Agent-Mediated Knowledge Management: An Exploratory Review for Research in Knowing the Knower

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ABSTRACT:

The relation between Knowledge Management (KM) as an application area and intelligent software agent as a technology for supporting KM is reviewed an elaborated in this paper. Starting with the changing characteristics of KM, this paper details the concepts and theories of organisational and personal KM, which brings the scope to some of the drawbacks in KM today. We then study the evolution of intelligent software agent technology and its characteristics that could be exploited for KM. The prime concerns in our proposed research are on the reactiveness and proactiveness of software agent in reaching out knowledge resources and experts. Previous researches on similar areas are discussed, in identifying limitations that should be looked into. We conclude this paper with questions which a research in agent-mediated knowledge management should deal with.

Keywords: *Software agent; Organisational knowledge management; Personal knowledge management*

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1. Introduction

In 1997, Davenport et al (1997) described the types of knowledge repositories projects, where people take documents with knowledge embedded in them – memos, reports, presentations, and articles – and store them in a repository for easy retrieval. There are other types of less structured form of knowledge found in the discussion database, in which participants record their own experiences on an issue and react to others' comments. Out of these, the authors' categorisation of knowledge repositories are found useful in developing a model: (1) *external knowledge*, e.g. competitive intelligence; (2) *structured internal knowledge*, e.g. research reports, product-oriented marketing materials, and techniques and methods; and (3) *informal internal knowledge*, e.g. discussion databases full of know-how, sometimes referred to as "lessons learned." They have also found 'knowledge access' projects that recognised the difficulties of finding a person with the knowledge one needs, and then successfully transferring it from that person to another. Since then, managers found the importance of connectivity, access and transfer, to get at the knowledge the organisation knows they have and sharing that knowledge with others.

Observations were made where knowledge sharing has not occurred on a widespread basis in terms of applications, as how it was originally envisioned. “No longer does the bottleneck of knowledge acquisition command our attention as it once did – instead, we are scrambling to find ways to impose structure and meaning on the virtual fire hose of mostly document-based ‘knowledge’ that is available to us freely on the Web” (Bradshaw et al., 1997; 12). Until today, knowing that the capture, sharing and utilisation of internal knowledge is fundamental to the organisation’s ability to create and sustain competitive advantage, it is of no deny that if organisational knowledge remains inaccessible or non-integrated, then the value of knowledge generation and codification is diminished (Wakefield, 2005). Hence, knowledge sharing and transfer within the organisation, and if necessary outside of organisation as well, is a critical activity.

This paper reviews the researches related to issues in mediating knowledge management processes. The structure of this paper covers the aspect of knowledge management in terms of organisational and personal knowledge management, the theory involving software agent and its components, and concludes with questions that are thought a research in agent-mediated knowledge management should deal with.

2. Knowledge Management

2.1. Knowledge Management Trend

Trends and directions of knowledge management (KM) have been cited by Foo, Sharma and Chua (2007) and Wiig (1999, 2000), in terms of expertise location and communication. Current trend includes the leveraging of expertise (or subject matter experts) found in different parts of the world (or within a multiple location organisation) that can be facilitated through improved expertise location (people finder) system and communication channels. Note that a common background of tacit knowledge must exist among individuals in an organisation (Foo et al, 2007).

The authors also suggested that the channels which are currently based on bulletin boards and discussion forums on a participatory basis may extend to real-time multimedia chat and instant messaging, and better yet, be extracted and taxonomised by agent technologies in future. This shows the changes in knowledge management trend, from explicit documentations and discussions, to an automated facility by agent technologies. Judgements of experts and other interactions will also be encapsulated; such a network of people-document-knowledge forms an important entity in knowledge management work” (Foo et al, 2007).

2.2. Organisational Knowledge Management

Knowledge that resides in the minds of people in an organisation, but has not been put in structured, document-based form, are called “tacit” (versus explicit) knowledge (Davenport et al, 1997). Details of explicit and tacit knowledge and the relationship between the two were discussed in detailed by Nonaka (1994). Davenport et al (1997) came across companies that were building and managing expert networks, where one of them comprised the primary business – the company motivates experts to participate

in the network with rewards paid to them to answer client questions once they are contacted, which is found quite challenging since the client (or engineers, in specific) are unlikely to ask for help. This challenge reflects how knowledge workers may behave in declining to 'get' help (or knowledge in this sense), even though they require it. In supporting this, evidence was cited from corporations, which suggests that "people issues" represent the greatest challenge to managing knowledge (Ruggles, 1999), where one of the critical areas involves how to facilitate knowledge transfers between organisational members (Wakefield, 2005).

In terms of organisational knowledge management, 'knowledge experts' may not only be individuals, but also a group of people. This was pointed out by Bercerra-Fernandez (2000: 320), stating that "for organisational people-finder knowledge management systems, grouping of experts with complementing expertise areas would result in virtual 'centres of excellence' in the organisation." This can be seen in interactions and knowledge shared within groups of projects (mostly in the company intranet), as in construction-based consultancy firms.

Sveiby (2001) claimed that among KM-vendors and KM-users there seem to be two tracks of KM activities: IT-Track and People-Track. The IT-Track deals with the management of information where practitioners are involved in construction of information systems and AI tools. This group of people considers knowledge as objects that can be created and manipulated in information systems. The People-Track, on the other hand, is more concerned about assessing, changing, and improving human individual skills and/or behaviour. Practitioners from this track considers knowledge as processes, a complex set of dynamic skills, know-how, etc., that is constantly changing (Sveiby, 2001).

The first priority of an ideal knowledge management strategy should think about people, processes, and technology. A strategy that does not incorporate all three elements of people, process and technology is likely destined to fail (Foo et al, 2007). The second in the list of an ideal KM strategy is to think about codification (capturing) versus personalisation (connecting), by examining the relative focus on explicit and tacit knowledge (focus on connecting people with information, and focus on connecting people with people), examining closely the kinds of knowledge to be working with (e.g. events, FAQs, best practices, lessons learnt, dialog, documents, problems, patterns), and examining how such knowledge can be best presented (e.g. rules, unstructured content, cases, synchronous notification, web conferencing, document versioning) (Foo et al, 2007).

Knowing that an organisational system could be based on the fundamental structure of information system, which is technology-people-process, there is a trend in organisational knowledge management that is based on process rather than people. Process-orientation has been proposed to tackle the missing link between knowledge management and business strategy with the help of process-oriented knowledge management strategies, but up to now these considerations remain on an abstract, strategic level and lack recommendations on how to proceed to design KM-oriented (business) processes (Maier & Remus, 2003).

2.3. Personal Knowledge Management

Even though the term 'knowledge management' is always used to define the 'organisational' context, an organisation cannot create or manage knowledge on its own without the initiative of individuals and the interactions within groups of people, what more if the tacit knowledge of those individuals and groups is the basis of the organisational knowledge management (Nonaka & Takeuchi, 1995). From this realisation, the term 'personal knowledge management' (PKM) becomes popular, which focuses on the way individual knowledge workers 'manage' their own knowledge. Recently, some researchers have focused on personal knowledge management skills and practices, claiming that it is the most important success factor in organisational KM (Apshvalka & Wendorff, 2005).

The KM activities in an organisation naturally entail organisational knowledge management and personal knowledge management as complementary activities that inevitably result from the presence of formal organisation and information organisation (Apshvalka & Wendorff, 2005). In addition to this, the existence of PKM as a subject of scientific research in KM is acknowledged by current researches, defining it as "ways of developing and managing an individual's personal capital" (Apshvalka & Wendorff, 2005: 37; Jashapara, 2004: 310), where each individual's worth on the market could be described as their personal capital (Apshvalka & Wendorff, 2005).

3. Software Agent

Software agents can be defined as entities that function continuously and autonomously in a particular environment that is often inhabited by other agents and processes (Bradshaw et al, 1997). Agents are expected to learn from their experiences, communicate and cooperate with people and with other agents, and, as required, move from place to place within private networks and on the public Internet.

There has been more than 400 definitions on software agents, where five most often quoted are (Paprzycki & Abraham, 2003; Rudowsky, 2004): i) "anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors" (Russell & Norvig, 1995: 31); ii) programs that engage in dialogues and negotiate and coordinate the transfer of information (Coen, 1995); iii) software entities that carry out some set of operations on behalf of a user or another program with some degree of independence or autonomy, and in so doing, employ some knowledge or representation of the user's goals or desires (Gilbert et al, 1995, in Ahmad et al, 2008); iv) "autonomous agents are computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realize a set of goals or tasks for which they are designed" (Maes, 1995: 108); and v) "an encapsulated computer system that is situated in some environment and that is capable of flexible action in that environment in order to meet its design objectives" (Jennings et al, 2000: 2).

Until 2010, researchers are still debating on the common definition for software agents. "Autonomous agents are computational systems that inhabit some complex dynamic environment; sense and act autonomously in this environment and by doing

so realise set of goals or task for which they are designed" (Ali et al, 2010: 442). Among some commonalities found in researches are the characteristics of agents as special software that involve in communications, bargaining, coordination, and perform so many other actions autonomously similar to those being done in real life (Ali et al, 2010), hence the name it carries as a category of "artificial intelligence".

There has been some confusion expressed about whether some particular software component is "really" an agent or "really" just a program (Franklin & Graesser, 1996, in Bradshawet al, 1997). Agent technology is not just about the construct, but also on human-computer interaction (Paprzycki & Abraham, 2003); whereas agent can be identified as any type of independent component, which is more on component behaviour (Macal & North, 2006).

On the other hand, from a practical modelling standpoint, agents have the characteristics of identifiable, situated, goal-directed, autonomous and self-directed, and flexible with ability to learn and adapt (Macal & North, 2006). These characteristics are similar to the important properties of an agent stated by Diosteanu and Cotfas (2009), which are reactive, autonomous, rational, goal-oriented, temporally continuous, mobile and communication.

There are a few definitions of software agents (or intelligent agents) found from various earlier sources, quoted by most authors (Wiig, 1999). The similarities among the definitions are on the autonomous behaviour of the agents to interact with its environment or surroundings. There is a wide range of features to describe an intelligent agent, but in relation to the research proposed, the intelligent agent should be autonomous, reactive, proactive, able to communicate, adaptive, goal-oriented, capable to cooperate, reason and learn, and flexible. These features are adapted from the 16 features of software agent listed by Paprzycki and Abraham (2003).

Since there is are no agreement on specific definition on software agents, this paper takes into account the four key criteria that are agreed by most authors on how an agent should be described as (Wooldridge & Jennings, 1995):

- Autonomy: agents should be able to perform the majority of their problem solving tasks without the direct intervention of humans or other agents, and they should have a degree of control over their own actions and their own internal state.

- Social ability: agents should be able to interact, when they deem appropriate, with other software agents and humans in order to complete their own problem solving and to help others with their activities where appropriate.

- Responsiveness: agents should perceive their environment (which may be the physical world, a user, a collection of agents, the Internet, etc.) and respond in a timely fashion to changes which occur in it.

- Proactiveness: agents should not simply act in response to their environment; they should be able to exhibit opportunistic, goal-directed behaviour and take

the initiative where appropriate.

In other words, within the context of the proposed research in this paper, the software agent is defined as an entity that receives input from its environment, evaluates the conditions and performs autonomous actions (autonomy), perceiving and acting through its own environment (social ability), to be responsive (responsiveness) and proactive (proactiveness) in achieving its objectives.

3.1. Characteristics Of Software Agent

The characteristics of software agent can be divided into two notions: weak notions (i.e. autonomous, sociable, reactive, and proactive); and strong notions (i.e. ability to do humanistic emotions like having beliefs, desires, intentions, diligence, knowledge, obligation, commitment, and many others) (Wooldridge & Jennings, 1995; Ahmad et al, 2008). The stronger notion of agency that is either conceptualised or implemented using concepts applied to humans is also known as the *intentional* notion. This notion espouses the mentalistic attributes of agents, such as knowledge, belief, desire, intention, obligation, etc. Wooldridge and Jennings (1995) contended that an *intentional* system seems to be a necessary condition for agenthood. They suggested two categories of attitudes that are appropriate for representing agents: information attitudes (i.e. belief and knowledge); and pro-attitudes (i.e. desire, intention, obligation, commitment, choice, etc.).

The characteristics are also being interpreted into features that software agents have, which include autonomy, reactivity, ability to communicate, capacity for cooperation, reasoning and learning, adaptivity, intelligence, goal-oriented, proactivity, mobility, robustness, reliability, scalability, flexibility, and reusability (Paprzycki & Abraham, 2003).

Software agents are also classified in terms of the following (Ahmad et al, 2008):

- Static vs. Mobility: Agents have abilities to move around some network, which yields the classes of static or mobile agents.

- Deliberative vs. Reactive: Deliberative agents possess an internal symbolic reasoning model, and they engage in planning and negotiating with other agents in order to achieve their goals. On the other hand, reactive agents only act using a response type of behaviour by responding to the present state of the environment in which they are embedded.

- Autonomy, Cooperation or Learning: Autonomy refers to the principle that agents can operate on their own without the need for human guidance. Cooperation refers to the collaboration by multiple agents in the environments. Learning is achieved by reacting and/or interacting with the agents' external environments.

- Role-based: Agents are classified according to their roles, such as information-gathering agents, mediating agents, knowledge agents.

- Hybrid: Hybrid agents combine two or more agent philosophies in a single agent.

These five classifications of agents were also simplified as six types of agents (Nwana & Ndumu, 1997; Ahmad et al, 2008):

- Collaborative Agents: emphasise autonomy and cooperation with other agents in order to perform tasks for their owners in open and time-constrained multi-agents environments; agents may learn, but not typically a major emphasis of their operation.

- Interface Agents: emphasise autonomy and learning in order to perform tasks for their owners. The key metaphor underlying interface agents is that of a personal assistant who is collaborating with the user in the same work environment (Maes, 1994).

- Mobile Agents: software processes capable of roaming wide area networks (WAN) such as the World Wide Web, interacting with foreign hosts, gathering information on behalf of their owners and coming 'back-home' having performed the duties imposed on them.

- Information/Internet Agents: perform the role of managing, manipulating or collating information from many distributed resources, such as the Internet; primarily developed to assist users in analysing voluminous information arising from a keyword search.

- Reactive Agents: represent a special category of agents, which do not possess internal, symbolic models of their environments; instead they respond in a stimulus-response manner to the present state of the environment in which they are embedded.

- Hybrid/Heterogeneous Agents: constitute a combination of two or more agent philosophies within a single agent; the alternative is to maximise the strengths and minimise the deficiencies of the most relevant techniques for a particular purpose.

3.2. Software Agent Evolution

Software agent is proposed to be used in variety of areas. Among the areas suggested in the last decade are messaging software, development tools, information management and retrieval, user interface software, process control, workflow management, and network management (Jennings & Wooldridge, 1996). The most promising areas as categorised by Jennings and Wooldridge (1996), which until today are seen in service performing and predictive software agents are being used in: personal information management, electronic commerce, and business process management.

Recently, Huhns (2009: 43) highlighted the computing challenges involving "the problems and opportunities afforded by massive decentralization and disintermediation." The problems and opportunities arise in such domains require

controlled action but when centralised control is infeasible. He claimed that these are the domains of distributed problem solving and multi-agent systems, which include healthcare, commerce, energy distribution, and traffic control. The computing challenges in such domains encompass all facets of achieving control within the huge scale of global infrastructures, while the agents effecting the control are limited to acting locally (Huhns, 2009).

In their landmark paper published in Scientific American, Berners-Lee et al (2001) proposed the Semantic Web, which portrays a scenario in which web agents coordinate tasks and serve humans through their understanding of the web pages. The Semantic Web overcomes some limitations of current software agent technology by standardising the protocols of metadata, improving the elementary information processing facilities, allowing information management systems interoperate with other semantic web applications, providing a link between the existing Web contents and semantic descriptions, and allowing metadata to be used in creating new information systems based on Semantic web technologies. The Semantic Web creates an environment where software agents can readily achieve complex tasks for users (Wang & Shakshuki, 2005).

Other than autonomy and social-ability, agents in the Semantic Web have the ability to handle semantic information. Other extended characteristics of agents in Semantic Web include the ability of employing software agent features to optimise search and customisation, the ability of exchanging and using multiple ontologies, the ability of querying different information sources, and the ability of providing easy-to-use application in well-presented knowledge. According to these characteristics, an agent-based Semantic Web information management will be able to keep weakly structured collections consistent, generate information presentation from semi-structured data, and create the semantics of these collections and data that is both machines-accessible and machine processable (Wang & Shakshuki, 2005).

3.3. Software Agent In Knowledge Management

Knowledge management would be supported by many artificial intelligence developments – such as intelligent agents, natural language understanding and processing, reasoning strategies, and knowledge representations and ontologies – that will be relied on to organise and facilitate knowledge application to important situations (Wiig, 1999; Chandrasekaran et, 1999). Even back in 1997, Davenport, De Long and Beers discussed on some firms using “artificial intelligence” software to manage knowledge, and they have classified this as knowledge repositories of structured internal knowledge.

Software agents have been proposed as one way to help resolve problems raised in knowledge management and knowledge sharing (Bradshaw et al, 1997). This is aligned with the key of having intelligent agents, which interoperates – “to exchange information and services with other programs and thereby solve problems that cannot be solved alone” (Genesereth & Ketchpel, 1994: 1). Matchmaker services, for example, had a major function to help client agents find information about the location of the generic agent instance for any agent within the domain that has advertised its

services, and to forward that request to matchmakers in other domains where appropriate (Finin et al, 1996, in Bradshaw et al, 1997). These matchmaking services provided by software agents are seen as a way to solve a problem of knowledge workers not inclined to ask for help by locating knowledge experts, either because they do not know how or merely not having interest to.

4. Related Work

There are quite a number of ambiguous examples found in researches on agents. Most are confined to the Internet, e.g. e-commerce systems, personalised information delivery, etc., which do not show full capability of an agent. Thus far it has not materialised or being implemented as regards to the revolution predicted by the agent-visionaries such as P. Maes. Agents implemented by MIT Media Laboratory, for example, are only as electronic mail agent, meeting scheduling agent and news filtering agent. A point to bear in mind is that agent is not just on construct, but also on human-computer interaction (Paprzycki & Abraham, 2003).

Some of the principle areas on which software agent technology is expected to have an impact are development and maintenance of complex systems, resource management, delivery of personalised content, and e-commerce on a large and small scale. In the scope of e-commerce, successful agent-based systems are in marketing and personalisation, knowledge management, real-time systems, expert systems, knowledge discovery, and network management, among a few (Paprzycki & Abraham, 2003).

There are quite a number of researches done on agent technology in knowledge management, with different scopes of processes within knowledge management itself. For example, a research focused on agent-based knowledge management solution in the web environment made use of geographical information system to locate the construction material suppliers in supply chain management for construction industry (Diosteanu & Cotfas, 2009). This is an example of a focused support for knowledge management in terms of solving the problem of identifying the location of nearby suppliers for specific or unique building materials, returning a result in a short time for better decision making. Yet, supply chain management is much more than just identifying location of suppliers, even if the time for identifying the suppliers is the bottleneck itself.

Some of the researches on artificial intelligence did not mention the concept of knowledge management, even though the idea was related to that sense. For example, a research was done on an agent-based department content management system, which could be considered as knowledge management effort since the idea of the system is to encourage knowledge sharing among the users (Wang & Shakshuki, 2005). Another example of a departmental level agent-mediated system is the automation of alerting humans to work on the tasks within stipulated time (Ahmed et al, 2009), which is very focused on solving a problem within an organisation involving isolated knowledge workers.

Another research is on agent-supported portals and knowledge management that was implemented on complex research and development projects, where time is the prime factor (Barthes & Tacla, 2002). This research concentrated on multi-agent systems in groupware, with a focus on company knowledge, where company knowledge refers to technical knowledge used inside the company, its business units, departments and subsidiaries, limiting its research concentration to certain 'place' in organisational network instead of certain 'place' or 'space' in semantic web. Overall, the scope on company knowledge clearly shows that the knowledge interest of the system is not situated in a human or an 'expert', but more on the knowledge that sits in departmental units, even though the whole process aims to deliver the right information to the right person at the right time.

A similar work has been done by Ahmad (2005), who developed a multi-agent system to mediate a document-based workflow process in a collaborative constraint-based portal. Software agents are used to resolve the problem of ad hoc task execution and enable collaborative interactions between users. The system presents users with a portal interface that guides them through their personalised actions, which are explicitly organised in a sequential manner. The successful performance of these actions, attributed by the satisfaction of constraints, contributes to the completion of the tasks. The collaborative interactions between users contribute to a coherent structure of coordination towards the achievement of shared goals.

Some challenges were listed in the implementation of people-finder knowledge management systems, in the aspects of reliance on self-assessment (on the knowledge shared), the development of knowledge taxonomies, using ontologies for information integration, and describing and catalogue people's knowledge (Bercerra-Fernandez, 2000). These challenges should be part of the design considerations to look into future research, especially if it carries the organisational objectives in the knowledge management process proposed.

An author found that grouping of network members into specific knowledge areas adds even greater strategic advantages in identifying and leveraging knowledge assets in an organisation, and stated, "Subgroup identification and indexing add value to knowledge management mapping and may result in greater knowledge transfer" (Wakefield, 2005: 943). Even though the author emphasised the common background of organisations is tacit knowledge that must exist among individuals, he missed out the needs of 'finding' the knowledge experts among individuals as and when needed.

Recently, several attempts have been made to explicitly resolve the issues of knowledge management using software agent technology. Van Elst et al (2003), for example, outlined the relation between Knowledge Management as an application area, and software agents as a basic technology for supporting KM. They argued that the basic features of software agents, typically social ability, autonomy, reactiveness, and proactiveness, could alleviate some drawbacks in KM technology (Van Elst et al., 2003). Dignum et al (2004) proposed a model that supports individual initiative and collaboration while prescribing a formal structure for organisational processes. They introduced the main aspects of the model and described a case study where the model is applied to the development of a knowledge sharing support system (Dignum et al.,

2004). A somewhat innovative effort in knowledge management was proposed by Zafeiris et al. (2005) when they developed an agent-mediated KM approach in an environment of multiple organisations which enables the discovery of knowledge assets within a distributed and heterogeneous knowledge repositories by means of software agents (Zafeiris et al., 2005).

While these pockets of researches focused on applying the agent technology in knowledge management, their contributions to knowledge management have yet to produce significant and ground-breaking impacts. Major issues of agent based technology that causes failure of the technology are information discovery problem, communication problem, ontology problem, legacy software integration, reasoning and coordination, and monitoring problems (Nwana & Ndumu, 1997). These issues (except ontology problem) are solvable according to examples and suggestions compiled by Paprzycki and Abraham (2003).

5. Summary And Outlook

Agent-based modelling application is required in order to apply agent technology to knowledge management processes. The modelling is for social processes, where agents would represent people or groups of people, and agent relationships represent processes of social interaction. In other words, modelling agent behaviours does not stop there, but should be extended to modelling the agent interactions, in terms of who is connected to who and the mechanisms governing the nature of the interactions (Macal & North, 2006).

The types of knowledge management systems (KMS) can be summarised as educational KMS, problem-solving KMS, and knowledge repositories, which fall into three attempts categories: to catalogue organisational knowledge, to develop databases of employees' insights and observations, and knowledge yellow pages or people-finder systems to manage knowledge by holding pointers to experts who possess specific knowledge within an organisation (Bercerra-Fernandez, 2000).

Understanding the issues of providing a suitable knowledge management system in an organisation is hindered by a paucity of empirical research that addresses the relationship among organisational, social and technological aspects of the system (Moteleb & Woodman, 2009). With this justification, a knowledge management system development (KMSD) was described as an approach with the following three interacting aspects: i) envisioning knowledge work behaviour (by uncovering the locating knowledge theme, communicating knowledge theme and interacting with knowledge theme); ii) designing the system (by uncovering design with knowledge entities, knowledge flow and knowledge interfaces); and iii) exploring technology options for the system (Moteleb & Woodman, 2009). This research takes into account the human individualistic and personalisation aspects, even though the system proposed was quite generic where software agent could be the implemented technology.

Since some of the search tools available in the Web today do not take into account the interests or the profiles of the users at the time of the information search, it is important

to provide a tool to filter information and refine the search in accordance with the profile of the user (Pierre et al, 2000). This general information search integrated with user profile research needs some extension with better scope. Combining this aspect with the people-finder concept (Bercerra-Fernandez, 2000), there should be a better solution using software agent in locating knowledge experts through user profiles and other documentations or interactions scattered in the Web.

Based on the above deliberations, we propose a few research questions that would be important to consider in carrying out an agent-mediated KM research:

- Could intelligent software agents be effectively applied to mediate personal knowledge management processes, especially in locating knowledge resources and experts?
- What are the pertinent KM concepts and theories that would be useful in mediating such processes?
- What are the necessary attributes should the software agents be endowed with to implement such mediation?
- What information and agent technologies that are available and how should these technologies be deployed to effectuate such mediation?

6. Concluding Remarks

Until today, there is still an issue of locating and knowing who knows certain knowledge, or in other words "knowing the knower". This is perceived as significant because of the inability of any system to capture tacit knowledge that embeds deep within an expert's mind, which may not be interpretable explicitly by just extracting the content of documents from the owner.

This paper suggests agent-mediated systems to cover two aspects of finding knowledge expert: agent to be reactive to search for knowledge experts within the organisation (Wang & Shakshuki, 2005; Ahmed et al, 2009), and agent to be proactive to search for knowledge experts outside the organisation or within the semantic web (Diosteanu & Cotfas, 2009). In order to achieve these objectives, this research will attempt to find out how the individual knowledge worker performs task, identifies knowledge sources, manages knowledge and the sources collected, and interprets or makes data available as and when it is needed. From these findings, the behaviours of the knowledge agent will be designed on two different situations: reactive search (when human requests to locate knowledge expert) and proactive search (agent understands the need from human's activity, search for and suggests knowledge expert).

The aspect of "knowing the knower" should not merely stop at 'matchmaking' the knowledge resources to knowledge seekers. This idea should be extended to the aspect of letting the agent to mediate knowledge management process. "Knowing the knower" might be the capability of the agent, instead of the human whose agent is behaving on behalf.

Finally, Davenport et al (1997) point out that data and information are constantly transferred electronically, but knowledge seems to travel most felicitously through a *human* network.

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