varying frames of references among report writers. As mentioned

archaeological reports are commonly written in extra-academic settings. For the study I make the assumption that it therefore is relevant to analyze report writers' frames of references in relation to professional standards coloured by organizational affiliations (Kristiansen, 1998). The study has implications for understandings of variations within professional archaeology literature. These variations could be further discussed in terms of archaeological knowledge production, and on management and regulations levels. The study does also have implications on the level of source representation calling for clarifications of vague representations and possibly omitted sources.

This paper begins with a background on development-led archaeology and a review of research about archaeological reports and about archaeology as literary production. Then follows a section on the theoretical concepts "information source reference" and "frames of reference", and one section on methods and material. In "Results" the empirical analysis is presented. The last two parts offer an interpretative discussion and the conclusions.

2. Development-led archaeology

Archaeologists can work in academic research and education within universities or research institutes. They can also work at museums with research, collections management, and public dissemination. However, most archaeological surveys in Sweden are performed as development-led archaeology ("uppdragsarkeologi") (Riksantikvarieämbetet, 2013). Other terms for the same or similar activity are "contract archaeology", "commercial archaeology", "preventive archaeology", "rescue archaeology", "salvage archaeology", and "site preservation archaeology". Development-led archaeology is a type of archaeology conducted by actors within the cultural heritage legislative framework. The goal is to identify, evaluate and sometimes excavate, remove, or see to the on-site preservation of culturally valuable sites or objects prior to land development (Riksantikvarieämbetet, 2012a; cf. Neumann and Sanford, 2001). In many US states and in Australia, professional archaeological undertakings are performed and reported within more comprehensive environmental impact assessments (Department of the Environment, 2008; United States Environmental Protection Agency).

Numbers are not available for direct international comparisons of archaeology performed outside academic and museum research, but professional archaeology makes up a significant part of archaeology in several countries. In Great Britain 59 per cent of the archaeologists are employed by commercial private sector organizations (Aitchinson and Rocks-Macqueen, 2013). In the USA 34 per cent of the anthropologists and archaeologist work in scientific research and development services while the rest hold positions outside scientific research (Bureau of Labor Statistics, 2013). Hence it is common for academically trained archaeologists to do archaeological research and to contribute to archaeological knowledge from positions outside academia. The term "independent scholar" can describe this type of professionals, even though "independent" is slightly misleading because most archaeologists outside academia depend on affiliations with government agencies, foundations or private firms (Orlans, 2002).

Swedish cultural heritage management is directed by the Heritage Conservation Act (Svensk författningssamling, 1988). Development-led archaeology was introduced in the 1940s and was widely used during the intensive development after Second World War (Kristiansen, 1998; Ambrosiani, 2012). Today's development-led archaeology is influenced by market principles (Rudebeck, 2004; Kristiansen, 2009; Johansen and Mogren, 2014; cf. Carver, 2009). The regulated market model was first set forth in the Heritage Conservation Act of 1997, and has evolved gradually since then. National regulations were commissioned by the National Heritage Board in 1998 and

again in 2008 to clarify the market principles, roles, and responsibilities (Riksantikvarieämbetet, 2012b). The County administrative boards (“Länsstyrelser”) in each county direct development-led archaeology activities in their counties. Land owners or land infrastructure developers are clients and financiers. Archaeological actors compete for assignments on basis of survey plans (“undersökningsplaner”) and estimated budgets (Riksantikvarieämbetet, 2012a, pp. 21-26). Although “good scientific quality” is stated as a criterion in the Heritage Conservation Act, the guidelines for implementation of the Heritage Conservation Act demands that professional archaeologists also pay attention to values such as public participation and involvement (Svensk författningssamling, 1988; Riksantikvarieämbetet, 2012a; Johansen and Mogren, 2014).

The term actor is used here for the firms, foundations, and government agencies performing archaeological surveys and excavation. Government agencies are either the National Historical Museums’ archaeology department (*Arkeologiska Uppdragsverksamheten*, a.k.a. *UV*) or archaeology departments at public regional museums. The strengthened marketization of development-led archaeology during the last two decades has led to a fragmentation of archaeology in the sense that we now see a greater number of actors of a greater variety of organizational types (Riksantikvarieämbetet, 2012b; cf. Karlsson, 2000; Ambrosiani, 2012; Jensen and Jensen, 2012). The growth of the professional archaeology sector (bringing with it a transfer of knowledge from academia to the professional sector) and the marketization of development-led archaeology can be considered as plausible explanations for the current state of information source references.

A single professional field archaeological project may involve a few or several steps divided into work phases. Reports can be produced at three phases in the Swedish professional field archaeology process; assessment reports, field evaluation reports, and excavation reports. These reports are usually attributed to one single writer, although co-writing is common. In more extensive reports different parts are typically attributed to different writers. Each year about a thousand surveys are prepared for land development in Sweden. Of these about 300 are archaeological assessments, about 600 are archaeological field evaluations and about 100 are archaeological excavations (Riksantikvarieämbetet, 2013). This study focuses on reports from the most common type of surveys, field evaluations.

3. Reports

Archaeological reports are part of the archaeological literary production. Theoretical discussions of archaeological literary production, or even of archaeology as literary production, emphasize the centrality of texts to the archaeological discipline and how knowledge is created through the circulation of references (Lucas, 2012).

Reports are intended to document and represent archaeological finds. No report can comprise a full extent of a survey. Reports present a distilled selection of assessment, evaluation, and/or excavation data and analysis. Reports also serve as pointers to how and where survey data are stored. According to the Swedish National Heritage Board’s guidelines each actor is expected to create documentation according to scientific principles (Riksantikvarieämbetet, 2012a). Surveys should be guided by research questions posed in relation to previous research and knowledge, and analyses are expected to be conducted in accordance with scientific standards. Results are required to be communicated in reports with the dual aim of serving as the basis for administrative decision-making and contributing to archaeological knowledge at large (Magnusson Staaf and Gustafsson, 2002; Riksantikvarieämbetet, 2012a). As a result

archaeological reports are key components in at least two related but separate processes: the academic research and administrative cultural heritage management (cf. Magnusson Staaf and Gustafsson, 2002; Huvila, 2011). Importantly, a report is also a product transacted from the archaeology firm to the land developer and to society (through deposit in a public archive).

Archaeological reporting has been discussed from a stylistic point of view, resulting in a meta-methodological discussion of the connections between trends in archaeological ontology and the stylistic character of reports (Hodder, 1989). The archaeological report as a phenomenon has also been explored theoretically as a “boundary object” serving a bridging role between archaeologists and other stakeholders of archaeological information. Seen as boundary objects reports not only organize field data but also influence relations between archaeologists, cultural heritage management professionals, land owners, and developers (Huvila, 2011). There are also studies of archaeological reports in more practical settings. One comprehensive study focuses on the form of the field documentation in Swedish reports, but do also discuss information source references. That study concludes that references, especially to archival sources, need to be specified more clearly in bibliographical lists (Magnusson Staaf and Gustafsson, 2002).

Professional literature, including reports, is sometimes called “grey literature” (cf. Farace and Schöpfel, 2009). Grey literature in archaeology is defined by the *Concise Oxford Dictionary of Archaeology*: “Archaeological reports with limited distribution, usually client reports prepared by archaeological contractors” (Darvill, 2009). The term is used within the community, for example by the *UK Archaeology data service* in the case of *The Grey Literature Library* and by researchers (e.g. in special issues of the peer review journals *Archaeologies* and *The Grey Journal* edited by Seymour, 2009, 2010b). However, the term has some derogatory connotations. Grey literature is sometimes framed as a potential problem due to limited accessibility, poor structure, content, and language (e.g. Hardman, 2010; Seymour, 2010a). Library and information science (LIS) scholars Dominic J. Farace and Joachim Schöpfel point out a need for a new definition of grey literature in general, based on the changed modes for access and distribution (Farace and Schöpfel, 2009). Within archaeology, the definition of grey literature needs revision to reflect today’s modes of literary production and distribution, but it also needs to be nuanced with respect to the factors conditioning content (cf. Seymour, 2010a). Because of the value-laden character of the term “grey literature”, the term “professional literature” is used here.

4. Information source references, source reference patterns, and frames of references in professional reports

This study draws on the research tradition of information use in documentation. Information source use is a general term denoting different types of uses while referencing, as studied here, is one specific way of using a source (cf. Huvila, 2006). Thus referencing cannot be studied as a reflection of source use, but as manifestations of which sources writers chose to, and are able to represent. The terms “refer to” and “cite” are used interchangeably to denote the activity of referring to sources. The term “(source) representation” specifically denotes the form of the metadata provided by report writers in bibliographical lists. The theoretical framework serves to clarify two connections: that between development-led archaeology and documentation as a constitutive part of development-led archaeology, and the connection between source references and frames of reference as constitutive parts of development-led archaeology documentation.

A basic assumption and motivator for the study of documents is that documents somehow are “pervasive in society and shape our lives” (Buckland, 2012, p. 2; cf. Lund, 2010; Foscarini, 2012). Hence it is reasonable to argue that reports are pervasive in development-led archaeology and in adjacent practices. Report documents are potentially influential in a number of ways: as material objects invoking actions and as carriers of both content and values. The influence depends on how the documents are constructed. Bernd Frohmann proposes a four-fold perspective to cover the “the configuring factors” of documents: the materiality of the documents, their histories, the institutions in which they are embedded, and the social discipline shaping practices with them (Frohmann, 2004, p. 405). This study focuses on the frames of references as variances within the archaeological institution in which archaeological reports are embedded. Source references and source reference patterns are thus seen as a factor configuring archaeological report documents, and in turn the role of reports in societies.

The quantitative study of references is a type of bibliometrics, the study of quantitative aspects of the production of, dissemination of, and references to recorded information (Tague-Sutcliffe, 1992). “Recorded information” is a vague term but the prefix *biblio* serves as a clue: bibliometrics primarily concerns books and other texts with book-like features as opposed to, for example, spoken or audiovisual communication. Citation analysis has previously been used in archaeology to study theoretical shifts, gender bias, and self-citations (e.g. Sterud, 1978; Beaudry and Victor, 1994; Hutson, 2006). Here a bibliometric approach is applied to all of the sources represented by report writers’ bibliographical lists. This study is limited to analyzing the characteristics of source items referred to. The study does not count the number of times each unique source is cited within each document. Quantitative bibliometric studies in LIS are commonly combined with qualitative approaches in interpretation and discussion (cf. Leydesdorff, 1989; Åström, 2006; Hammarfelt, 2012). Björn Hammarfelt has used bibliometrics to explore how the social and intellectual organization of research fields impact referencing practices and citation patterns (Hammarfelt, 2012). This study has a similar approach, but in the reverse direction. Starting with source representations I use bibliometrics to explore patterns and discuss frames of references in relation to the characteristics of the originators of the reports. Because of the empirical limitation of this study, the social and intellectual organization of professional archaeology will not be discussed. Instead I use “frames of references” as an intermediate concept to explore concentrations and scatter within the data set and to discuss how source patterns may be related to report originators (cf. Tague-Sutcliffe, 1992).

Archaeological information source use has previously been studied qualitatively in order to develop an understanding of the implicit information-related issues of practical work (Huvila, 2006, 2014a). Furthermore a number of studies focus on archaeologists’ and cultural heritage management professionals’ uses of specific information sources or information use within specific institutional environments (Borchardt, 2009; Sufian, 2009). Recently attention has been directed to archaeologists’ use of images. The conclusion is that while images have a crucial role in the development of archaeology as a discipline (as means of documentation and through visualizations of classifications), and while image use is common among contemporary archaeologists, the theoretical aspects of archaeological image use and image use contexts are still to be addressed (Moser, 2012; Beaudoin, 2014). Archaeologists are also sometimes included as a subset within larger empirical groups in studies of information needs and uses in the humanities. For references to a selection of these of studies see Huvila (2014a). These studies do not focus on professional archaeologists.

Previous studies of archaeologists' information use provide a background to this study. However the circumstances for archaeological information use change continuously. Archaeologists today may have access to local, national, and global sources through online archives. Substantial funding goes into the development of information-sharing infrastructures (Huvila, 2014b). The greater variety of actors and organizational types within development-led archaeology may also bring with it a greater number of organization-specific information cultures and occupational identities affecting information interests (cf. Sundin and Hedman, 2005; Widén-Wulff, 2010). The analysis in this study is designed to reflect not only source characteristics, but also characteristics of the users and their relations to the sources. Hence this study will contribute to the research about archaeological information use and also address the question about the impact of contexts of use (cf. Kansa and Kansa, 2011; Moser, 2012; Huvila, 2014b).

5. Methods

The material analyzed is a set of source items derived from bibliographical lists in Swedish archaeological field evaluation reports[1]. The quantitative approach in this study is a way to structure the data set, to summarize distributions, to test connections between parts of data and to reveal latent patterns, and finally to make comparisons with results from a previous studies of archaeologists' information sources (Tague-Sutcliffe, 1992; Denscombe, 2009).

5.1 Data and coding

The data selection is based on the field evaluation reports collected in SAMLA, the Swedish National Heritage Board's open archive. Archaeological actors submit their own reports to the archive and not all reports are submitted. 289 reports searchable with the term "field evaluation" ("förundersökning") with the issue date 2013 were submitted by April 21, 2014[2]. The voluntary submission policy to SAMLA might bias the sample, but it is hard to say how this bias affects the results.

From the SAMLA output a systematic sampling was made (Djurfeldt *et al.*, 2010). Every third report from No. 1-289 was retrieved resulting in a sample of 97 reports. The sample makes up about 33 per cent of the sampling frame; reports issued 2013 and submitted to SAMLA. The sample makes up about 17 per cent of the estimated total population of Swedish field evaluation reports issued yearly (600 reports). Each report was given an identification number.

Each information source item is assigned an identification number and coded with an iteratively developed structure. The initial structure was developed on the basis of source types and features discussed in "Archaeologists and their information sources" (Huvila, 2014a). The structure was tested in a coding of six field evaluation reports issued by three different actors from 2012 to 2013 and adjusted subsequently. The category structure consequently comprises categories relevant at the time of Huvila's empirical study 2004-2005 and also source categories and characteristics appearing in later published reports (Table I).

The categorization resulted in a database with nominal data. Definitions of categories appearing in the analysis and notes on sources of error related to each category are clarified as the categories appear in the analysis section. Appendix 1 provides the complete coding structure. Groups of categories were in some instances collapsed based on shared features to enable a more general analysis. For an overview of the generalized categories and the categories included see Appendix 2.

Table I.
Variables in two-dimensional coding structure

Variables in two-dimensional coding structure		Type and number of unique values
Report dimension (dimension no. 1)	Report identification number	Numbers (1, 2, 3, ...)
	Report type	Number (3)
	Organizational type (report author)	Number (5)
Source item dimension (dimension no. 2)	Source identification number	Numbers (1:1, 1:2, 2:1, etc.)
	Source originator, archive name or map title	Names as spelled out in bibliographical lists
	Source age	Publishing year
	Source type	Numbers (32)
	Source format	Numbers (5)
	Source language	Numbers (4)
	Spatial relation source writer/source publisher –report writer/report publisher	Numbers (8)

The source items in field evaluation reports are sometimes ambiguous. Throughout the coding LIBRIS, the joint catalogue of the Swedish academic and research libraries, has been used to identify source items and when possible to complement items with information omitted in the bibliographical lists. Eight of the 97 reports lacked bibliographical lists altogether. These were subject to a special analysis in order to determine if, and if so how, references to information sources were incorporated in the report texts or by other means.

5.2 Analysis

The analysis employs descriptive statistics to explore the features of the information sources referred to and source reference patterns in the data set. The main analytical tool to explore the source references is frequency distribution analysis (Denscombe, 2009; Djurfeldt *et al.*, 2010). Frequencies of types of source items are compared to other types of source items, and to the data set as a whole to illustrate frequencies and relative frequencies. Percentages and cardinal numbers are both used in the results section. Percentages are used when the data set at large is described, cardinal numbers are used for more detailed-level descriptions.

To explore the source reference patterns further multiple correspondence analysis and cluster analysis were used. Multiple correspondence analysis reveals the latent correspondences between categories in the data set. The correspondence analysis shows the categories' having stronger correspondences to each other, that is, appearing more often together or close to each other in the data set than with other categories. The results are visualized through a two-dimensional perceptual map (Hair *et al.*, 2010). The first dimension of this map is interpreted as representing source age, and the second dimension is interpreted as representing the spectrum between academic literature through professional literature and on to archaeological reports. The observations on the map appear as clouds of observations along these two dimensions. In order to further delimit between these clouds, that is, to ensure that the included observations are more like each other than like observations in other clouds, a *k*-Means cluster analysis was run (Hair *et al.*, 2010)[3]. The cluster analysis resulted in three clusters of source reference patterns. Throughout the results section examples from the reports are used to illustrate the quantitative analysis.

6. Results

The analysis was guided by the analytical questions: which are the features of the information source references in professional reports (as represented in bibliographical lists)? Which are the recurrences, and which are the divergences? What patterns are discernible? The results are structured in four sections: number of sources, source types and formats, spatial relations and source languages, and source reference patterns.

6.1 Number of sources referred to

The Table II gives a general overview of the number of sources in the bibliographical lists.

The average number of source items is eight per report. In total, 68 per cent of the reports have ten or fewer source items. In total, 14 per cent of the reports have 16 or more source items in the bibliographical lists. Out of the 14 per cent with 16 or more source items all but one has between 16 and 29 source items. The highest number of source items, 42 items, is found in a combined field evaluation and excavation report (report no. 58).

The overall average of eight source items per report (Table II) can be compared with the average number of source items for each organizational type (Table III).

Foundations and member associations cite an average of five source items per report. Incorporated businesses and sole proprietorships refer to eight, like the overall average. Government agencies cite a slightly higher number of source items, 11 items.

Eight of the 97 reports in the study lack references to source items assembled in bibliographical lists. These are assigned the value 0 in the calculation of source items per report. However, although not containing formal bibliographical lists these reports do cite information sources both explicitly and implicitly. References to information sources are made implicitly through informal references to the official identification numbers of heritage sites or finds, either in text or on maps, directing readers to the Swedish National Heritage Board's heritage database FMIS. References are also made in the main text body to information sources such as archaeological survey reports, either implicitly through official identification numbers or explicitly to publications, but without the corresponding information in formal bibliographical lists. Furthermore two of the reports include source material in the report document, one includes two lab reports (for wood type and C¹⁴ tests) and one includes 15 pages of correspondence and police records from the years 1946-1947 concerning the search for, and finding of, an allegedly missing gold object. All of the eight reports without formal bibliographical lists include maps and five of the reports also include photos.

Table II.

Number of source items/report – general overview

Reports with 0 source items	8 (8%)
Reports with 1-5 source items	28 (29%)
Reports with 6-10 source items	30 (31%)
Reports with 11-15 source items	17 (18%)
Reports with 16 or more source items	14 (14%)
Sum	97 (100%)

Table III.

Number of source items/report – subset organizational types

Organizational type	Average number of source items/report
Foundations and member associations	5
Incorporated businesses and sole proprietorships	8
Government agencies	11

The explicit and implicit references to sources in reports without bibliographical lists raise the question of in-text referencing to sources not represented in bibliographical lists in reports with formal bibliographical lists. If this to some extent is the case, then source references in professional reports are represented, and should therefore be studied as, dispersed throughout texts. Although it lies beyond the scope of this study, this possibility should be taken into account in further studies.

6.2 Source types and formats

In total, 27 codes were used to cover the source types in the 97 reports. Some of the codes came to be used frequently, like “Archaeological report”, while other just occurred rarely, like “Correspondence” or “Image, photo”. In order to give an overview several categories in the overall frequency distribution have been collapsed (Figure 1).

The most common sources are archaeological report, professional literature, and maps. The archaeological report category comprises both reports and three references to DAFF reports (Documentation of fieldwork phase; “Dokumentation Av FältarbetsFasen”). DAFF is an intermediate report form used by a government agency from 2000 to 2009. Professional literature in this study includes monographs, book chapters, and articles written by contract archaeologists or extra-academic professionals in adjacent disciplines. As Leonid Pavlov has noted it is as hard to find an unambiguous definition of grey literature as it is of literature in general (Pavlov, 2006). The same goes for professional and academic literature. For the sake of the analysis I draw an interpretative line based on the environments where the texts were composed and published (in the cases the texts were published). Texts more clearly stemming from academic environments (e.g. dissertations and research articles) were coded as academic, and texts more clearly stemming from professional environments (e.g. articles in popular journals and anthologies edited by heritage societies) were coded as professional. For example, texts produced by the National Heritage Board were coded as professional with exception for the cases when they were co-produced with university departments (when they were coded as academic). The map category comprises both current and historic maps.

The least common types of sources are covered in the “Other” category in the above pie chart. Categories included in “Other” are references to literature such as reference works and to documents such as administrative documents, cultural heritage management documents, historic building conservation documents, and technical

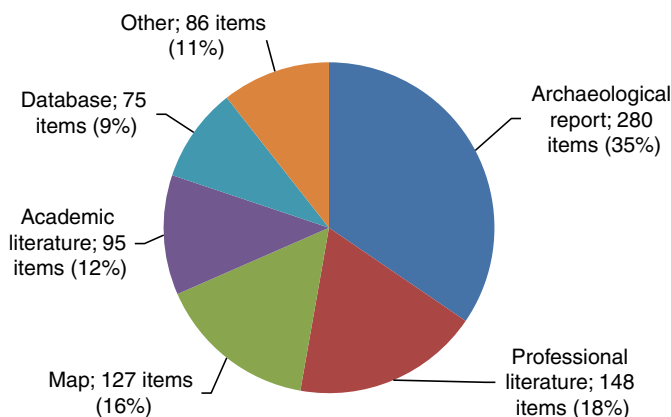


Figure 1.
Source types – frequency distribution general overview

reports. The category also covers references to general web sites and specific web pages, images, and to personal communication and notes as information sources. A reference to verbal communication (“muntliga uppgifter”) can look like this:

Muntliga uppgifter

Bäck, M. 2013-08-23.

Jeppsson, A. 2013-08-21.

(Report id. no. 93)

or like this:

Gustafsson, S. muntlig uppgift angående ¹⁴C-daterat sädeskorn från Södra Sallerup 15C

(Öresundsförbindelsen).

(Report id. no. 63)

These references do not specify the position or home institution of the person with whom the reports writer has had the verbal contact, and in the first of the two examples the communicated topic is left out. These source items have limited information value for readers outside the immediate context of the field evaluation.

The overall source type distribution can be compared with Table IV, displaying the most and least common source types cited by each organizational type.

The subset displaying the frequency distribution of source types for each of the three different organizational types displays variations from the overall distribution. The archaeological report as a dominating source parallels the overall pattern, but with a comparably lower level of domination for the incorporated businesses and sole proprietorship group. Professional literature as the second most common source represented by the foundation and member associations and the government agencies groups matches the general analysis. For the Incorporated businesses and sole proprietorship group maps are the second most cited source. The outcome of the comparison between the general distribution of source types and the subsets for each organizational type is that foundations and member associations and government agencies are the most similar to each other and also the most similar to the general overview regarding the first and second most cited source types. The group incorporated businesses and sole proprietorship differs from the two other organizational types in the higher comparative weight put on maps and academic literature.

6.3 Temporal distribution of source types

A temporal distribution analysis of the sources referred to by the report writers in 2013 displays the most common source types from each time period. Due to the comparatively

	Foundations and member associations	Incorporated businesses and sole proprietorships	Government agencies
1. Archaeological report;	46 items (42%)	Archaeological report; 91 items (27%)	Archaeological report; 144 items (39%)
2. Literature – professional;	25 items (23%)	Map; 81 items (24%)	Literature – professional; 83 items (22%)
3. Map; 16 items (15%)		Literature – academic; 49 items (15%)	Literature – academic; 44 items (12%)

Table IV.
Most frequently cited source types, subset organizational type

larger number of sources from later decades, the display is divided into shorter time periods for the later decades. The periods before 1900 are grouped as one category (Table V).

The distribution table shows consistencies over time periods; the most common source type from the 1980s and on through to 2013 is the archaeological report. The most common source type from the period before is professional literature, a result consistent from the 1900s to the 1970s. The most common source type dated before 1900 is maps. In addition to consistency the table also displays how certain source types dominate different time periods. About half of the total number of sources from the 1980s and after are reports. This prevalence of reports from the 1980s and after might be related to the gradual rise of development-led archaeology during the last decade of the twentieth century, and also to the relative accessibility of reports produced in more recent times. Equally, professional literature dominates the references to sources dated between 1900 and 1979 by making up about half of the number of sources from that timespan.

6.4 Source formats

The source format category is designed to cover the impact of digitization on the cited sources. However, most source items in this data set (744 items) cannot be analyzed by source format. Source formats are infrequently represented in the bibliographical lists, perhaps due to the convention to only specify exceptions from the “normal” format, e.g. the “normal” analogue form of books have not traditionally been specified in bibliographical lists. Yet, at a time when increasing digitization of sources possibly confuses the common understanding of “normal format” and also how the “new normal” formats are to be represented, a few observations can be made on the basis of this data set.

Source items specified as analogue are very few (three items). Among these are sources we find sources defined as stencil (“stencil”), e.g.:

Carlsson, E. 1992. Arkeologisk förundersökning i kv Kansliet, Falu stad och kommun. Arkeologisk rapport 1992:3. Dalarnas museum. Stencil. (Report id. no. 52).

“Stencil” in Swedish can be used in its technical sense to denote a document duplicated using a stencil duplicator but stencil can also be used in a figurative sense to denote “paper copy”. If stencil in this case denotes a stencil duplicated document the specifications in the bibliographical lists might indeed mark an exception from the normal report format.

Another group of items separable on the basis of format are the ones explicitly represented as digital. These make up 6 per cent of the total number of sources in the data set (52 of 811 source items). Among the sources explicitly represented as digital the dominating groups are database sources (33 items) and maps (11 items). These may sometimes refer to material from the same database, since several of the

2000-2013	Archaeological report	188 items (57%)
1980-1999	Archaeological report	80 items (46%)
1950-1979	Literature – professional	31 items (53%)
1900-1949	Literature – professional	22 items (39%)
Before 1900	Map	67 items (94%)
Source not dated	Database	60 items (56%)

Note: Percentage: proportion to total amount of sources from time period

Table V.
Most common source
type originating
from each time
period (based on
dated sources)

databases referred to are map databases (like the Land Survey Board's archive (*Lantmäterimyndighetens arkiv*) and the Geographical Survey Archive (*Rikets allmänna kartverk*)). Another digital database often referred to is FMIS. The sources represented as digital are primarily Swedish sources (with only two exceptions), provided by a national institution (42 items of the 52 items). The source ages vary from 1,636 (a digitized map) and on through 2013 (an academic article). However most of the digital sources are not dated (32 of 52 items), and in other aspects also sparsely represented, like these examples:

Formminnesregistret FMIS. www.fmis.raa.se (Report id. no. 35).

and:

Lantmäteriverket, Historiska kartor; www.lantmateriet.se (Report id. no. 86).

These sparse representations leave readers to search in the report text body for indications of which database excerpt the report writer has used. Oral format, that is references to conversations, make up twelve of the source items.

6.5 Spatial relations and source languages

An analysis of spatial relations between source originators and report originators reveal that most sources referred to are from the same country as the report originator. Only 2 per cent of the source items are from outside Sweden (Figure 2).

In total, 26 per cent of the sources cited have the report writer or another person or group from the same organization as the report writer as originator. The major part of the sources is by originators outside the report writer's own organization, but from the same country. Another 25 per cent are national resources like national databases or national archives. The languages of the source items reflect this distribution, most sources are in Swedish. Among the sources in other languages English (13 items) is more common than the other Nordic languages Norwegian, Danish, and Icelandic (six items all together).

6.6 Source reference patterns

To explore source reference patterns, defined as source features more often appearing together with each other than with other source features, a cluster analysis was performed. Each column in Table VI represents one cluster.

Cluster I reveals how archaeological reports are clustered together with administrative documents, cultural heritage documents, historical building conservation reports, and technical reports. This cluster also contains personal communication and sources from the

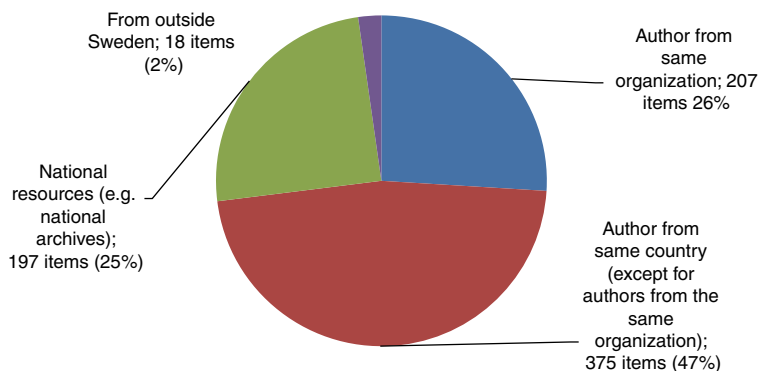


Figure 2.
Spatial relation
source originator –
report originator

Table VI.
Cluster analysis
(*k*-means) source
use patterns

Cluster I: administrative pattern	Cluster II: professional/academic pattern	Cluster III: map pattern
Foundations and member associations	Incorporated businesses and sole proprietorships	Before 1900
Government agencies	Before 1950	Source not dated
Before 2000	Before 1980	Database
Before 2013	Literature – academic	Map
Administrative document	Literature – professional	National resource
Archaeological report	Reference work	
CHM document	From outside Sweden	
Hist. building cons. report	Same country	
Personal communication		
Technical report		
Same organization		

same organizations as the report originator. These sources are relatively recent, from the 1980s to 2013. Two organizational types appear in this cluster: foundations and member associations and government agencies.

The third organizational type, incorporated businesses, and sole proprietorships, can be found in Cluster II. Cluster II also contains academic and professional literature along with reference works. The spatial relations clustered here are same country and from outside Sweden, indicating less use of local sources than Cluster I reveals. The sources are also older, from 1900 to 1980. Cluster III contains even older sources such as maps and documents from historical databases. These are primarily national resources.

In my interpretation the cluster analysis reveals an administrative pattern (pattern I), an academic/professional pattern (pattern II) and one map pattern (pattern III). Foundations and member associations and government agencies more commonly refer to reports and administrative documents, which also tend to be local sources. Incorporated businesses and sole proprietorships make less use of local sources, and tend to rely on professional and academic literature (other than reports). Regarding the map pattern the cluster analysis indicates an equal dependence on the map category for each of the three different organizational types.

7. Discussion: source references and frames of reference in professional archaeological reports

Previous studies of archaeologists' information sources have mainly been qualitative studies of source use. This quantitative analysis reveals characteristics that support a refined understanding of archaeological reports, especially of the source use patterns.

The most common source referred to is archaeological reports. Reports are about twice as common as the second most common source type. In Huvila's study of information source use the informants mention the importance of reports far more often than they are stated to be used (Huvila, 2014a). Within the reports in this study reports are referred to frequently. The second most common source is professional literature (foundations and member associations and government agencies) and maps (incorporated businesses and sole proprietorship). These findings match Huvila's (2014a), although this study's division of the literature into academic ("scholarly" in Huvila's terminology) and professional reveal that professional literature is referred to more often in professional reports. One plausible explanation for this finding is that,

although Swedish academic libraries are open to the public, professional archaeologists' access to scholarly literature from their own workplaces is limited.

Besides reports and literature, maps are frequently cited as information sources, which is consistent with Huvila's (2014a) results. Other than maps, non-codex-like information sources are rare in the bibliographical lists. In previous studies archaeological materials, aggregates of original materials, and images have been described as information sources vital to archaeologists (Beaudoin, 2014; Huvila, 2014a; cf. Moser, 2012). The complete lack of references to archaeological materials and the very rare references to images suggest that report writers either do not use these sources (possibly because of concerns over access, copyright, reproduction cost, or image quality) or that there are circumstances hindering archaeologists from representing these materials as sources. One reason could be lack of standards (or lack of knowledge about standards among writers) for presenting these materials in bibliographical lists.

Source formats are rarely specified in the bibliographical lists. Formats are specified for 12 interpersonal conversations ("oral"), three analogue items, and 52 digital items. If these specifications are interpreted as specified exceptions from the general format, then the data suggests that conventionally printed documents still are the dominating source format. However, this interpretation can only be made based on lack of evidence in the data set and should therefore be considered with caution. It is plausible to assume that a number of source items cited are analogue and others are digital, without the format being specified in the bibliographical lists. Disregarding the state of the "normal" source format it could be argued that information on format is essential to readers who wish to retrieve a specific source with help from details in a bibliographical list. Because of the multitude of source types and with increased digitization also a multitude of source formats in archaeology source format representation could, if developed, support more efficient information retrieval.

References to databases and web pages (with the exception of map databases) are fairly common (about as common as references to academic literature), like the results in Huvila's (2014a) study. This group includes references to, for example, FMIS and historical document databases. A major characteristic of these sources are the shallowness of the representations. The representations most commonly point to the database and its web interface, not to the excerpt derived from the database. The shallow representations suggest that this level of source representation is accepted by the professional community, by the readership, and by the county administrative boards monitoring the quality of the reports.

The importance of up-to-date sources, especially for monographs and articles, expressed by informants in previous studies is to some extent confirmed by this study (cf. Huvila, 2014a). The temporal distribution analysis of source ages displays a relationship between source age and source type. The oldest sources are, not surprisingly, historical maps. Maps dominate among sources from the seventeenth century up until the beginning of the twentieth century. The twentieth century development is more intriguing. Professional literature dominates the sources from the twentieth century up until the 1980s. The most common sources, the archaeological reports, are most typically from the 1980s and on. This distribution reflect the general development of professional archaeology from the initiation of the development-led archaeology in the 1940s through to the quantitative growth during the development-intensive post Second World War decades and the marketization and reinforcement during the 1990s and 2000s (cf. Kristiansen, 1998; Ambrosiani, 2012). The growth of development-led archaeology gave rise to the wide adoption of the report genre.

The post Second World War decades and the market regulation stimulated the number of small scale surveys and enforced formal reporting (Magnusson Staaf and Gustafsson, 2002). An additional plausible explanation of the popularity of the reports prepared 1980-2013 is their accessibility. In the later years some of these reports became available digitally through archaeology organizations' own web sites and since 2013 also through the national online archive SAMLA.

The national character of the cited sources is indisputable (cf. Huvila, 2014a). Only a fraction of the sources are written in languages other than Swedish or published in other countries. The most common language among the sources in other languages is English. Interestingly the digital sources are predominately national Swedish sources provided by national institutions. This finding suggest that digitalization of sources does not in itself support internationalization.

In a previous study Huvila discusses the importance of the personal reference shelf for choice of sources. The personal shelf provides easily accessible and familiar sources, but does also to limit the user (Huvila, 2006). The personal reference shelf can be complemented by a more or less extensive "collective reference shelf", depending on the organization within which the writer works. Today the concept of a reference shelf can also be extended to the "digital reference shelf" archaeologists may keep through folders of downloaded full texts and bookmarked links. The idea of a reference shelf shed light on both the organizational, geographical, and temporal character of the sources represented by the report writers in this study. Although it is outside the scope of this study, the results presented here draw attention to how the reference shelves can be a significant node in professional archaeologists' information infrastructures, and how the formation of content on such shelves could impact on knowledge production.

Comparison with studies of archaeologists' information sources raises a question about discrepancy between sources stated to be important and the sources represented in the reports (cf. Moser, 2012; Beaudoin, 2014; Huvila, 2014a). This, together with the sometimes shallow (e.g. database sources) and informal (e.g. verbal sources) source representations and the lack of bibliographical lists in a number of reports, suggests that forms for representing archaeological information sources could be further developed with specific emphasis on the non-codex-like source types. New source types, such as database excerpts accessed online, must be assigned a collectively accepted representational form in order to be widely cited in bibliographical lists.

Disregarding sources not referred to, the sources cited reveal patterns nuancing the view on the report genre. The source reference patterns reveal one administrative, one professional/academic pattern, and one map pattern. These three clusters show that the main division between source reference patterns in the report genre is the division between the administrative source reference pattern and the professional/academic source reference pattern. This finding implies that report writers primarily relate to two spheres of knowledge production: an administrative sphere containing planning documents and also reports more closely related to current and local cultural heritage management and a professional/academic sphere containing more general academic sources, but also a range of non-academic professional publications. The professional/academic frame of reference can be understood in the light of academic socialization influencing professional information interests. The administrative frame of reference can in turn be understood as an information interest influenced by development-led archaeology's dependence on administrative procedures (cf. Sundin and Hedman, 2005). Orientation towards administrative procedures has been called a "bureaucratic competency" among archaeologists (Kristiansen, 1998, p. 189). This study verifies the

assumed bureaucratic competency by showing how the competency influences an information source reference pattern.

A common way to describe archaeological reports has been to emphasize the dividing line between academic writing on the one hand and professional report writing on the other hand (cf. Seymour, 2010c). Professional reports are then more or less implicitly described as lacking academic quality (regarding structure, content, level of analysis, etc.). The variations shown in this study point towards the distinction between administrative and professional/academic frames of references as relevant in the description of the report genre. The results also suggest there are organizationally influenced information source choices. Foundations, member associations, and government agencies do in this study seem to be more prone to apply a bureaucratic competency in their source use listings (cf. Widén-Wulff, 2010). These results add to previous research about archaeological reports as boundary objects and shed light on how inconsistent information interests can continue to co-exist in development-led archaeology. Furthermore the results may be part of the explanation to why uniformity enforced by standardizations and through monitoring by county administrative boards can be hard to achieve in development-led archaeology, an environment with several organizational types and frames of references (Huvila, 2011; cf. Magnusson Staaf and Gustafsson, 2002; Riksantikvarieämbetet, 2012b).

The study presented in this paper has two notable limitations. First the data set is limited to field evaluation reports and variations within that group of reports. A study comparing assessment reports and excavation reports in addition to field evaluation reports might serve to contrast the results about variations within the sample with results on variations due to, e.g., the purposes of field evaluation reports at their specific stage in the archaeological process. Second, the document perspective used in this study gives a limited understanding of contextual reasons for the source references and patterns exposed. These limitations suggest a future participant observation study with an extended perspective on information source use in the creation of archaeological reports addressing questions such as: what happens when sources are accessed and evaluated prior to use in the development-led archaeology setting? What are sources in practice, in addition to the sources represented in print? How do archaeologists negotiate between the different frames of reference found in this study?

8. Conclusion: nuancing the view on reports from a “frames of references” perspective

Information source references in archaeological reports are relevant to research on several levels. From a basic information management perspective it is relevant to monitor which sources archaeologists use and how they represent those items. Data on source use provide grounds for evaluating and developing databases, archives, and libraries. Data on source representation also serve as a basis for improving source representation standards and skills in a multi-modal information environment such as archaeology.

One notable result from this study is that digitization has not yet led to any significant internationalization of sources represented. Judged by the sources represented, knowledge production in development-led archaeology still seems largely confined to the national borders. Hence for digitization to lead to internationalization in development-led archaeology internet access needs to be accompanied by measures during education, in the professional community and through standards. A related issue is the absence of representation of image materials as sources. As we are now at a phase when not only photos and drawing, but also digital visualizations of data, are central to archaeological

interpretations those materials need to be seen and cited as sources. Without standards for, and application thereof, references to image materials the archaeological community will suffer from gaps or “dead-ends” in places where references should be found.

On a more aggregated level this quantitative study adds to already existing knowledge about archaeologists’ information source use (cf. Moser, 2012; Beaudoin, 2014; Huvila, 2014a). The study also contributes as an examination of archaeological information use in a specific context, which has been requested by previous researchers (Kansa and Kansa, 2011; Moser, 2012; Huvila, 2014b). The results shed light on the influence of academic and administrative cultures on development-led archaeology, and also show how these cultures interact with organizational cultures in the shaping of frames of references among professional archaeologists. Awareness of variations between frames of reference among report writers can contribute to alter the perception of reports as “grey literature”, in the sense being not academic (cf. Seymour, 2010a).

The variations in frames of references shown in this study also emphasizes the need for readers and users of reports to gain understandings about the different contexts in which reports are composed, not as a way to rank these reports but as a way to recognize variations and apply source criticism based on those understandings. From a policymaker and monitoring perspective the variations are not to be overlooked, but to be observed and discussed. The variations point to questions about how the current organization of development-led archaeology affects archaeological knowledge production at large.

From an overarching point of view, this study can be seen as a reflexive approach to the presentation of archaeological results. Similar attention given to how field methods, ideological, and theoretical strands of thought influence archaeology can be directed towards the configuring factors of archaeological documentation (Hodder, 1989; Lucas, 2012; cf. Frohmann, 2004). This approach provides further understandings for the documents through which development-led archaeology interpretations are communicated, and in an extended sense: how development-led, professional archaeology becomes influential (or not) in society.

Notes

1. The data and analysis files are available in the digital archive DiVA: <http://urn.kb.se/resolve?urn=urn:mbn:se:uu:diva-244234>
2. Query to SAMLA: “((keyword: Arkeologisk keyword: förundersökning) and (dateissued:2013))” produced 289 result(s).
3. Program: XLSTAT 2014:3.

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Further reading

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Appendix 1. Coding structure (complete)

Report dimension

Report identification number

Numbers (1, 2, 3, etc.)

Report type

1. Assessment report
2. Field evaluation report
3. Excavation report

Organizational type (report writer)

1. Foundation
2. Incorporated business
3. Part of government agency
4. Member association
5. Sole proprietorship

Source item dimension

Source identification number

Numbers connected to report identification number (1:1, 1:2, 2:1, etc.)

Source originator, archive name or map title

Names as spelled out in bibliographical lists

Source age

Publishing year

Source type

Text based

1. Archaeological report
26. DAFF (“Dokumentation av fältarbetsfasen” – documentation of field work phase)
30. Notes (“GAM-anteckningar”)
2. Monograph or anthology, academic (academically edited or published by academic institution)
3. Monograph or anthology, professional
4. Book chapter, academic (peer review, academically edited or published by academic institution)
5. Book chapter, professional
6. Article, academic (peer review)
7. Article, professional
8. Conference paper, academic (academic writer)
9. Conference paper, professional
10. Doctoral dissertation
11. Masters thesis
12. Bachelors or other undergraduate-level thesis
13. Reference work
14. Popular literature (books, articles, booklets)
28. Technical report (e.g. osteology, geotechnical, soil technical report)
29. Historic building conservation document (e.g. “Byggnadshistorisk rapport”)
27. Cultural heritage management document (e.g. Overarching conservation programme)
32. Administrative document, other
31. Correspondence

Data, database items

15. Database or OPAC, unspecified selection

16. Data from archive or OPAC, specified selection
17. Web site, general (main site direction)
18. Web page, specific (specified site direction)

Visual or sensorial items

19. Map
20. Archaeological material (artifacts, features, structures, non-artefactual organic or environmental remains)
21. Image, photo
22. Image, drawing
23. Three dimensional model
24. Moving image
25. Oral

Source format

1. Analogue
2. Digital, born analogue
3. Digital, born digital
4. Oral
5. Not possible to decide from info in biblio. list

Source language

1. Swedish
2. Danish, Norwegian, Icelandic
3. English
4. Other

Spatial relation source originator – report writer/report publisher

1. Same originator as report in question
2. Published by the same organization as report writer belongs to
3. Published by organization from the same county as report writer's organization
4. Published by organization from the same country, but not county as report writer's organization
8. National Swedish resource (e.g. national archives like ATA, FMIS, LMS, SGU)
5. Published by organization from Denmark, Norway, Iceland
6. Published by organization from EU country (other than Sweden, Denmark, Norway, Iceland)
7. Published by organization from country outside EU

Appendix 2. Generalized categories and included categories

Organizational type (report writer)

Foundations and member associations, combines

1. Foundation
4. Member association

Incorporated businesses and sole proprietorships, combines

2. Incorporated business
5. Sole proprietorship

Source type

Text based

Archaeological report, combines

1. Archaeological report
26. DAFF ("Dokumentation av fältarbetsfasen" - Documentation of field work phase)

Literature – academic, combines

2. Monograph or anthology, academic (academically edited or published by academic institution)
4. Book chapter, academic (peer review, academically edited or published by academic institution)
6. Article, academic (peer review)
8. Conference paper, academic (academic writer)
10. Doctoral dissertation
11. Masters thesis
12. Bachelors or other undergraduate-level thesis

Literature – professional, combines

3. Monograph or anthology, professional
5. Book chapter, professional
7. Article, professional
9. Conference paper, professional
14. Popular literature (books, articles, booklets)

Database, combines

15. Database or OPAC, unspecified selection
16. Data from archive or OPAC, specified selection

Web, combines

17. Web site, general (main site direction)
18. Web page, specific (specified site direction)

Image, combines

21. Image, photo
22. Image, drawing
24. Moving image

Personal communication, combines

25. Oral
31. Correspondence

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71,6

Source format

Digital, combines

2. Digital, born analogue
3. Digital, born digital

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Spatial relation source originator – report writer/report publisher

Same organization, includes

1. Same originator as report in question
2. Published by the same organization as report writer belongs to

Same country, includes

3. Published by organization from the same county as report writer's organization
4. Published by organization from the same country, but not county as report writer's organization

From outside Sweden, includes

5. Published by organization from Denmark, Norway, Iceland
6. Published by organization from EU country (other than Sweden, Denmark, Norway, Iceland)
7. Published by organization from country outside EU

About the author

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