Expertise Seeking: A Review

Morten Hertzum

Computer Science and Informatics, Roskilde University, Roskilde, Denmark

Now at: Royal School of Library and Information Science, University of Copenhagen, Birketinget 6, 2300 Copenhagen, Denmark. Phone: +45 3234 1344. Mail: hertzum@acm.org

Abstract. Expertise seeking is the activity of selecting people as sources for consultation about an information need. This review of 72 expertise-seeking papers shows that across a range of tasks and contexts people, in particular work-group colleagues and other strong ties, are among the most frequently used sources. Studies repeatedly show the influence of the social network – of friendships and personal dislikes – on the expertise-seeking network of organisations. In addition, people are no less prominent than documentary sources, in work contexts as well as daily-life contexts. The relative influence of source quality and source accessibility on source selection varies across studies. Overall, expertise seekers appear to aim for sufficient quality, composed of reliability and relevance, while also attending to accessibility, composed of access to the source and access to the source information. Earlier claims that seekers disregard quality to minimise effort receive little support. Source selection is also affected by task-related, seeker-related, and contextual factors. For example, task complexity has been found to increase the use of information sources whereas task importance has been found to amplify the influence of quality on source selection. Finally, the reviewed studies identify a number of barriers to expertise seeking.

Keywords: expertise seeking, expert seeking, people finding, source selection, information seeking

1   Introduction

People seek information from other people. Several studies find that the use of people as sources equals or surpasses that of documentary sources, at least for complex and urgent tasks (Byström, 2002; Hersberger, 2001; Julien & Michels, 2004; Robinson, 2010). Valued qualities of using people as sources include that people know more than they record in documents, that explaining an information need to a human allows the information need to evolve in the course of the conversation, and that people may mould their expertise to the problem at hand (Cross & Sproull, 2004; Groth & Bowers, 2001; Hertzum, 1999; Kidd, 1994). While multiple studies have investigated how and why people select other people when they need information, this literature is scattered. We will use the label expertise seeking for these studies. This review aims to analyse the literature on expertise seeking to identify patterns and repeated findings and to point toward mixed results and gaps in our understanding.

In the context of this review, expertise seeking is *the activity of selecting people as sources for consultation about an information need*. To clarify this definition, we note: First, expertise seeking is about source selection and thereby dissociated from communication, which concerns the interaction with the source subsequent to source selection. Second, expertise seeking is about the selection of people as sources. The selection of people involves, however, considerations about when a person is

preferable to other types of sources. We prefer the term expertise seeking because it better includes these considerations than terms such as expert seeking and people finding. Third, the source is selected for consultation about an information need, thereby distinguishing expertise seeking from activities aimed at initiating extended collaboration rather than consultation. This distinction is somewhat malleable but, for example, excludes staff hiring from expertise seeking as defined in this review. Fourth, expertise seeking differs from expertise retrieval (in ways similar to how information seeking differs from information retrieval). Expertise seeking concerns the psychological, social, and organisational aspects of how people select other people as sources. Conversely, expertise retrieval addresses the algorithmic aspects of linking people to expertise areas in order to provide technological support for the identification of people sources. For reviews of expertise retrieval, see Balog, Fang, Rijke, Serdyukov, and Si (2012) and Becerra-Fernandez (2006).

Figure 1 provides a framework of expertise seeking. The framework, a result of this review, illustrates that an expertise seeker's selection of one out of several possible sources is affected by selection criteria, aims to satisfy an information need, takes place in a context, and may face barriers. The review first considers which sources are selected, then turns to the multiple factors that influence the source-selection process as implicit or explicit selection criteria, and finally addresses barriers to expertise seeking. In more detail, the review covers eight topics:

1. *Ranking of information sources*: Are people among the sources most frequently used? What are the most frequently used people sources?

2. *People versus documentary sources*: How are people and documentary sources balanced against each other? What factors affect this balance?

3. *Internal versus external sources*: How are sources internal to a seeker's organisation balanced against external sources?

4. *Quality versus accessibility*: Is the selection of people as sources determined by source quality, source accessibility, or both? Which components constitute quality and accessibility?

5. *Task-related factors*: How is source selection affected by factors such as task equivocality, task complexity, and task importance?

6. *Seeker-related factors*: How is source selection affected by factors such as job experience, self-esteem, and gender?

7. *Contextual factors*: How is source selection affected by factors such as the strength of social ties between seekers and sources and their hierarchical level in an organisation?

8. *Barriers to expertise seeking*: What are the barriers that complicate, degrade, or prevent expertise seeking?

Research on expertise seeking is important because the activity of expertise seeking is practically important to seekers, who may get different input for their decisions depending on whom they consult. In addition, people spend as much as 56%-65% of their working time communicating to obtain and supply information (Pinelli, Kennedy, & Barclay, 1991; Robinson, 2010), thereby making source selection important to spending this time effectively, or to reducing it by removing barriers to expertise seeking. In terms of implications for research, a review of expertise seeking may provide an overview of previous work, improve our understanding of the activity of expertise seeking, and inform work on expertise retrieval by collecting the many factors that are important to source selection in addition to the topical area of the source's knowledge.

2 Method

The 72 papers included in this review were selected and analysed through a process that involved formulating criteria for including papers in and excluding papers from the review, inspecting a total of 7945 papers for inclusion or exclusion, and analysing the content of the included papers.

2.1 Inclusion and exclusion criteria

The selection of papers for inclusion in the review was governed by five criteria, formulated prior to the selection process:

First, papers about expertise seeking were included, whereas papers about expertise retrieval were excluded (see Section 1 for definitions of these two terms). Papers contributing to both expertise seeking and expertise retrieval were included.

Second, papers containing analyses of persons' criteria for, or against, selecting another person as a source of expertise were included and so were studies of selecting, or not selecting, people over other types of sources. Conversely, analyses of collaboration, communication, and information seeking rather than source selection were excluded. As an example, Hara, Solomon, Kim, and Sonnenwald (2003) was excluded because it was about collaboration rather than source selection.

Third, papers about people selection for the purpose of hiring employees were excluded because employee hiring was considered a process that went beyond expertise seeking in both scope and duration. Relatedly, papers about journalists' selection of (expert) sources were excluded because this topic, too, has a literature of its own and because journalists' source selection was considered inseparable from discussions of what makes news.

Fourth, papers reporting on empirical studies were included, irrespective of whether the studies were qualitative or quantitative. Papers not reporting on empirical data were excluded.

Fifth, full research papers in English were included. Conversely, brief communications, editorials, book reviews, and the like were excluded. Books and theses were also excluded.

2.2 Selection procedure

The papers for the review were selected in four steps, see Table 1 for an overview.

First, all issues of *Information Processing & Management* (IPM), *Journal of the American Society for Information Science & Technology* (JASIST), and *Journal of Documentation* (JDOC) were inspected for the years 2000-2012. These three journals were chosen because they were core outlets for research on information seeking and known, in advance, to contain multiple papers about expertise seeking. Papers were inspected on the basis of their title and abstract. Of the 3170 research papers published in the three journals during the inspection period, this step resulted in the tentative selection of 41 papers for the review.

Second, to broaden the search for papers to other outlets Google Scholar was, in late January 2013, searched for papers containing the term 'expertise seeking', 'expert seeking', or 'people finding' in combination with the terms 'source' and 'selection' (the exact query was: ("expertise seeking" OR "expert seeking" OR "people finding") AND source AND selection). The choice of the search terms was informed by the terminology of the papers selected in the previous step. Like in the previous step the search was restricted to papers published in the years 2000-2012. The 1780 papers matching the query were inspected on the basis of their title and, when considered relevant, their abstract. On this basis 22 of the papers were tentatively selected for the review.

Third, to mitigate bias introduced by inspecting papers from specific, preselected outlets (Step 1) or containing specific, preselected terms (Step 2), the reference lists of the 63 tentatively selected papers from the two previous steps were inspected for relevant papers. This step also served to cover studies published before 2000 because these older studies were likely to be referenced in the papers published between 2000 and 2012. Of the 2995 references, 64 papers were tentatively selected for the review on the basis of the information present in the reference.

Fourth, the full text of the 127 tentatively selected papers from the previous steps was acquired and, on that basis, it was decided whether to include them in the review. The decision was made by applying the inclusion and exclusion criteria (Section 2.1). In addition, papers reporting from the same study were identified and preliminary publications, typically conference papers, were excluded whenever a final analysis of the same data was included in a later paper. This last step of the selection process resulted in the exclusion of 55 tentatively selected papers, leaving 72 papers for review.

2.3 Data analysis

The papers were reviewed through a process that alternated between open-ended exploration of the papers to identify topics and systematic walkthroughs of all 72 papers to collect information about specified topics. The open-ended explorations served as a data-driven way of eliciting common themes, interesting singular findings, and other topics researched in the literature on expertise seeking. Some topics were readily apparent, such as the relative influence of quality and accessibility on source selection. Other topics were only realised gradually, for example the division of the expertise-seeking literature into studies in work and non-work contexts. The systematic walkthroughs ensured that all papers treating a specified topic were included in the analysis. Each walkthrough was restricted to a single topic in an effort to sharpen the focus of the walkthroughs and thereby avoid oversights. The walkthroughs were documented in extensive tables, some of which have been condensed and included in this review. Writing the review involved repeated references back into the actual text of the reviewed papers to double check the extracted information and to get more of the context.

2.4 Data summary

The 72 reviewed papers are listed in the appendix. To summarise the information in the appendix, the domains studied in the reviewed papers were engineering (20), education (8), management (8), daily life (7), business professions (6), creative professions (4), healthcare (4), government (3), law (1), and other (6). Five studies were unrelated to domains and used students as participants. The participants in most studies were from North America (48); in the remaining studies they were from Europe (13), Australasia (7), multiple countries (3), and the Middle East (1). Finally, the most frequently used method of data collection was the survey (37), followed by interviews (14), both survey and interviews (6), observation (6), experiments (4), diaries (3), and other (2). Collectively, the 72 studies analysed data from 10542 participants.

3 Review results

In the following, we analyse the reviewed papers with respect to the eight topics listed in Section 1. The three first topics concern the sources. The frequency with which different types of sources are selected is analysed by reviewing rankings of information sources (Section 3.1), seekers' selection of people or documentary sources (Section 3.2), and their selection of internal or external sources (Section 3.3). The five remaining topics concern the source-selection process and the factors influencing it. First among these factors are the selection criteria quality and accessibility, which have been studied frequently and point toward opposing drivers of the source-selection process (Section 3.4). Source selection is however also influenced by a host of other factors, which relate to the task (Section 3.5), the seeker (Section 3.6), and the context (Section 3.7). Finally, the source-selection process may be hampered by barriers that are perceived as complicating or even preventing access to some sources (Section 3.8). Figure 1 provides a framework illustrating the interrelations among the elements of expertise seeking.

3.1 Ranking of information sources

In 19 studies participants have rank-ordered a set of information sources by their frequency of use. The resulting rankings provide evidence of the role and relative importance of people compared to a variety of other information sources. Table 2 shows the five sources receiving the highest average rankings in each of the 19 studies. As noted in the table, the participants in most of the studies rank-ordered more than five information sources. The maximum number of sources ranked was 26 (Yitzhaki & Hammershlag, 2004). Thus, the top-5 sources in Table 2 are a select subset of the total set of sources used. Four issues stand out:

First, people are prominent sources. In 18 of the 19 studies the top-5 sources include one or several people sources. For example, people ranked first in Cool and Xie's (2000) study of aerospace engineers and in Medaille's (2010) study of theatre artists. In the nineteenth study (Hirsh & Dinkelacker, 2004) people were prominent for two of the four studied tasks but not for the two others.

The two tasks for which people were not among the top-5 sources were satisfying routine research information needs and performing thorough literature searches.

Second, people sources include different groups of people. The most frequent people source appears to be workgroup colleagues and other nearby co-workers (e.g., Chakrabarti, Feineman, & Fuentevilla, 1983; Marton & Choo, 2002; Summers, Matheson, & Conry, 1983). However, people sources also include supervisors, subordinates, and specialists such as librarians and technical staff (e.g., Anderson, Glassman, McAfee, & Pinelli, 2001; Culnan, 1983). In addition, some people sources, such as customers and vendors, are external to the information seeker's organisation (e.g., Allen, 1966).

Third, the prominent non-people sources comprise documentary sources and experimentation. The range of documentary sources is broad and includes, among others, books, conference papers, newspapers, periodicals, radio, television, and web sites. There are documentary sources among the top-5 sources for 18 of the 19 studies. The only exception was the engineers, but not the scientists, in Allen's (1966) study. Experimentation is a prominent information source in two studies in engineering domains (Allen, 1966; Gerstberger & Allen, 1968) and one in the creative professions (Hemmig, 2009). The low occurrence of experimentation among the top-5 sources may reflect that experimentation has not been considered an information source by many expertise-seeking researchers.

Fourth, Agarwal, Xu, and Poo (2011) compared participants' actual and perceived use of information sources. Apart from a more frequent actual than perceived use of online information, the two rankings were similar, see Table 2. This similarity is methodologically important because most of the 19 studies are based on survey data and, thus, report rankings of participants' perceived source use. Agarwal et al. (2011) provided some basis for treating the survey results as indicative also of actual source use. Methodologically, it may also be noted that the studies do not consistently distinguish between the sources from which information was obtained (e.g., a co-worker vs. a book) and the channels through which the sources were accessed (e.g., a printed book vs. an online book).

3.2   *People versus documentary sources*

Rankings of information sources are complicated by the large number of sources used by seekers. To get an indication of the relative importance of people as sources, six studies have, instead, investigated the percentage of sources used that were people as opposed to documentary sources, see Table 3. As noted above people and documentary sources are the two main types of source in studies of expertise seeking. Four findings are evident about the relative importance of people and documentary sources:

First, Table 3 shows that people as well as documentary sources are frequently used. People account for 31% to 83% of the sources, documentary sources for 9% to 65%. In addition, Robinson (2010) found, on the basis of 20 days of measurements, that the studied engineers spent 7.8% of their working time seeking information from other people. This corresponds to several hours a week for every single engineer and every single working week. Robinson also found that the percentage of time spent seeking information from documentary sources was not significantly different from that spent seeking information from people ($p > 0.05$). This finding discords with Choo (1994) and Lu and Yuan (2011) who found that the perceived frequency of use was larger for people than documentary sources ($p < 0.001$ and $p < 0.05$, respectively). A likely reason for the mixed findings is that Robinson's study included information seeking at all levels of importance, whereas the two other studies might tend toward the more important tasks, for which Lu and Yuan found that the preference for people was most prominent. The frequent use of both people and documentary sources suggests that they are complementary and interdependent. Hertzum and Pejtersen (2000, p. 761) emphasised such interconnections when they stated that "engineers search for documents to find people, search for people to get documents, and interact socially to get information without engaging in explicit searches".

Second, the use of people over documentary sources increases as tasks become increasingly complex (Byström, 2002), increasingly non-routine (Christensen & Bailey, 1997), and increasingly short-term (Julien & Michels, 2004). Consistent with Byström's findings, Yuan, Rickard, Xia, and Scherer (2011) found that whereas answers to simple tasks could be sought from documentary sources, people

provided more appropriate answers to complex tasks, which involved process, opinion, and decision-making. Relatedly, Yuan et al. found that general information, such as background knowledge, was often found in documentary sources, whereas a need for specific information mostly led to selecting people, who could assist in determining the applicability of the provided information to the specific situation. Byström (2002) further found that the additional people consulted when tasks became more complex were mainly experts and people convened at meetings. This suggests an escalation of the effort to satisfy the information need by involving more competent people or a larger number of people. Notably, task effects on the balance between people and documentary sources are not restricted to a single work domain, rather they span local government (Byström, 2002), agricultural education (Yuan et al., 2011), daily life (Julien & Michels, 2004), and engineering (Gerstenfeld & Berger, 1980).

Third, the preference for either people or documentary sources is affected by personal attributes, such as gender. Julien and Michels (2000) found that men and women differed in what they considered the ideal source when asked to choose among people, electronic, and print sources. For women 51% of the ideal sources were people, for men 65% were electronic. Men and women were, however, more similar in terms of the sources concretely used. Another personal attribute affecting source selection is illiteracy and poor language skills, which force seekers to rely predominantly on people as sources. Poor language skills may also preclude the use of many expert people. For example, Somali women living in the UK have been found to get a lot of their healthcare information from their social network, partly because designated sources such as healthcare professionals and books are inaccessible for language reasons (Davies & Bath, 2002).

Fourth, people may have a capacity for absorbing uncertainty, while documentary sources are inescapably incomplete. In explaining why managerial decision makers considered people to be of higher quality than documentary sources ($p < 0.001$), Choo (1994) argued that the decision makers were faced with large amounts of information and, therefore, valued people who were able to derive inferences from a corpus of information and communicate these inferences rather than the raw information. This capacity to absorb uncertainty by making sense of information and presenting inferences related to current information needs has also been noted by Savolainen (2008), who found that people were praised for their ability to provide filtered information about the problem at hand. In contrast, documentary sources leave it to the seeker to derive inferences relating to current information needs and tend to provide an incomplete basis for such inferences. Groth and Bowers (2001, p. 282) pointed out that "there is not a reasonable way in which one can attempt to document 'everything'. Indeed, it is not always clear what 'everything' or 'enough' might mean, or at least not clear independently of consideration of purposes." Thus, some information can only be attained from people, because it does not exist in writing or because the documentation is not understandable unless elaborated by someone who knows the work described in the documentation.

3.3   *Internal versus external sources*

Among the studies of expertise seeking in organisational settings, 18 investigate issues related to how seekers balance sources internal to the organisation against external sources. The rationale for these studies is that the organisational boundary may restrict the flow of information and introduce different perceptions and behaviours regarding internal and external information (Allen, 1966; Anderson et al., 2001). As an example, Choo (1994, p. 36) noted that the norms, specialisations, and conceptual frameworks developed in an organisation to increase the efficiency of its information processing make it "necessary to recode information messages at the firm's boundaries." Three findings can be extracted from the reviewed studies:

First, results vary concerning the frequency with which external sources are used. One possible explanation for the varying results is differences in information need. While Hertzum (2000) found that internal sources dominated overall, the reverse picture emerged for the studied software engineers' need for information about the users' work. For this specific information need the frequency of external sources was 58%. Independent of tasks, Wilkinson (2001) found a preference for internal sources in her study of law firms. However, Wilkinson also found that the preference for internal sources was significantly driven by the large law firms ($p < 0.05$), whereas lawyers from small

and medium law firms were evenly spread between those preferring internal and external sources. Consistent with this finding, Hertzum and Pejtersen (2000) reported that in the large studied company it was a general recommendation that the engineers looked for information internally before they turned to external sources. A main reason for this recommendation was that getting into contact with a well-informed company colleague was a valuable source of input about previous company-internal work on the issue. To the extent that organisation size mediates the balance between internal and external sources, it may also help explain why Groth and Bowers (2001) in their study of a small-to-medium organisation found that external sources were freely contacted and that help was freely given to external sources.

Second, two studies have found external people more valuable than external documentary sources. Rulke, Zaheer, and Anderson (2000) found that managers' knowledge and capabilities were positively related to the importance they assigned to external people ($p < 0.05$) but unrelated to the importance they assigned to external documentary sources ($p > 0.05$). Zipperer (1993, p. 75) found that the interviewed exhibit designers obtained "nearly all of their professional information at trade shows" and, in contrast, that the exhibit designers considered professional journals "basically useless". These two studies discord however with several of the studies that rank-ordered information sources (see Table 2) because online information, official documents, and other external documentary sources rank first in several of these studies. A partial reason for this difference in findings may be that the set of external documentary sources considered in Rulke et al. (2000) and Zipperer (1993) was somewhat narrow and tended not to match the participants' need for up-to-the-minute information.

Third, relating to the topic of the next section, the use of external sources is influenced by their perceived accessibility while results for the influence of source quality are mixed. Five studies report that the frequency of use for external sources correlated with their accessibility (Auster & Choo, 1994; Chakrabarti et al., 1983; Cool & Xie, 2000; Culnan, 1983; O'Reilly, 1982) in that low accessibility co-occurred with a low frequency of use. When external sources were used studies disagreed about whether the external sources were perceived, compared to internal sources, as lower quality (Choo, 1994), slightly higher quality (Marton & Choo, 2002), lower technical quality (Gerstberger & Allen, 1968), high satisfaction (Cool & Xie, 2000), or as providing information of less utility (Chakrabarti et al., 1983). These mixed results preclude conclusion. In his study of engineering projects, Allen (1966) found that solutions suggested by external sources were rated lowly significantly more often than highly ($p < 0.05$), whereas solutions suggested by internal company research tended to be rated highly more often than lowly ($p = 0.06$). Importantly, the ratings were not made by the engineers who sought the information but by the customers who received the product of the engineers' work. Thus, Allen aimed to measure the effect of expertise-seeking practices on product quality, rather than merely to understand the mechanisms that governed expertise-seeking practices.

3.4   Quality versus accessibility

Multiple studies have investigated the factors that affect source selection and, in particular, whether source selection is dominated by considerations about the quality or accessibility of a source. Table 4 summarises the 15 studies that report beta coefficients (standardised regression coefficients) of both quality-related and accessibility-related factors. Formally, beta coefficients indicate how many standard deviations the dependent variable (e.g., the frequency of source use) will change per standard-deviation change in the predictor variable (e.g., quality or accessibility). Because beta coefficients, unlike unstandardised regression coefficients, are independent of the unit of measurement of the predictor variable, they allow for direct comparison of which of a set of predictor variables has the greater relative effect on the dependent variable (Schroeder, Sjoquist, & Stephan, 1986). For example, the first row of the table shows that Agarwal et al. (2011) studied one quality-related factor, labelled quality, and two accessibility-related factors, labelled access difficulty and communication difficulty. Quality affected the frequency of source use 2.14 times as much as access difficulty (as indicated by the ratio between the, unsigned, beta coefficients), and the effects were in opposite directions (as indicated by the different signs of the beta coefficients): The frequency of source use increased with increasing quality and decreased with increasing access difficulty. Communication difficulty did not significantly affect the frequency of source use. The study included one other factor,

task complexity, with a significant effect on the frequency of source use. Factors other than those related to quality and accessibility are only included in Table 4 if they had a significant effect on the frequency of source use. We note seven findings:

First, source selection is affected by both quality and accessibility. In 14 of the 15 studies source selection was significantly affected by quality-related factors, with (unsigned) beta coefficients ranging from 0.17 to 0.66. And, in 10 of the studies source selection was significantly affected by accessibility-related factors. The (unsigned) beta coefficients for the accessibility-related factors ranged from 0.01 to 0.60. Six additional studies aimed to determine statistically whether source selection was affected by quality or accessibility but are not included in Table 4 because they did not report beta coefficients for both quality-related and accessibility-related factors. Of these studies, Auster and Choo (1994), Cross and Sproull (2004), and Woudstra, Hooff, and Schouten (2012) found that quality significantly affected source selection. Five of the six studies found a significant effect of accessibility on source selection (Cross & Sproull, 2004; Culnan, 1983; Gerstberger & Allen, 1968; Rosenberg, 1967; Woudstra et al., 2012). Thus, there is ample evidence of quality effects as well as accessibility effects on source selection.

Second, the results of the studies in Table 4 are mixed when it comes to whether quality or accessibility has the larger impact on source selection. However, looking only at the (sub) studies that are restricted to people sources (the rows labelled 'P' in the table), we find a tendency toward beta coefficients for the quality-related factors that are no smaller, and often higher, than for the accessibility-related factors. For example, Yuan, Carboni, and Ehrlich (2010) found similar effects of quality-related and accessibility-related factors on the frequency with which people were used as sources in their study of a global engineering sales team. And, Marton and Choo (2002) reported larger beta coefficients for quality than accessibility for all the six people sources in their study of female IT professionals' expertise seeking. Across these six people sources, the average effect on the frequency of source use was 11.5 times larger for each standard-deviation change in quality than for each standard-deviation change in accessibility. Furthermore, O'Reilly (1982) found, in his study of healthcare workers, an interaction between quality and accessibility ($p < 0.01$) indicating that people were used more frequently under conditions of high quality and low accessibility than under conditions of low quality and high accessibility. Collectively, the studies show that the selection of people as sources is not governed by a principle of least effort, as it has been suggested by Gerstberger and Allen (1968), because such a principle would entail that accessibility consistently dominated quality. Lu and Yuan (2011) proposed, instead, a sufficiency principle, according to which seekers simultaneously consider multiple factors and aim to strike a balance between quality and accessibility in their selection of sources.

Third, the relative effects of quality and accessibility on the frequency of source use may differ for people and documentary sources. An initial indication of such a difference is that while the studies restricted to people show a rather consistent tendency toward effects for quality no smaller than those for accessibility, the six studies that analysed people and documentary sources together (the rows labelled 'P&D' in Table 4) showed mixed results. Three of these six studies found the larger effects for quality-related factors (Agarwal et al., 2011; Lu & Yuan, 2011; Morrison & Vancouver, 2000), two studies found the larger effects for accessibility-related factors (Chakrabarti et al., 1983; Hardy, 1982), and the last study found near identical effects of quality-related and accessibility-related factors (Zimmer, Henry, & Butler, 2008). A possible reason for the mixed results was proposed by Lu and Yuan (2011) who noted that accessibility dominated in early studies whereas quality dominated in more recent studies and suggested that the accessibility of documentary sources had become less of a challenge with the Internet and with the digitalisation of information. Direct evidence that the source type may affect the size of the effects of quality and accessibility has been provided by Zimmer et al. (2008), who found that the relationship between accessibility and the frequency of source use was weaker for people than documentary sources ($p < 0.05$). They did not find support for an effect of source type on the relationship between quality and the frequency of source use ($p > 0.05$).

Fourth, quality appears to have two overarching components: reliability of the information and relevance to the information need. Woudstra et al. (2012) proposed these two overarching components on the basis of social capital theory and validated them empirically. The studies in Table 4 focus

predominantly on the reliability component, but other studies have investigated a broader range of quality-related factors. Table 5 shows the quality-related factors investigated in a sample of five studies. In addition to further evidence for the reliability component the table provides clear evidence of a relevance component, especially in the two studies that used observation and interviews to identify factors that affect source selection (Fidel & Green, 2004; Hertzum, 2002). Also, three of the studies pointed to a temporal aspect of quality, in terms of up-to-dateness and timeliness (Hertzum, 2002; Kim & Han, 2009; Woudstra & Hooff, 2008). This temporal aspect pertains to the relevance component. All the factors in Table 5 are consistent with a division of quality into reliability and relevance, except the factor "the information is not available elsewhere".

Fifth, accessibility appears to have two components: access to the source and access to the source information. While the former includes aspects such as physical proximity (e.g., Borgatti & Cross, 2003), the latter is about the social ease of communicating with the source (e.g., Agarwal et al., 2011), getting the source engaged in the information need (e.g., Cross & Borgatti, 2004), and understanding the information provided by the source (e.g., Xu, Tan, & Yang, 2006). The relative importance of access to the source and access to the source information varies across the studies in Table 4. Table 5 provides additional evidence of both access to the source (e.g., is not busy) and access to the source information (e.g., cognitive effort). Culnan (1985) distinguished between two similar components of accessibility and found that 1 of 15 undergraduate students, 7 of 37 graduate students, and 0 of 14 consultants cited both components when interviewed about what "accessible" meant to them in relation to using people as sources. This suggests that the two components are quite distinct. In addition, Robinson (2010) found that when seeking information from people the studied engineers spent relatively less time accessing the source ($p < 0.001$) and also relatively less time accessing the source information ($p < 0.001$) than when seeking information from documentary sources.

Sixth, the 15 studies in Table 4 are based on data collected by means of surveys, which provide for large samples of respondents but suffer from the possibility of discrepancies between what respondents report and what governs their behaviour in practice (Woudstra & Hooff, 2008). It is therefore of interest to compare these studies with studies that have used other methods of data collection. Six of the reviewed studies used observation and interviews for investigating the distribution of selection criteria between quality-related and accessibility-related factors, see Table 6. With the exception of Fidel and Green (2004), who focused on untangling accessibility, these studies found that quality-related factors were much more frequent than accessibility-related factors. For example, Savolainen (2008) found an almost complete dominance of quality-related factors for both people and documentary sources. However, these studies report the frequency with which different factors were mentioned as selection criteria in interviews or during observations. It is possible that the study participants were merely deliberating more about quality criteria, rather than selecting sources of high quality. Thus, it is unclear whether the high percentage of quality-related factors indicated that these factors frequently determined the choice of source or whether it indicated that the study participants had more refined repertories of criteria for deliberating about quality-related than accessibility-related aspects of source selection.

Seventh, seekers obtain information about sources' quality and accessibility in multiple ways. For example, McDonald and Ackerman (1998) found that work artefacts, such as the records of the change history of software components, were used by software engineers to identify possible experts. People who had made many or recent changes to software components that were related to the seeker's information need were considered higher quality sources. Relatedly, Shami, Ehrlich, Gay, and Hancock (2009) found that seekers used the level of their colleagues' participation on a company-internal social system as a way of gauging their accessibility and willingness to help. A high level of participation, something difficult to fake, was perceived as a reliable indicator that the person was open to contact. Conversely, persons who did not volunteer information about their areas of expertise as part of their profile in the system created a perception of low accessibility because they withheld information useful to seekers' decisions about whom to contact. In addition to such uses of technical artefacts in the source-selection process, seekers make frequent use of human gatekeepers in obtaining information about possible sources' accessibility and quality. Civan, McDonald, Unruh, and Pratt (2009) found three variations of the gatekeeping role: conduits who carried information resources

between seekers and sources, contact brokers who introduced seekers to potential sources, and champions who were themselves sources of expertise.

3.5 *Task-related factors*

While quality and accessibility are the most frequently studied factors of the source-selection process, Yuan et al. (2011, p. 542) found that "overall task requirements seem to be the dominant factor influencing knowledge seeking." Participants in that study showed considerable agency and resourcefulness in circumventing accessibility constraints to accomplish their tasks. Several studies have investigated the effects of task importance, urgency, complexity, equivocality, and uncertainty on source selection and found that they affect source selection in different ways. Notably, task-related factors have mainly been found to moderate the influence of other factors, such as quality and accessibility, rather than to exert a direct influence on source selection. This is evident in three main findings about task-related factors:

First, task importance and task urgency moderate the influence of quality and accessibility. Agarwal et al. (2011) found that task importance had no direct influence on the frequency of source use but that it amplified the effects of quality on the frequency ($p < 0.05$), amount ($p < 0.05$), and order ($p < 0.01$) of source selection. That is, with increasing task importance, the selection of sources became more dependent on their quality. In contrast to this reassuring result, Lee (2002) found that when physicians and nurses had a problem with a task central to the core competence of the hospital then the social costs of help seeking were perceived as higher than for a less central task and this led to lower levels of help seeking ($p < 0.001$). Lee emphasised that the link from central tasks, through social costs, to less help seeking from people should be a key managerial concern because degraded performance on central tasks may be critical to the hospital's treatment of the patients and, more generally, to an organisation's strategic advantage and competitiveness. In addition, Xu et al. (2006) found that as task importance increased seekers might tend to pay less attention to quality in their selection of sources ($p < 0.1$), and to look for physically closer rather than more distant sources ($p < 0.1$). To explain these results Xu et al. proposed that for important tasks the seekers wanted as much information as possible and that most relevant information might come from closer sources because they were more likely to be familiar with the task situation. They also proposed that task importance might imply urgency, and that local sources could be consulted more quickly. Agarwal et al. (2011) studied task urgency explicitly and found that it had no direct influence on the frequency of source use but reduced the influence of communication difficulty ($p < 0.05$). That is, for urgent tasks the seekers were more likely to be willing to invest the resources required to overcome difficulties in the communication with the source.

Second, task complexity often, but not consistently, increases the frequency with which people consult information sources. Agarwal et al. (2011) found that task complexity increased the frequency with which business professionals made use of information sources ($p < 0.01$). Culnan (1983) found that task complexity affected the use of only some information sources. Of the people sources investigated by Culnan, task complexity increased the use of peers but not the use of superiors, subordinates, and external consultants. Anderson et al. (2001) and O'Reilly (1982) found no effect of task complexity on the frequency with which people were used as sources. O'Reilly noted, however, that the studied tasks might have been too similar for differences in task complexity to become influential. These mixed results extend those in Section 3.2, which documented a relation between high task complexity and the selection of people over documentary sources.

Third, several studies refer to media richness theory in arguing that task-related factors influence source selection. These studies (e.g., Anderson et al., 2001; Christensen & Bailey, 1997; Yuan et al., 2011) equate people with rich media and documentary sources with leaner media. On this basis, media richness theory (Daft & Lengel, 1986) predicts an increasing use of people with increasing task equivocality. This prediction was empirically verified by Christensen and Bailey (1997), who also found a significant interaction between task equivocality, which they operationalised as task nonroutineness, and source accessibility ($p < 0.001$). When people's accessibility was restricted the effect of high task equivocality was reduced in that participants to a larger extent selected the leaner but more accessible documentary source. An increase in task uncertainty, the other main construct in

media richness theory, has been found to increase healthcare decision makers' use of documentary sources but not their use of people (O'Reilly, 1982) and to increase aerospace engineers' use of people as sources (Anderson et al., 2001). While the former finding is consistent with media richness theory, the latter appears not to be.

3.6 Seeker-related factors

Most of the factors that enter into the source-selection process are perceived by the seeker in a concrete situation. The perceived nature of the factors relating to the quality and accessibility of a source is, for example, evident in Hertzum (2002) and Fidel and Green (2004), see Table 5. That is, the seeker is involved in shaping the factors that determine the expertise-seeking process; the seeker is not merely acting on factors that are objectively available. Multiple studies have investigated how factors relating specifically to the seeker influence expertise seeking. Job experience is the most studied of these factors. Other seeker-related factors include the seeker's psychological attributes and gender. In addition, the information seeker obviously affects the expertise-seeking process by deciding when the information need has been satisfied and the process can stop. Four findings concern seeker-related factors:

First, expertise seeking tends to decrease with increasing job experience. For example, O'Reilly (1982) found that with increasing tenure employees less frequently consulted their work-group colleagues for information. Similarly, Baldwin and Rice (1997) found that with increasing job experience employees less frequently consulted people and less frequently read documentary sources. Morrison (1993) focused specifically on newcomers to an organisation and compared their expertise seeking at the point of employment with that after six months of employment. She found that as newcomers gained experience in their new job they more often sought referent information ($p < 0.001$) and performance feedback ($p < 0.01$) and they less often sought technical information ($p < 0.05$), normative information ($p < 0.001$), and social feedback ($p < 0.01$). In contrast to these studies, Summers et al. (1983) found that job experience accounted for little variation in source use. The only people source significantly affected by job experience in that study was attending conventions.

Second, several psychological attributes have been found to affect source selection. For example, Vancouver and Morrison (1995) found that (a) the likelihood of requesting feedback from sources with the power to reward the seeker was larger for experimental participants with high performance expectations, (b) the likelihood of requesting feedback from expert sources was higher for participants with a high need for achievement, and (c) the likelihood of requesting feedback in situations with a good relation between seeker and source was higher for participants with low self-esteem. In continuation of these findings, Tan and Zhao (2003) found that with increasing self-efficacy seekers became more willing to inquire about information, and DePaulo and Fisher (1980) found that study participants who asked more for help expected the helper to view them as less competent and felt more nervous and uncomfortable asking for help. That is, seekers experienced a social cost of asking for help.

Third, the seeker's gender influences source selection. Borgatti and Cross (2003) found that information scientists tended to seek out sources of the opposite gender ($p < 0.05$) and that genomic researchers tended to seek out sources of the same gender ($p < 0.001$), both groups consisted of about equally many men and women. In spite of the difference in direction, the results for both groups showed that source selection was affected by gender. In addition, Lee (2002) found that men and people in a male-oriented occupational role (in this case, physicians as opposed to nurses) experienced higher social costs of expertise seeking and, consequently, asked less for help.

Fourth, expertise seekers appear to satisfice in their consultation of sources. Zach (2005, p. 30) found that senior art administrators continued their information seeking "until they reached an arbitrary level of comfort with the input they had acquired". The required level of comfort depended on the task – high for important tasks and often quite low for simple issues – and was complemented by time, which constituted the other factor in deciding when to stop seeking. Sometimes comfort and time were in conflict and then the arts administrators resorted to satisficing (Simon, 1956), that is to asking themselves whether their knowledge was good enough, whether they could expect more than

diminishing returns from additional information seeking, and how much impact the decision would have on their organisation. Several other authors have also characterised expertise seekers as satisficers (e.g., Lu & Yuan, 2011; Stefi-Mabry, 2003). Satisficing emphasises that the decision about when sufficient information has been acquired is perceived and situated.

3.7   Contextual factors

Hofmann, Balog, Bogers, and Rijke (2010) found that professors at the studied university were much more likely than Ph.D. students to be selected for providing information to the media. They concluded that the contextual factors that influence source selection (e.g., job role) may to a large extent be task specific, thereby reducing the possibilities for generalisation about contextual factors. Some contextual factors have, however, been found to affect source selection across differences in tasks. These factors mostly concern the ties between people, with social capital theory as an often used framework for studying them (e.g., Cross & Borgatti, 2004; Johnson, 2007; Woudstra et al., 2012). Six findings relate to contextual factors:

First, having a social tie, such as friendship, with a source plays a major role in seekers' choice of whom to ask for information. Social ties, for example, increase the frequency of information exchange (Yuan, Fulk, Monge, & Contractor, 2010) and circumvent seekers' reluctance to trust advice from sources with whom they have little experience (Cross & Sproull, 2004). The influence of social ties on source selection implies that the friendship network of an organisation is important to its expertise-sharing network and, in turn, to its performance. People prefer working with people they like, and several studies have found that people avoid seeking information from unpleasant colleagues unless it is absolutely necessary (Casciaro & Lobo, 2005; Yuan et al., 2011). This led Casciaro and Lobo (2005) to recommend that organisations (a) manufacture liking in critical relationships, (b) position likable people so they can bridge organisational divides, and (c) work on changing the competent jerks into more likable persons. Social ties incur costs in that they must be maintained, as argued by Hansen (1999) who investigated the relationship between tie strength and project completion times. He found that strong inter-unit ties were beneficial (i.e., correlated with shorter project completion times) when the knowledge to be transferred was complex, whereas weak inter-unit ties were beneficial when the knowledge was not complex. The proposed explanation for this differential effect of tie strength was that strong ties were more costly to maintain than weak ties and that this extra maintenance cost was only offset when the knowledge to be transferred was complex.

Second, the seeker's experience with a source has considerable influence on expertise seeking, mainly by increasing perceived accessibility, providing for a more accurate perception of source quality, or both. Woudstra and Hooff (2008) found that experience with a source was by far the quality-unrelated factor most important to source selection, accounting for 11% of the source-selection considerations mentioned in the study. In the study by Hirsh and Dinkelacker (2004), nearly 60% of the engineers considered experience with a source significant or very useful in selecting which source to use. Gerstberger and Allen (1968) concluded that the degree of experience the seekers had with a source mainly affected source selection by tending to lower their perception of the cost of using the source. In contrast, Hertzum (2002) argued that experience with a source was central to information seekers' ability to assess source credibility and found that the studied engineers gave prominence to getting a feel for the credibility of a person they would be dealing with, especially in the critical cases where trust was at risk of breaking down. Civan et al. (2009) qualified the role of past experience with a source by their finding that such experience was important to the identification of sources, but not necessarily to whether a source was selected. This finding concords with Borgatti and Cross (2003), who proposed that when people seek information from others they recalibrate their understanding of the source's skills, thereby affecting the probability of using the source again in the future.

Third, sources make themselves differentially available to seekers, for example to create or fulfil expectations of reciprocity. In a study contrasting information seeking with information giving, Nevo, Benbasat, and Wand (2012) found that source selection during information seeking was influenced by perceived source quality, whereas receiver selection during information giving was influenced by expectations of reciprocity. This shows that the sources from whom information is sought may, on their part, work to select the seekers they want to provide with information. Zmud, Lind, and Young

(1990) extended this finding by reporting that downward (i.e., superordinate-to-subordinate) communication tended to be information giving and was conducted with a view to ensuring that the selected receivers understood the communicated information; in contrast lateral, peer-to-peer communication was mainly driven by concerns for getting access to needed information. Supervisors can also make themselves more valued information sources among their subordinates by taking a proactive role in defining and structuring their subordinates' work (VandeWalle, Ganesan, Challagalla, & Brown, 2000). Sources' work to select their seekers may explain some cross-study differences in the effects of, for example, seeker-related factors.

Fourth, a source's organisational affiliation influences who seekers consult, especially when complex tasks require accurate information as opposed to empathy. Johnson (2007) found that with increasing task complexity the surveyed residents of the capital of Mongolia made increasing use of people that were consulted in the context of an organisation, made unchanged use of other people, and made decreasing use of media. This suggests that for important tasks a person's affiliation with a specific organisation may be as important to the choice of information source as whether the source is a person or documentary source. Relatedly, Davies and Bath (2002, p. 311) quoted one of their pregnant Somali interviewees for saying:

They [other women] know as little as me. But when there is something wrong with you, you talk and it makes you feel better. But is it right? No, no I'll talk to the doctors about that.

This quote suggests that accurate information is often sought from people with an organisational affiliation, whereas comfort and empathy, which may be equally important to seekers, are instead sought from peers and friends. In this example the need for comfort and empathy stemmed from the nature of the information need but the information-seeking process itself may also foster a need for comfort and empathy. Hyldegård (2009) documented that throughout a month-long process of source selection and information seeking the studied students only rarely experienced the process as easy, relaxing, simple, and satisfying.

Fifth, seekers tend to avoid competitors in their choice of sources. Hersberger (2001) found that homeless people avoided asking other homeless people for information about acquiring food stamps and finding shelter because these were limited resources for which the homeless people were competing. This finding is related to company employees' reluctance to consult external experts because people external to the company are seen as competitors (Cool & Xie, 2000). In these situations competent sources are disregarded because a contextual factor is considered more important than the quality of the source.

Finally, the reviewed studies investigate expertise seeking in both work (e.g., Cool & Xie, 2000) and non-work (e.g., Hersberger, 2001) settings. However, only a single study has investigated differences between these two settings. Julien and Michels (2004) found that more sources were consulted for non-work information needs but that a larger percentage of the sources consulted at work provided useful information, suggesting more care in source selection at work or the presence of more task-unrelated factors in non-work source selection.

3.8   *Barriers to expertise seeking*

Several studies list barriers to expertise seeking, often as a supplement to the main focus of the study. These barriers have been grouped and divided into types. Table 7 shows the five types and 31 barrier groups, along with the number of studies that mention each barrier group. We acknowledge a considerable overlap between these barriers and the factors reviewed in the previous sections. In most of the reviewed studies any factor that influenced expertise seeking negatively was regarded as a barrier (e.g., Helms, Diemer, & Lichtenstein, 2011). The three most frequently mentioned barriers are that it is time-consuming and costly to get information from sources (e.g., Quigley, Peck, Rutter, & Williams, 2002), that source knowledge is incomplete or unreliable (e.g., Helms et al., 2011), and that it takes effort to engage the source cognitively in the information need (e.g., McDonald & Ackerman, 1998). These barriers are about the seeker, the source, and the expertise-seeking process, respectively. The two remaining types of barrier concern the context, including that relevant information may be

scattered across many sources (Julien & Michels, 2004), and the task, including that the information provided by a source may not be useful to the seeker's task (e.g., Landry, 2006).

Another source-related barrier is a lack of practical experience with the problem at hand (Helms et al., 2011). This barrier is noteworthy because it is mentioned in a study of barriers to seeking information from the people formally appointed as an organisation's sources of expertise on specific topics. Relatedly, Cross and Sproull (2004), Hertzum (2002), and Wilkinson (2001) provided evidence that managers, engineers, and lawyers often preferred informal sources over formally appointed experts. In explaining this preference, Hertzum proposed that the informal sources had practical experience, whereas the formal experts had been somewhat removed from practical work as a result of their appointment as experts.

4 Discussion

The reviewed studies provide a rich empirical base for investigating expertise seeking. The studies do however not converge on a small set of factors that explain most source selections. Rather, a variety of factors has been found to influence source selection. In the following, we discuss the theoretical frameworks applied in the reviewed studies, some methodological issues important in making sense of the study findings, and the implications of the reviewed studies for research and development.

4.1 Theoretical frameworks

Most of the reviewed studies abstain from introducing a theoretical framework for understanding expertise seeking and merely reference previous empirical studies. The most frequent theoretical frameworks, when introduced, are media richness theory in relation to how task factors influence source selection, social capital theory in relation to contextual factors, and satisficing in relation to the balance between quality and accessibility.

Media richness theory (Daft & Lengel, 1986) proposes that the task-related factors equivocality and uncertainty influence the choice of communication media with higher task equivocality leading to the use of richer media, such as face-to-face communication, whereas higher task uncertainty should not necessitate the use of richer media but simply lead to increased levels of communication. While some studies have used media richness theory to explain an increased use of people as sources, it is noteworthy that media richness theory is about channel selection, not source selection. Thus, media richness theory may be an apt framework for explaining a preference for consulting people through one channel, say face-to-face, rather than another, say email, but is incapable of explaining a preference for consulting one person over another or one document over another. Xu et al. (2006) explicitly noted this distinction and, consequently, did not use media richness theory in their study of source selection.

Social capital theory (e.g., Coleman, 1988; Nahapiet & Ghoshal, 1998) proposes that the relations among people are a valuable resource for action. This way, social capital facilitates expertise seeking by affecting the conditions necessary for information to be exchanged. In the absence of social capital a seeker may know whom to consult but find it difficult to engage the source in the necessary exchange of information. Conversely, a person with strong ties to a source can rely on this social capital to encourage the source to be cooperative. Being able to trust that the source will be cooperative decreases the costs borne by the seeker, such as the risk of losing face. The ability to 'cash in' social capital when information is needed increases the efficiency with which a seeker can obtain information and, thereby, emphasises the importance of social networks to expertise seeking. Social capital theory does, however, not explain network-unrelated aspects of expertise seeking, such as the influence of task factors on the balance between quality and accessibility in source selection.

Satisficing (Simon, 1956) asserts that humans aim for a performance that is good enough for present purposes and that, beyond that, they generally do not spend additional resources looking for the best option available. Several authors have proposed that the repeated finding of an effect of both quality and accessibility on source selection is consistent with a satisficing approach to expertise seeking (e.g., Lu & Yuan, 2011; Zach, 2005). This proposal has superseded that of early studies (Gerstberger & Allen, 1968; Rosenberg, 1967), which found that accessibility dominated quality, thereby suggesting a

principle of least effort (Zipf, 1949) rather than satisficing. Satisficing and least effort share the characteristic that quality and accessibility are seen as separate factors traded against each other. An alternative possibility is that the perception of the quality of a source is dependent on the perception of its accessibility. Few of the reviewed studies have investigated such interdependencies but the somewhat related technology acceptance model has. According to the technology acceptance model (Davis, 1989, 1993) the effect of perceived ease of use (an accessibility factor) on the decision to use a technology is mediated through perceived usefulness (a quality factor). That is, making a technology easier to use increases its perceived usefulness.

Media richness, social capital, and satisficing posit different mechanisms for explaining how expertise seekers select their sources. The reviewed studies provide some support for all three theoretical frameworks, suggesting that they are to some extent complementary. At the same time, the three frameworks may point toward the selection of different sources. Social capital theory may, for example, point toward talking with close ties in situations where these sources are insufficiently competent from a satisficing perspective or unnecessarily rich from a media-richness perspective. The reviewed studies clarify neither when to apply which framework, nor whether other theoretical frameworks may explain additional aspects of expertise seeking. In order to know when to apply which framework, and thereby build an integrated framework, we need knowledge of the interactions between factors from different frameworks. However, in spite of the 72 reviewed papers we currently have limited knowledge of the interactions between the factors that influence expertise seeking, except the interactions between quality and accessibility. It appears that additional empirical investigation of the interactions between factors is a prerequisite for the formulation of an integrated theoretical framework.

4.2 Methodological issues

Three methodological issues recur in the reviewed studies and should be considered in relation to this review because they complicate the interpretation of individual studies and the aggregation of findings across studies.

First, the base level of a factor may co-determine its effect on source selection, but base levels are rarely accounted for in the reviewed studies. For example, Xu et al. (2006) found that the perceived understandability of a source did not influence participants' preference for the source. Xu et al. offered the explanation that understandability was high for all sources in the study and thus did not differentiate among them, possibly because it was easily achieved through interpersonal communication. As a consequence, understandability was unimportant to the selection of one source over another, even though high understandability might have been important to the participants. In general, the results of two studies may discord for no other reason than different base levels. In one study, quality may appear to have no effect on source selection because quality has a high base level. In another study, quality may explain a substantial amount of the variation in the frequency of source use because quality varies considerably across sources. But, high quality may have been equally important to the participants' source selection in both studies.

Second, any two of the reviewed studies differ in multiple ways, thereby complicating the aggregation of findings across studies. For example, Quigley et al. (2002) found that quality, operationalised as authoritativeness, did not appear to affect the surveyed researchers at a US university in their source selection, whereas Savolainen (2008) found that quality, operationalised as content of information, was by far the factor most frequently mentioned by the Finnish environmentalists interviewed about their source selection for non-work purposes. Multiple factors may contribute to explaining the different influence of quality, including the differences between work and non-work, between researchers and environmentalists, between authoritativeness and content of information, between the US and Finland, between surveys and interviews, and any combination thereof. Or, the different influence of quality may, at least in part, be attributed to chance. In some cases, multiple differences also exist among the groups of participants in a single study. For example, Yitzhaki and Hammershlag (2004) studied differences in source use between computer-science academics and industrial software engineers but explicitly noted (p. 841) that in addition to the academia/industry difference the academics were considerably older, had been in their jobs longer, and differed in educational

background compared to the industry participants. Such additional differences introduce the possibility of alternative explanations of the study results.

Third, it is evident from this review that people and documentary sources are perceived and used differently by expertise seekers, but several of the reviewed studies analyse source selection for people and documentary sources combined. Such analyses mask effects specific to either type of source. Woudstra and Hooff (2008) proposed separate analyses of people and documentary sources to understand better the process of source selection. This review reiterates this proposal.

4.3   Implications for research and development

In spite of the considerable research on expertise seeking, several issues call for future work. First, many factors have been found to influence source selection but their interactions are not well understood. This is, for example, evident in the partiality of the theoretical frameworks used for explaining expertise seeking and in the modest number of interactions investigated in more than one study. Studies of task-related, seeker-related, and contextual factors indicate that a number of these factors moderate the influence of quality and accessibility rather than exert a direct influence on expertise seeking. In addition, a more accessible source may be perceived as higher quality than a similarly competent but less accessible source because the cost-benefit ratio of consulting the more accessible source is better. That is, interactions between factors are frequent and important to understanding expertise seeking.

Second, several methodological issues complicate the interpretation of the reviewed studies. Future work should address the effect of the base level of factors and analyse people and documentary sources separately. It should also be remembered that 61 of the 72 reviewed studies are from North America and Europe. This bias may limit the applicability of the findings to these regions. For example, the social costs of help seeking may be higher in countries with a larger power distance (Hofstede, 2001) between super- and subordinates, and the gender effects on expertise seeking may co-vary with cross-country differences in gender equality. Studies comparing expertise seeking in North America or Europe with expertise seeking in other parts of the world are welcome.

Third, studies are needed of how seekers obtain information about the factors that influence expertise seeking. Most of the reviewed studies, in particular those based on surveys, bypass this issue completely. Current process studies (Civan et al., 2009; McDonald & Ackerman, 1998) distinguish between source identification and source selection, and find that different factors influence these two phases. Thus, process studies add another level of detail. Ghazali and Shiratuddin (2004) propose an expertise-seeking activity framework, which includes expert identification and expert selection and may provide a starting point for further process studies. Such studies may, for example, investigate how expertise seeking is balanced against experimentation aimed at working out issues oneself and how expertise seeking differs in work and non-work contexts.

Fourth, the majority of the reviewed studies view expertise seeking as an isolated activity. There is a scarcity of studies of how expertise seeking affects downstream outcomes such as task completion time or product quality. Currently, the downstream outcomes of expertise seeking are only addressed in a couple of studies (Allen, 1966; Hansen, 1999), thereby weakening conclusions about the value of expertise seeking. Studies of downstream effects would also enforce considerations about how to balance the seekers' need for expertise against the sources' need for keeping disruptions at a manageable level. The reviewed studies predominantly adopt a seeker perspective.

In terms of practical implications, the reviewed studies document many barriers to expertise seeking. The social costs of help seeking warrant particular attention because they are higher for central tasks and have been found to reduce the level of help seeking (Lee, 2002). Another topic of which to be aware is the impact of the friendship network of an organisation on expertise seekers' selection of their sources. There is much practical sense in Casciaro and Lobo's (2005) recommendation for organisations to manufacture liking in relationships critical to effective expertise seeking. It would be a valuable contribution of future work to devise additional ways of alleviating or managing the barriers. Systems for expertise retrieval may be one such contribution but they appear, at present, to

support only a subset of the factors that enter into the source-selection process (see, Balog et al., 2012).

5 Conclusion

Expertise seeking, the activity of selecting people as sources for consultation about an information need, is widespread in practice and has been the subject of considerable research. This review of 72 expertise-seeking papers shows that people are an important source of information and that the selection of people as information sources is affected by a variety of quality-related, accessibility-related, task-related, seeker-related, and contextual factors.

People, especially work-group colleagues and other strong ties, are consistently among the most frequently used sources in work contexts as well as daily-life contexts. The use of people over documentary sources increases as tasks become more demanding and may be partially explained by people's capacity for absorbing uncertainty. In selecting people as sources, multiple studies have found that expertise seekers attend to both quality and accessibility. Thus, explanations based on satisficing have superseded previous proposals that source selection followed a principle of least effort. The quality-related factors that influence source selection concern (a) the reliability of the information and (b) its relevance to the information need, whereas the accessibility-related factors concern (a) the access to the source and (b) the access to the source information.

Some studies argue that task-related factors are the most influential factors in the source-selection process. Task equivocality, complexity, importance, and urgency have all been found to influence source selection, in different ways. For example, task equivocality increases the use of people as sources, consistent with media richness theory, whereas task importance increases the influence of quality on source selection. With respect to seeker-related factors, job experience has been found to decrease expertise seeking. It has also been found that men and people in male-oriented job roles experience a higher social cost of asking for help and engage in less expertise seeking. Expertise seeking is also affected by contextual factors such as social networks. Strong social ties facilitate the exchange of information but are costly to maintain and may therefore not be cost-effective compared to weak ties, at least not for simple tasks. A contextual factor specific to organisational contexts is whether a source is internal or external to the organisation. The reviewed studies show that external sources are used less than internal sources. Finally, we note that the notion of expertise tends to be left unelaborated in studies of expertise seeking.

Appendix: The 72 reviewed papers

Study	Context	Country	Type of study	Participants
Agarwal et al. (2011)	Business professions	Singapore	Survey	346
Allen (1966)	Engineering	US	Other	19
Anderson et al. (2001)	Engineering	US	Survey	872
Auster and Choo (1994)	Management	Canada	Survey	115
Baldwin and Rice (1997)	Business professions	US	Interviews	100
Borgatti and Cross (2003)	Engineering	US	Survey	72
Byström (2002)	Government	Finland	Diaries	39
Casciaro and Lobo (2005)	Other	US	Survey	?
Chakrabarti et al. (1983)	Engineering	US	Survey	500
Choo (1994)	Management	Canada	Survey	67
Christensen and Bailey	Students	US	Experiment	105

(1997)

Civan et al. (2009)	Daily life	US	Observation + interviews	15
Cool and Xie (2000)	Engineering	US	Survey + interviews	14 + 14
Cross and Borgatti (2004)	Management	US	Survey + interviews	38 + 40
Cross and Sproull (2004)	Management	US	Survey + interviews	118 + 40
Culnan (1983)	Other	US	Survey	362
Culnan (1985)	Other	US	Survey	75
Davies and Bath (2002)	Healthcare	UK	Interviews	13
DePaulo and Fisher (1980)	Students	US	Experiment	64
Fidel and Green (2004)	Engineering	US	Interviews	32
Gerstberger and Allen (1968)	Engineering	US	Interviews	19
Gerstenfeld and Berger (1980)	Engineering	US	Survey	310
Groth and Bowers (2001)	Engineering	Sweden	Observation + interviews	1 year's contact
Hansen (1999)	Management	US	Survey	120
Hardy (1982)	Other	US	Survey	968
Helms et al. (2011)	Students	Australia	Interviews	62
Hemmig (2009)	Creative professions	US	Survey	44
Hersberger (2001)	Daily life	US	Observation + interviews	28
Hertzum (2000)	Engineering	Denmark	Observation + interviews	16 meetings
Hertzum (2002)	Engineering	Denmark	Observation + interviews	16 meetings
Hertzum and Pejtersen (2000)	Engineering	Denmark	Interviews	28
Hirsh and Dinkelacker (2004)	Engineering	Multinational	Survey	60
Hofmann et al. (2010)	Education	Netherlands	Survey + interviews	6
Hyldegård (2009)	Education	Denmark	Survey + interviews	10
Johnson (2007)	Daily life	Mongolia	Survey	320
Julien and Michels (2000)	Daily life	New Zealand	Diaries	9
Julien and Michels (2004)	Daily life	Canada	Diaries	1
Kim and Han (2009)	Students	South Korea	Survey	258
Landry (2006)	Healthcare	US	Interviews	12
Lee (2002)	Healthcare	US	Survey	264
Lu and Yuan (2011)	Education	US	Survey + interviews	165 + 26
Marton and Choo (2002)	Engineering	Canada	Survey	67
McDonald and Ackerman (1998)	Engineering	US	Observation + interviews	87
Medaille (2010)	Creative professions	US	Survey	73 + 8
Morrison (1993)	Business professions	US	Survey	240
Morrison and Vancouver (2000)	Engineering	US	Survey	282

Nevo et al. (2012)	Business professions	US	Survey	180
O'Reilly (1982)	Healthcare	US	Survey	163
Quigley et al. (2002)	Education	US	Survey	230
Robinson (2010)	Engineering	UK	Other	78
Rosenberg (1982)	Education	US	Survey	96
Rulke et al. (2000)	Management	US	Survey	128
Savolainen (2008)	Daily life	Finland	Interviews	18
Savolainen (2010)	Daily life	Finland	Interviews	16
Shami et al. (2009)	Engineering	Multinational	Interviews	67
Steff-Mabry (2003)	Other	US	Survey	90
Summers et al. (1983)	Education	Canada	Survey	1078
Tan and Zhao (2003)	Engineering	Singapore	Survey	158
Vancouver and Morrison (1995)	Students	US	Survey	64
VandeWalle et al. (2000)	Business professions	US	Survey	310
Wilkinson (2001)	Lawyers	Canada	Interviews	154
Woudstra and Hooff (2008)	Government	Netherlands	Experiment	56
Woudstra et al. (2012)	Government	Netherlands	Experiment	88
Xu et al. (2006)	Education	Singapore	Survey	154
Yitzhaki and Hammershlag (2004)	Other	Israel	Survey	233
Yuan, Carboni et al. (2010)	Engineering	Multinational	Survey	43
Yuan, Fulk et al. (2010)	Business professions	US	Survey	218
Yuan et al. (2011)	Education	US	Interviews	14
Zach (2005)	Creative professions	US	Interviews	12
Zimmer et al. (2007)	Management	US	Survey	204
Zipperer (1993)	Creative professions	US	Interviews	5
Zmud et al. (1990)	Management	US	Survey	158

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Table 1. Summary of the paper-selection process

Source	Range	Papers in range	Tentatively selected papers	Papers selected for review
IPM	Years 2000-2012	893	11	7
JASIST	Years 2000-2012	1793	24	15
JDOC	Years 2000-2012	484	6	4
Google Scholar	Years 2000-2012	1780	22	5
References	The 63 tentatively selected papers	2995[a]	64	41
Total		7945	127	72

[a] This number includes many duplicates because the 63 papers reference some of the same papers.

Table 2. Ranking of information sources by frequency of use

Study	1st	2nd	3rd	4th	5th
Agarwal et al. (2011)					
Actual source use	Online info	Face-to-face	Phone/chat	Email/forum	Book/manual
Perceived source use	Face-to-face	Phone/chat	Online info	Email/forum	Book/manual
Allen (1966)					
Scientists (top-5 of 8)	Literature	Personal experience	External source	Experimentation	Technical staff
Engineers (top-5 of 8)	Experimentation	Customer	Vendor	External source	Personal experience
Anderson et al. (2001)					
	Personal store of info	Co-worker in org.	Colleague outside org.	Literature in org. library	Librarian/tech. info specialist
Auster and Choo (1994)					
(top-5 of 16)	Newspaper, periodical	Subordinate manager	Subordinate staff	Broadcast media	Internal memo
Byström (2002)					
Automatic task (top-5 of 6)	Official document	Meeting	Expert	People concerned	Literature
Normal task (top-5 of 6)	Official document	Expert	People concerned	Meeting	Literature
Decision task (top-5 of 6)	Expert	Meeting	Official document	Literature	People concerned
Chakrabarti et al. (1983)					
(top-5 of 22)	Work group	Trade periodical	Handbook	Newspaper	Expert in firm
Choo (1994)					
(top-5 of 16)	Newspaper, periodical	Subordinate manager	Subordinate staff	Broadcast media	Customer
Cool and Xie (2000)					
	People on project team	Periodical	Book	People in work group	People in dept/division
Culnan (1983)					
Bank (top-5 of 9)	Personal subscription	Peer	Internal document	Superior	Subordinate
Manufacturer (top-5 of 9)	Personal subscription	Subordinate	Peer	Internal document	Superior
Gerstberger and Allen (1968)					
(top-5 of 8)	Literature	Group	Vendor	Technical staff	Experimentation
Hemmig (2009)					
(top-5 of 8)	Experimentation	Colleague	Class or demonstration	Magazine /journal	Manufacturer /supplier
Hirsh and Dinkelacker (2004)					
Keeping current (top-5 of 12)	External website	Web search engine	Colleague outside org.	Standard body	Online news / disc. group
Routine research info need (top-5 of 12)	Web search engine	External website	Library web service	Standard body	Company intranet
Thorough literature search (top-5 of 12)	Web search engine	External website	Library web service	Standard body	Visit library in person
Exploring unfamiliar area (top-5 of 12)	Web search engine	External website	Colleague outside org.	Library web service	Online news / disc. group
Johnson (2007)					
(top-5 of 8)	Television	Newspaper	People	Internet	Library
Marton and Choo (2002)					
(top-5 of 13)	World wide web	Colleague in same group	Radio/TV /newspaper	Computer-mediated comm.	Colleague in other group
Medaille (2010)					
(top-5 of 7)	Friend /	Website	Email list	Organisation	Newspaper

	co-worker			/association	/magazine
Rosenberg (1967)					
Researchers (top-5 of 8)	Personal library	Material in same building	Phone someone knowledgeable	Reference librarian	Library outside your org.
Non-researchers (top-5 of 8)	Personal library	Material in same building	Phone someone knowledgeable	Knowledgeable person in org.	Reference librarian
Summers et al. (1983)					
(top-5 of 13)	Conversation with colleague	Note, file, personal book	Book / textbook	Curriculum material	School or district library
Yitzhaki and Hammershlag (2004)					
Engineers, initial info (top-5 of 26)	Colleague in org.	Bibliographic database	Textbook	Supervisor	Online handbook
Scientists, initial info (top-5 of 26)	Printed journal	Colleague in org.	Textbook	Printed conf. paper	Online conf. paper
Engineers, mid project (top-5 of 25)	Colleague in org.	Textbook	Printed handbook	Supervisors	Online handbook
Scientists, mid project (top-5 of 25)	Colleague in org.	Printed journal	Textbook	Printed conf. paper	Bibliographic database
Zmud et al. (1990)					
Lateral communication (top-5 of 14)	Phone	One-on-one chat	One-on-one conference	Voice messaging	Handwritten notes
Downward communi-cation (top-5 of 14)	One-on-one chat	One-on-one conference	Phone	Handwritten notes	Voice messaging

Table 3. Studies of the percentage of sources used that are people versus documentary

Study	People %	Documentary %	Other %	Total %
Byström (2002)				
Automatic tasks	31	65	4	100
Normal tasks	58	39	3	100
Decision tasks	72	25	3	100
Gerstenfeld and Berger (1980)				
Basic research	38	62		100
Applied research	50	50		100
Hertzum (2000)	77	23		100
Julien and Michels (2000)	56	23	21	100
Julien and Michels (2004) [a]				
Crisis (i.e., very short-term)	83	17	0	100
Short-term	53	15	31	100
Long-term	38	37	24	100
Temporally undetermined	57	9	33	100
Robinson (2010) [b]	7.8	6.4		

[a] Sources contacted on the phone are counted as people. [b] This study gives the percentage of working time spent seeking information.

Table 4. Studies reporting standardised regression coefficients (beta) of how selection criteria affect source use

Study and sources [a]	Quality-related factors		Accessibility-related factors		Other factors [b]	
	Factor	Beta	Factor	Beta	Factor	Beta
Agarwal et al. (2011)						
P&D	Quality	0.47***	Access difficulty	-0.22***	Task complexity	0.11**
			Comm. difficulty	-0.01		
Borgatti and Cross (2003)						
P [c]	Valuing src	0.34***	Physical proximity	0.07	Knowing src	0.23***
			Accessibility	0.28***	Hierarchy	0.04*
			Low cost	-0.01		
P [d]	Valuing src	0.17***	Physical proximity	0.09	Knowing src	0.23***
			Accessibility	0.35***	Gender	0.11*
			Low cost	-0.01		
Chakrabarti et al. (1983)						
P&D	Utility of info	0.18	Cost to use	-0.15		
			Skills to use	0.19		
			Availability	0.21		
			Ease of use	0.60**		
Cross and Borgatti (2004)						
P	Aware of src skills	0.42***	Accessibility	0.15***	Hierarchy	0.07***
			Comfortability	-0.01	Tenure	-0.09***
			Src engagement	0.12***		
Hardy (1982)						
P&D	Content	-0,24**	Speed	-0.44**		
Lu and Yuan (2011)						
P&D	Quality	0.44**	Accessibility	0.18	People/doc	0.55*
Marton and Choo (2002)						
P [e]	Quality	0.66***	Accessibility	0.08		
P [f]	Quality	0.35**	Accessibility	0.01		
P [g]	Quality	0.34*	Accessibility	-0.16		
P [h]	Quality	0.41**	Accessibility	-0.20		
P [i]	Quality	0.61***	Accessibility	-0.10		
P [j]	Quality	0.31*	Accessibility	-0.02		
Morrison and Vancouver (2000)						
P&D	Expertise	0.44***	Accessibility	0.09***		
O'Reilly (1982)						
P	Quality	0.43***	Accessibility	0.08	Education	0.15**
Tan and Zhao (2003)						
P	Expectancy value	0.21*	Accessibility	-0.11	Learning focus	0.19*
			Effort cost	0.11	Self-efficacy	0.23*
Vancouver and Morrison (1995)						
P	Expertise	0.55**	Accessibility	0.10**	Relationship	0.39**
					Reward	0.25**
VandeWalle et al. (2000)						
P	Perceived value	0.22***	Perceived cost	dropped	Consideration	0.11*
					Initiation	0.16**
Xu et al. (2006)						
P	Source quality	0.57*	Physical proximity	0.08		
			Understandability	0.02		
Yuan, Carboni, et al. (2010)						
P	Individual aware	0.28*	Individual access	0.38*	Individual media	0.17*
	Dyadic aware	0.49***	Dyadic access	0.49***	Dyadic media	0.14**
Zimmer et al. (2008)						
P&D	Quality	0.33***	Accessibility	0.31***	People/doc	-0.35**

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. [a] P indicates analyses of people sources only and P&D indicates analyses of people and documentary sources together. [b] Only factors that significantly affect source use ($p < 0.05$) are listed under other sources. [c] Information scientists. [d] Genomic researchers. [e] Customers. [f] Business and professional associates. [g] Competitors. [h] Managers/supervisors. [i] Colleagues in the same group/department. [j] Colleagues in different group/department.

Table 5. Quality-related and accessibility-related factors in five selected studies

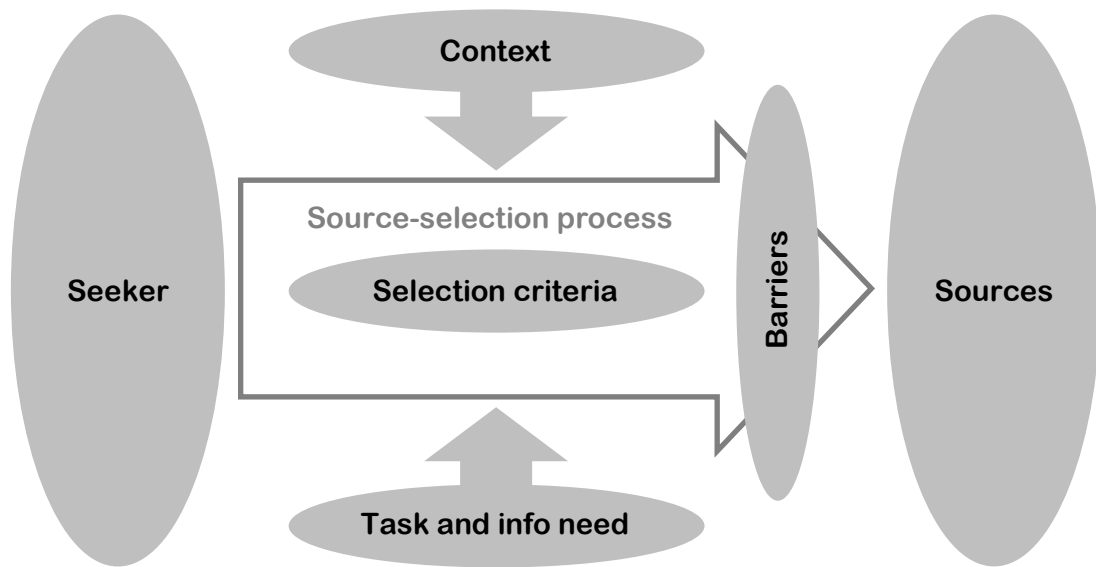| Study	Quality-related factors	Accessibility-related factors
Fidel and Green (2004)	- Can give data that meets the needs of the project - Is most likely to have the information needed - The information is not available elsewhere - Can give the latest information - Is reliable - Gives definite answers - Is accurate	- Sources I know - Has a lot of different types of information in one place - Can give the right level of detail - Saves time - Has the right format - Sources with which I feel comfortable - Is physically close - Can be searched with keywords or codes - Is interactive - Is available - Is not busy - Is accessible
Hertzum (2002)	- Appropriate organisational unit - Technical quality - Appropriate project experience - Appropriateness to task - Appropriate external body - Up-to-dateness - Representativeness	- Accessibility - Ease of use - Cost to use
Kim and Han (2009)	- Believability - Appropriate amount - Objectivity - Timeliness - Understandability	
Woudstra and Hooff (2008)	- Topic of knowledge - Perspective - Reliability - Up-to-dateness	- Physical proximity - Availability - Approachability - Cognitive effort - Saves time
Woudstra et al. (2012)	- Reliability - Relevance	- Cognitive accessibility - Physical accessibility - Relational accessibility

Table 6. Studies of the percentage of selection criteria mentioned that are about quality versus accessibility

Study and sources	Quality-related %	Accessibility-related %	Other %	Total %
Fidel and Green (2004)				
People and documentary	32	68		100
Hertzum (2002)				
People	64	14	22	100
Documentary	54	30	16	100
Hofmann et al. (2010)				
People	55	21	25	100
Savolainen (2008)				
People	94	6		100
Documentary	91	9		100
Savolainen (2010)				
People	85	0	15	100
Documentary	55	35	10	100
Woudstra and Hooff (2008)				
People	77	5	20	100

Table 7. Barriers to expertise seeking

Type	Barrier	Number of studies
Context		
	Relevant information is confidential	2
	Company size and culture	1
	Lack of intermediaries to support expertise seeking	1
	Relevant information is scattered	1
Seeker		
	Time-consuming and costly to get information from source	9
	Seeker unfamiliar with source	4
	It is an uneasy experience	3
	Losing face by revealing uncertainty and lack of knowledge	3
	Seeker has too few relationships	3
	Information overload	2
	Seeker cannot formulate question	2
	Seeker lacks background knowledge	1
	Unable to remember oral answers	1
Source		
	Source knowledge is incomplete or unreliable	7
	Source inaccessible	5
	Source perceived as unapproachable or unwilling to help	5
	Source biased	4
	Source credibility difficult to assess	3
	Source not up-to-date	3
	Source external to organisation	3
	Busyness of source	2
	Source has too few relationships	2
	Source physically distant	2
	Source does not provide for discussion of a variety of viewpoints	1
	Source is a competitor	1
	Source lacks practical experience	1
Expertise-seeking process		
	Cognitively engaging source in information need	6
	Complicated answer	3
	Language	3
	Source unable to communicate answer	3
Task		
	Acquired information not useful	3

Figure 1. Expertise seeking