

Expert-seeking Activity Framework

Osman Ghazali & Norshuhada Shiratuddin

Faculty of Information Technology
Universiti Utara Malaysia, 06010 Sintok, Kedah, MALAYSIA
osman@uum.edu.my, shuhada@uum.edu.my,

Abstract. Expert seeking is an activity in which one seeks expertise from someone else in order to solve certain problems. When one realizes he or she requires helps to accomplish tasks that need new skills and knowledge, the process of expert seeking is initiated. This process involves many elements including formulating goals and strategies, identifying and selecting experts, and repeating the steps when necessary. Electronic tools have been utilized in assisting these steps, and these include personal homepages, online forums, expert databases, and expert-seeking systems. By incorporating these elements, an expert-seeking activity framework is proposed, which can be guidance for researchers to better understand expert-seeking activity.

Keywords

Expert Seeking, Expert-Seeking System, Expert Finding, Expertise Management, Expertise Modelling

1. Introduction

It is a norm for mostly everyone to encounter problems while completing tasks. These problems consequently require helps from others, and these could be in the form of information and experts. The former activity is known as information seeking, while the latter is expert seeking.

Expert seeking is an intentional action with problems and goals, which begins when people are in problematic situations and are seeking for information or experts for role players.

This paper starts with a discussion on expert seeking in organizations. Among the issues being elaborated are the environment, problems, goals, and process involved. The next section describes some electronic tools, which could be applied in seeking experts. The final part then presents a proposed expert-seeking framework.

2. Expert Seeking In Organizations

According to Merriam-Webster dictionary an expert is '*one with the special skill or knowledge representing mastery of a particular subject*'. Skills or knowledge indicate mastery in a particular field, which will make an individual being recognised as the specialist, therefore possessing authority in the field.

Skill can be divided into a number of different levels of expertise that indicate skill an individual possesses. The individual can be evaluated based on how well he or she performs a particular task, the better the performance the higher the skill. Dreyfus and Dreyfus (1986)

present skills in five stages: novice, advance beginner, competent, proficient, and expert. The higher level of skill an individual possesses, the better expert he is.

McDonald and Ackerman (2000) describe expertise as the ability of an individual to apply skills and knowledge in a new situation, which is also called "*creative endeavour*". Before an individual can be recognised as an expert, the individual needs to demonstrate his or her ability by applying skill and knowledge in problem solving. This is true in the organisations' working environments, in which workers always need to apply their skills and knowledge in performing their work.

According to OECD (1996), taxonomy of knowledge comprises of *know-what*, *know-how*, *know-why* and *know-who*. *Know-who* is the most needed knowledge in expert-seeking activities. In order to get to somebody that possesses knowledge about *know-what*, *know-how* and *know-why*, one must have *know-who* knowledge. *Know-who* will guide us on who should be approached for a particular problem.

In expert-seeking activity, the term expert can have a broad meaning. An expert can be anybody in an organization that has skills or knowledge in a particular field. One person could be an expert in a particular individual context but not an expert in another individual context. Anybody that possesses knowledge about *know-what*, *know-how*, *know-why* and *know-who* can be an expert.

2.1 The Environment in Which Expert Seeking Takes Place

Expert-seeking activities mostly happen in a dynamic work environment where people always deal with tasks that require new skills and knowledge, and an environment where there are many people with different expertise. These tasks may require collaboration and team formation that comprise people from different area of expertise. In this kind of environment the ability to find experts in required expertise is crucial to the successful completion of the tasks.

An adhocratic organisation that is an organisation with highly organic structure is the type of organisations closely describes the environment where expert seeking is always in action. An adhocratic organisation '*has little formalization of behaviour; high horizontal job specialization based on formal training; a tendency to group the specialists in functional units for housekeeping purposes but to deploy them in small, market-based project teams to do their work; a reliance on the liaison devices to encourage mutual adjustment, the key coordinating mechanism, within and between these teams; and selective decentralization to and within this teams, which are located at various places in the organization and involve various mixtures of line managers and staff and operating experts.*' (Mintzberg, 1979)

Example of adhocratic organizations are hospitals and universities that focus on innovate research, where workers join in organic multidisciplinary teams to create new knowledge and skills, and organization with frequent product change such as aerospace, electronic, think-tank, consulting research, advertising, filmmaking, petrochemicals etc (Laudon & Laudon, 2003).

2.2 Expert-seeking Problems

Belkin, *et al.* (1982) introduce the term *Anomalous State of Knowledge (ASK)* that describes the situation in which a human needs information or expertise. According to them, we have our images of the world that form our conceptual state of knowledge. When we are performing our tasks, we use our conceptual image of knowledge to accomplish the tasks. However, when the tasks require information or knowledge outside of our conceptual images of knowledge, we will be in the '*knowledge anomaly*' state. This anomaly can be lack of knowledge about the topic or situation regarding the tasks. It leads to information seeking or expert-seeking activity.

However, in the case of an expert being needed to augment an organization's resources in a project, it is not necessary for an individual to be in anomalous state of knowledge, e.g. a task is within an individual personal knowledge but it is too big to be an individual assignment or project, therefore collaboration with others is inevitably needed. Wersig (1979) views of problematic situation, see figure 1, would be more appropriate to describe the state of experts needs.

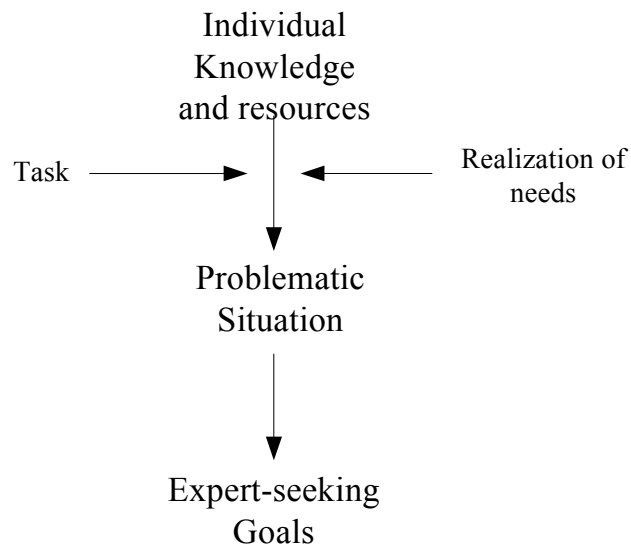


Figure 1: Problematic situation

A problematic situation could be any situation that individuals encounter which requires them to seek expert help or assistance. It happens when an individual has to perform a particular task, and in order to perform the task the individual realize that he need experts assistance. This situation leads to the formulation of goals to solve the problematic situation that will determine the strategies to be used in expert seeking. With these goals the person embarks on expert-seeking activity.

2.3 Expert-seeking Goals

Expert-seeking goals vary, depending on the situations and problems that individuals want to solve. They can be identified within a particular individual or organizational expert-seeking context.

Yimam and Kobsa (2000) identified two broad categories of expert-seeking goals in organizations. The first category is seeking experts for information purposes, and the second is seeking experts for role-players. In seeking experts for information, people seek experts in order to get information about something, to get additional information about documents, or to substitute document resources. Because the kind of help needed from experts in this expert seeking is only provision of information, the expertise requirements for this type of expert seeking may not be as complex as expert seeking for role players (Yimam & Kobsa, 2000). In seeking experts for role player, expert seekers need an expert to play a particular role in certain activities or to perform certain given functions. Usually, the expert needs to possess knowledge that meets the expert seekers' requirements. Seeking this kind of experts requires more detailed information about the expertise needed. In this situation, the searching will need more structured techniques not just for acquiring information.

2.4 Expert-seeking Processes

McDonald and Ackerman (2000) and McDonald (2000) describe a generic expert-seeking behaviour that includes the following elements: identification, selection and escalation (see figure 2). This model describes expert-seeking process, which is commonly found in any expert-seeking activity.

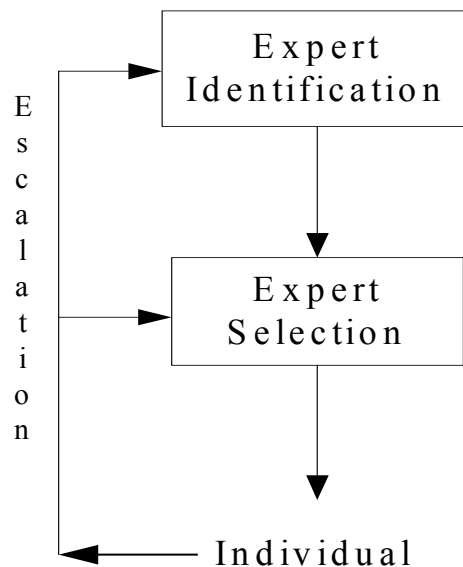


Figure 2: Expert-seeking behaviour model (McDonald & Ackerman, 2000; McDonald, 2000)

Expertise identification is an action of finding a set of candidates who are likely to have the required expertise (McDonald & Ackerman, 2000; McDonald, 2000). In real work setting, expertise identification can rely on prior experience with others, key people such as concierge, or historical documents (McDonald, 2000; Cross *et al.*, 2001).

Expertise selection is the process of selecting one person to approach for help, and it is guided by individual criteria (McDonald & Ackerman, 2000; McDonald, 2000). Individuals can be selected based on social factors (Vivacqua & Lieberman, 2000), such factors are closeness, previous experience with that particular expert, and etc.

Finally, escalation is the mechanism that fixes breakdowns in identification and selection (McDonald & Ackerman, 2000; McDonald, 2000). Breakdowns can happen in the initial identification and selection, probably because expert seekers are not clear with what they are seeking and what problems they want to solve as they are in an anomalous state of knowledge. In order to fix the breakdowns in expert-seeking activities, expert seekers have to repeat expert selection or/and expert identification processes.

2.5 Approaches to Experts Identification

Shanteau, *et al.* (2002) in their research have extensively study approaches to identify expertise. Among the approaches that have been used in various domain, are: experience, products of expert, certification, social acclamation, consistency reliability, consensus reliability, discrimination ability, behavioural characteristics, knowledge tests, creation of expert, and Cochran-Weiss-Shanteau index of performance. While some of these approaches are quite similar and very interrelated in their approaches, some are unique.

2.6 Approaches to Experts Selection

Selecting the right person (expert) for a particular problem is one of the important elements in expert seeking. Every individual, either expert seeker or expert is a human being, and has unique needs and behaviour. This unique needs and behaviour, also known as social factors, will influence the effectiveness of the communication and collaboration between experts and expert seekers (Vivacqua & Lieberman, 2000). Thus, the ability to exploit social factors in selecting the right experts for expert seekers to ask information or work together is essential in expert-seeking process. Hence, social factors should be the main consideration in expert selection.

Social factors in expert seeking are about social relationships that influence interactions between expert seekers and experts. It is about how well expert seekers and experts can get together. Social relationship can be investigated in term of social structure, which refers to patterning in social relationships within an organization (Cross, *et al.*, 2001; Wasserman, 1994). An organization can be viewed as a network of actors that interprets, creates, shares and acts on information and knowledge (Cross, *et al.*, 2001; Wasserman, 1994; Zack, 2000).

Social Network Analysis is a tool that can be used to describe and analyse the organizational social structure (Cross, *et al.*, 2001; Wasserman, 1994; Zack, 2000). It usually employs graph theory that represents nodes of actors and their relationship; the nodes could be anything under investigation like people, product, paper, and etc. This approach has been used extensively for measuring and describing social structure. It also has been used in several studies of computer-mediated communication.

3. Electronic Tools Aid Expert-Seeking Activities

Many electronic tools can aid people to find experts in organizations. Among them are discussion forums, personal homepages, organizations' databases and knowledge directories, and expert-seeking systems (see figure 3). Though, discussion forums and personal homepages are not specifically created for expert-seeking purpose, they are good resources for information about people and their expertise, which are useful in expert seeking. In contrast, expert databases and expert-seeking systems are specifically developed for managing expertise in organizations (Yimam & Kobsa, 2000; Becerra-Fernandez, 1999), and hence, aid expert-seeking activities.

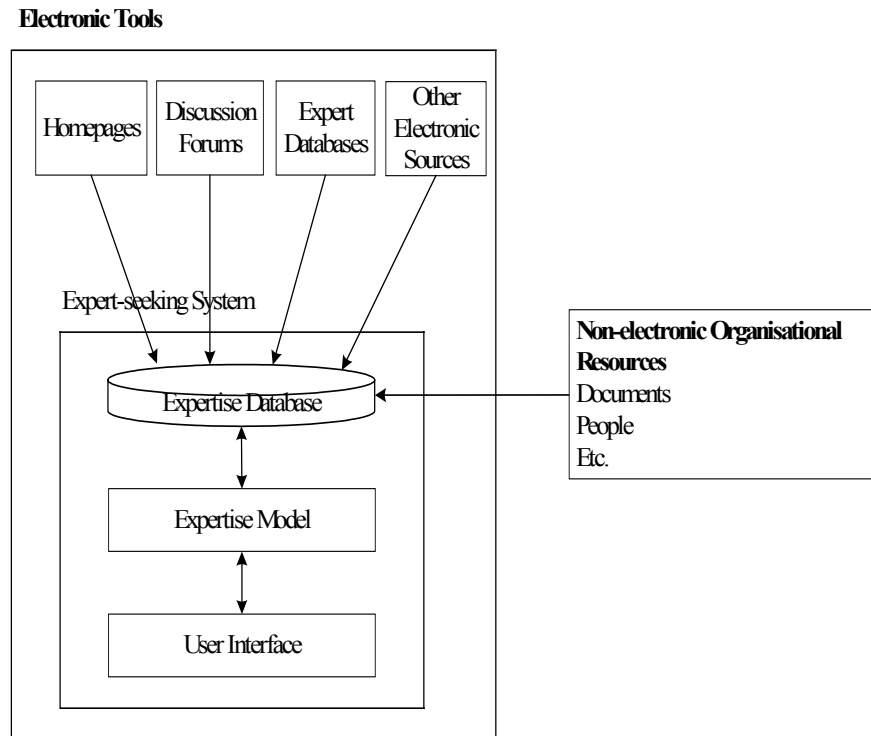


Figure 3: Electronic tools

3.1 Discussion Forums

A discussion forum is an electronic form of notice boards, a forum that enables members to post notices, and share ideas on a specific topic. An organization can have many discussion forums as an avenue, where any discussion about anything can take place. Members of the forum can post messages or follow-up messages in the forum they join at any time. All messages posted in the discussion forums are stored in organizational databases, which then can be resources for expert tracking.

Experts can be identified from the documents they send to the forums, discussions in which they participate, questions they answer, and their expertise declaration. To search experts through forums, users can browse previous discussions and then make inferences from the discussions about who are the experts in a particular field.

Forums can provide useful information about expertise to automatic expert-seeking systems. Krulwich and Burkey (1996) developed ContactFinder, an automatic expert-seeking system that assists users by referring them to other users who can help them. This system relies on

discussions on bulletin boards to keep track of people who are key contacts in various topic areas.

3.2 Personal Homepages

Another way of searching for an expert is by looking at personal homepages. Homepages provide information about people as they usually describe who they are and what they do. Furthermore, the Web is becoming widely used in the community and organizations, and access to the Internet and intranet is becoming an everyday routine. This is in line with the idea for the Web “to be a pool of human knowledge” and “to allow collaborators in remote sites to their ideas and all aspects of a common project” (Berners-Lee, *et al.*, 1994). Homepages would be good resources for expert seeking and information sharing.

Many people use personal homepages as a means to communicate with others. By publishing information about themselves on their homepages, they are publishing their information to the whole world or the whole organization. On the Internet, the information is available to a global public, while in intranet the information is available to users of certain groups in an organization. Usually, on personal and organizational homepages, there are links to other useful websites of other people’s interests or documents. These links form threshold of Websites and knowledge link that is very useful for expert seeking. These Web pages can act as a gateway to pages for the organisation or individual, (Tauscher & Greenberg, 1997). In addition, a study by Bly, *et al.* (1998) on 28 personal homepages in four organisations found that 75 percent of the examined personal homepages contained project-related information, 50 percent contained personal information such as hobbies, and 39 percent contained photos of the authors. This shows that homepages are a good source of expertise information.

3.3 Expert Databases

An expert database is a way of keeping information about the knowledge resources an organization has. All information about organizational expertise is stored in the expert database, which then is made accessible to others who are looking for experts. This concept has been used in many organizations in the forms of electronic yellow pages, knowledge directories and knowledge maps (SkillView Technologies, 1998; Davenport, 1995a; Davenport, 1995b; Becerra-Fernandez, 1999; Seemann, 1997). For example, SkillView Technologies (1998) developed knowledge maps to store information about an organization human capital of “what people know” and “who knows it”. They have also developed a skill inventories database which stores information about “what people can do” and “who can do it”.

Expert databases are different from expert-seeking system in a way that it only stores expertise information in databases. Users to the database can search the database to look for experts. They do not provide recommendation to user regarding who is the best expert to help a particular individual in a particular problem. However, expert database can serve as source of input to expert-seeking system, in which expertise information from expert databases can be used by expert-seeking system to identify experts in a particular field (Yimam & Kobsa, 2000).

3.4 An Expert-seeking System

An expert-seeking system is an information system that helps users to search for experts with particular knowledge. This is mainly done by keeping information about organizational expertise in databases, modelling expert-seeking processes and providing user interface

(Yimam & Kobsa, 2000; McDonald, 2000). Upon receiving requests from expert seekers through the user interface, the system will generate a list of experts that potentially meet expert seekers' requirements by analysing information in expertise databases. The analysis is performed by an expertise model that models expert-seeking processes.

Expertise database is similar to expert database, however in expert-seeking system, the database is designed according to the requirements of the expertise model. Expertise database will gather information about expertise from either organisational electronic sources or organisational non-electronic sources (see figure 3). Such sources are users, experts, documents, electronic sources and etc. Expertise information data gathering can either be collected manually or automatically by the expert-seeking system. In manual data collection, information is updated into the database by system administrator or users. Meanwhile, in automatic data collection, artificial intelligent techniques are employed to automatically collect information from organisational resources.

Expertise model is a component that represents an expert-seeking process in expert-seeking system (Yimam & Kobsa, 2000). This is an important component in expert-seeking systems because it will determine the effectiveness of the recommendation made by the expert-seeking system. Different systems may have different processes in their expertise models. It depends on which identification approaches and selection approaches employed by the expert-seeking system.

User interface is a component that facilitates the interaction between users and expert-seeking systems. A successful information system must have a good user interface, that enable users to make interaction queries such as comparison of queries, expertise analysis, and expertise visualisation (Yimam & Kobsa, 2000).

4. An Expert-Seeking Activity Framework

Based on the concept of problematic situation (Wersig, 1979) and expert-seeking process (McDonald & Ackerman, 2000) with combination to the electronic tools, we propose an expert-seeking activity framework (see figure 4). We merge the three elements to produce a comprehensive guidance, specifically targeted at novice researchers or newcomers to expert-seeking activities.

This framework should be able to assist researchers and system developers to understand expert-seeking processes in organizations. Since, every organization has different structure and resources, fully understanding of organizational requirements before a system implementation is trivial to the success of any expert-seeking system or knowledge management system. This framework will facilitate the process of understanding what specific problems that require people in an organization to seek for experts, expert-seeking processes involved, organizational expertise resources available, electronic tools, and how all these can be integrated in an expert-seeking system that can support organizational objectives.

This framework describes expert-seeking activity in two distinct phases: pre-process and process. Pre-process is a problematic situation that triggers an expert-seeking process. Every

person has his own knowledge and resources. However, when performing everyday tasks, the person needs knowledge and resources beyond his own, the person is in problematic situation (the situation in which the person realises that he needs information or help from others in order to perform his tasks). These situations lead to the formulation of expert-seeking goals, and expert-seeking activities.

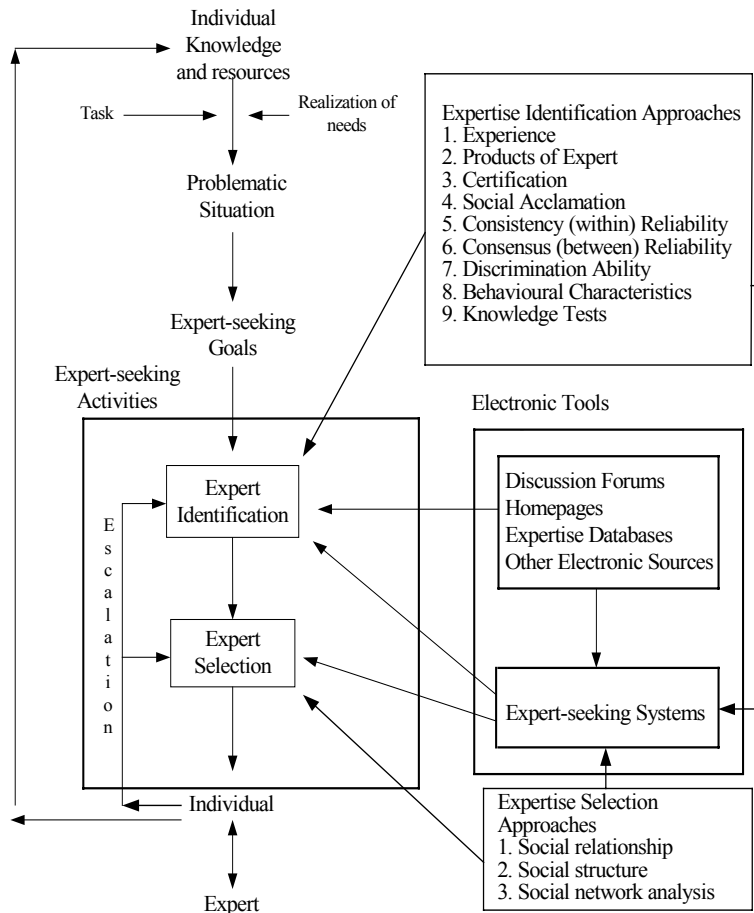


Figure 4: An expert-seeking activity framework

Expert-seeking process comprises of three main activities: expert identification, selection and escalation. Expert identification is the first step in expert-seeking process. A number of approaches can be employed in expert identification, and different organisations may employ different approaches such as based on experience, product of experts, certification, and etc. It also can be supported by electronic tools available in the organization. The second step is expert selection, and usually this step considers social factors, social relationship in the form of social structure, to select the right experts. The tool can be used to analyse social structure is social network analysis, which can be incorporated in an expert-seeking system.

After the selection process, the expert seekers will approach the selected experts to get help. This can be in the form of asking for information or collaboration with the experts.

If everything goes well, new knowledge will be added to expert seeker's pool of knowledge. However, if it is not, the expert seeker may repeat the expert-seeking process until he/she finds the right expert.

5. Conclusion and Future Work

We have presented an expert-seeking activity framework that comprises of problematic situation that triggers expert-seeking actions, expert-seeking behaviour model, expert identification approach, expert selection approach and electronic tools. This framework can be used to understand and investigate expert-seeking activities in an organization. In our future work we aim to employ this framework to investigate and model expert-seeking activities in an adhocratic organisation. We will focus on modelling the process of expert identification and selection, which are required to support expert seekers in their work. Both types of expert-seeking behaviour (expert seeking for an information source and expert seeking for a role player) will be incorporated into the model.

References

- Becerra-Fernandez, I. (1999). *Searchable Answer Generating. Environment SAGE: A Knowledge Management System to Search for Experts in Florida*. In proceedings of the 12th Annual International Florida Artificial Intelligence Research Symposium FLAIRS : Knowledge Management Track, Orlando, Florida.
- Belkin, N. J., Oddy, R. N., & Brooks, H. M. (1982). *ASK for information retrieval: Part I. Background and theory*. Journal of Documentation 38(2): 61-71.
- Berners-Lee, T., Cailliau, R., Luotonen, A., Nielsen, H. F., & Secret, A. (1994). *The Worldwide Web*. Communications of the ACM 37(8): 76-82.
- Bly, S., Cook, L., Bickmore, T., Churchill, E., & Sullivan, J (1998). *The Rise of Personal Web Pages at Work*. CHI 98 Summary, ACM Press.
- Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2001). *Knowing What We Know: Supporting Knowledge Creation and Sharing in Social Networks*. Organizational Dynamics 30(2): 100-120.
- Davenport, T. H. (1995a). Knowledge Management at Hewlett-Packard, Early 1996, Ernst & Young. 2002.
- Davenport, T. H. (1995b). Managing Knowledge Competencies at Microsoft, Ernst & Young. 2002.
- Dreyfus, H. L. & Dreyfus, S. E. (1986). *Mind Over Machine: The Power of Human Intuition and Expertise in the Era of the Computer*. New York, The Free Press.
- Krulwich, B. & Burkey, C. (1996). *The ContactFinder: Answering bulletin board questions with referrals*. The National Conference on Artificial Intelligence.
- Laudon, K. C. & Laudon, J. P. (2003). *Management Information Systems*, 8th ed., New Jersey: Prentice Hall.
- McDonald, D. W. (2000). *Supporting Nuance in Groupware Design: Moving from Naturalistic Expertise Location to Expertise Recommendation*. Unpublished PhD thesis. Information and Computer Science, University of California, Irvine.
- McDonald, D. W. & Ackerman, M. S. (2000). *Expertise Recommender: A Flexible Recommendation System and Architecture*. Computer-Supported Cooperative Work 2000, ACM Press.
- Mintzberg, H. (1979). *The Structuring of Organizations*, Prentice Hall.
- OECD (1996). *The OECD Jobs Strategy - Technology, Productivity and Job Creation*. OECD Vol. 1.

- Seemann, P. (1997). *A Prescription for Knowledge Management: What Hoffmann-Laroche's Case Can Teach Others*. Perspectives on Business Innovation Journal (1).
- Shanteau, J., Weiss, D. J., Thomas, R. P. & Pounds, J. C. (2002). *Performance-Based Assessment of Expertise: How to Decide If Someone is An Expert or Not*. European Journal of Operational Research 136(2): 253-263.
- SkillView Technologies (1998). *Knowledge Management Systems*, SkillView Technologies. 2002.
- Tauscher, L. & Greenberg, S. (1997). *How people revisit web pages: empirical findings and implications for the design of history systems*. International Journal Human-Computer Studies 47: 97-137.
- Vivacqua, A. & Lieberman, H. (2000). *Agents to Assist in Finding Help*. Proceedings of the ACM Conference on Human Factors in Computing Systems, ACM Press.
- Wasserman, S. & Faust, K. (1994). *Social network analysis: Methods and applications*. Cambridge, Cambridge University Press.
- Wersig, G. (1979). *The Problematic Situation as a Basic Concept of Information Science in the Framework of the Social Sciences: A Reply to Belkin*. International Federation for Documentation. "Theoretical Problems of Informatics: New Trends in Informatics and its Terminology. Moscow: VINITI: 48-57.
- Yimam, D. & Kobsa, A. (2000). *Expert Finding Systems for Organizations: Problem and Domain Analysis and the DEMOIR Approach*. Beyond Knowledge Management: Sharing Expertise. M. Ackerman, A. Cohen, V. Pipek and V. Wulf. Boston, MA, MIT Press.
- Zack, M. (2000). *Researching Organizational Systems using Social Network Analysis*. In proceedings of the 33rd Hawaii's International Conference on System Sciences, Maui, Hawaii's.