Enhancing Communication between Knowledge Workers

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ABSTRACT

Knowledge workers are people who perform activities in which large amounts of information need to be analyzed by collaborating with others before decisions can be made. These types of activities are not straightforward and are therefore difficult to model, which in turn makes it difficult to automate them. Processes in organizations get more complex as organizations grow and adapt to the environment which results in knowledge workers needing access to more knowledge from inside and outside the organization to solve problems they encounter. In the event of an ad hoc situation the unavailability of knowledge can cause serious problems, which can result in damage to the company. To overcome this problem we performed an explorative research and developed a framework that is based on characteristics of such situations, and functionality needed to support communication between knowledge workers. The framework consists of four activities (scenario, solution, practice and evaluation) that together result in an optimal situation for knowledge workers to deal with ad hoc situations. The framework involves a knowledge base in which data is collected regarding possible solutions to problems that can arise in a company's day to day business. Also a forum is used to allow for better communication between knowledge workers in ad hoc situations, which enables knowledge sharing and usage to more quickly solve ad-hoc challenges and problems.

Keywords: Human interaction management, knowledge workers, knowledge base, Business process management

1. INTRODUCTION

In the past few years organizations have become more focused on optimizing their business processes and the integration within other business processes (Han, Kauranen, Kristola, & Merinen, 2006). It is possible to state that the first steps of business process management (BPM) can be found in the work of Frederick Taylor who tried to optimize industrial efficiency (Firesmith, 2003). Production processes were seen as a linear progression where raw materials were transformed into a product. Han et al., 2006 state that it took a while before the management of processes could be raised from departmental to enterprise level, because of the difficulty of controlling enterprise wide integrated processes. Today the environment of companies has changed from stable and predictable to constantly changing, where companies need to improve their business processes to enhance performance (Trkman, 2010). Zairi (1997) defines BPM as: "A structured approach to analyze and continually improve fundamental activities as manufacturing, marketing, communications and other major elements of a company's operations". BPM has been incorporated in companies to support the company when dealing with changing situations while continuously improving a company's fundamental activities and making them more flexible.

Another view on BPM states that BPM is a concept which is focused on the automation of business processes and the interaction and collaboration between systems (Han et al., 2006). Currently most of the standard procedures and predetermined processes are supported by information systems which handle many activities without human involvement. However these automated processes do not include the human-to-human interaction and important human decision making as done by knowledge workers. An area of research and consultancy often referred to as Human Interaction Management (HIM) (Harrison-Broninski, 2005).

HIM is an approach which allows the modeling and management of human-driven business processes and supports them with software (Han et al., 2006). Because objectives change often in human driven business processes, it is difficult to predict the process and its outcome (Lee, Seo, Kim, & Kim, 2009). This is especially true in knowledge intensive situations where knowledge workers have to make decisions based on a vast collection of knowledge. Making these decisions in a limited timeframe is a challenge organizations face nowadays. BPM does not support these types of activities and (sub)processes According to Johnson, Jamers, & Lareina (2005) raising the productivity of employees who perform knowledge intensive activities will provide companies with competitive advantages that are more difficult for their competitors to imitate than just improving the business processes.

The definition of ad hoc situations used in this paper is: "An ad hoc situation refers to a situation for a particular purpose only, additionally it lacks generality or justification (thefreedictionary, 2009). We add to this definition that these types of situations emerge suddenly and need to be solved quickly by the knowledge workers of the organization. Exchanging data between knowledge workers about how to perform these knowledge intensive tasks is one way to add additional value to the company resulting in an even larger competitive advantage. This additional advantage can be of value to a company and is therefore interesting to research. Based on the above the research question which will be answered is:

How can internal communication between knowledge workers in ad hoc situations be improved?

The contribution of this research is an addition to the scientific research about the communication between knowledge workers. This is relevant because many organizations have knowledge workers.
This research is explorative and can be classified as 'explanation' according to the theory types of Gregor (2006). In this research we try to explain to phenomenon of collaboration between knowledge workers in ad hoc situations and how this can be improved.
The remainder of this chapter is organized as follows, first, in section 2, related research will be described and based on this the elements from which the framework is constructed will be discussed and a visualization of the ad hoc situation approach will be developed. In section 3 an example of how the framework can be applied is provided. After this the validation of the framework is described in section 4 and finally in section 5 conclusions and future research will be discussed.

2. RELATED RESEARCH

Knowing how internal communication between knowledge workers can be innovated, could result in more insight in how these tasks are executed and thereby create the possibility of modelling them. To improve internal communication a knowledge base will be used to save and store the knowledge available in the organisation. This knowledge base can support performance of the knowledge intensive tasks, because it can contain knowledge that supported the resolving of previous problematic situations. This knowledge can be easily retrieved, which allows for easy accessibility and quick finding in urgent situations. The combination with the forum allows for the discussion about content in the knowledge base and an easy way to post ad-hoc situations which need easy access to the knowledge of other knowledge workers in order to solve the situations as soon as possible.
The framework constructed is based on different elements that together form the problem situation as described in the research question. First related research on knowledge and knowledge workers will be described after which internal communication and its relation to knowledge will be addressed. After that the knowledge base and the use of the knowledge base concept is described followed by the framework itself which will then be further explained in section 3.

2.1 Knowledge and knowledge workers

Knowledge workers can be found in knowledge based organizations, which are organizations where the production factor is knowledge. According to Drucker (2001) knowledge workers can be defined as: "Individuals who add to a company's products and services by applying their knowledge". Knowledge can be divided into explicit and tacit knowledge (Nonaka, 1994). Explicit knowledge or codified knowledge refers to knowledge that is transmittable in formal, systematic language. Tacit knowledge is a continuous activity of knowing and embodies what Bateson (1973) has referred to as an "analogue" quality (Nonaka, 1994). The different forms that explicit and tacit knowledge can adopt are visualized in figure 1. With the framework we want to externalize tacit knowledge and the sharing of explicit knowledge, but we will not go into detail on how to retrieve tacit knowledge because this is outside the scope of this research. In some companies knowledge is power and people will not share what they know, but it can be this knowledge that would solve a difficult situation at hand. When there is an atmosphere and the possibility to share knowledge, for example a Community of Practice, this knowledge can be shared and therefore be saved in the body of knowledge of the organization. This allows knowledge to be available in the company even when the original owner of the idea has left the company because of, for example retirement.

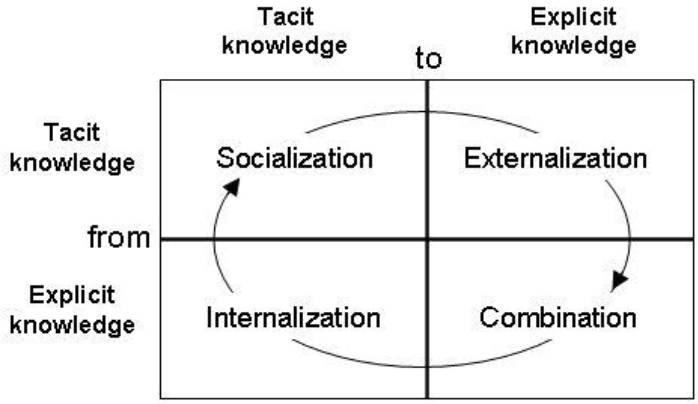

Figure 1 Forms of tacit and explicit knowledge (Nonaka, 1994)

In figure 1 it is shown that not all knowledge in a company can be exchanged between employees. To improve internal communication it is therefore important that also tacit knowledge will be made explicit so that this too can be submitted to the knowledge base.

2.2 Internal communication

There are many new techniques for improving the internal communication in an organization which are currently classified under the label Web 2.0. Khoshafian (2008) describes Web 2.0 as being: "the emerging use of Web 2.0 technologies like blogs and wikis (both perfect examples of network IT) within the Intranet". According to Khoshafian (2008) enterprise applications are increasingly becoming BPM applications. One of the characteristics of the so-called BPM Suites is that they also support collaboration, because it is an essential asset of the BPM suite (Khoshafian, 2008).
In our framework for the improvement of internal communication we use the knowledge base and forum concepts to support knowledge workers. The forum and knowledge base will be explained in the following paragraphs. We will use the description of the concept of CoPs: "groups of people informally bound together by shared expertise and a passion for a joint enterprise" by Wenger and Snyder (1999). According to Wasko & Faraj (2000) online CoP technologies can be successfully used by companies seeking to stimulate knowledge sharing among employees. Examples of technologies are for example discussion forums. Typically, members of an online CoP interact with each other: they ask and answer questions, they pitch ideas and they share knowledge (Wenger, McDermott, & Snyder, 2002). In a CoP member satisfaction and a feeling of belonging to the CoP are determinants of

member loyalty to the community. Additionally information and system quality were found to affect members' satisfaction, while trust influenced the members' sense of belonging to the community (Fin, 2008).
The discussion that takes place on the forum makes knowledge explicit and exchangeable between knowledge workers, which would allow for an increase in their knowledge level. The availability of a knowledge base allows for the gathering of the body of knowledge for the company, but does not encourage better internal communication. The connection of a forum to the knowledge base allows for knowledge workers to discuss their findings. Making sure that knowledge workers actively participate in the forum and on the improvement of internal communication requires that the knowledge workers are seen as a community of practice (CoP).

2.3 The forum

After discussing internal communication it is important to describe the technology used to enable this type of communication. As described above we propose the use of a forum and also the use of email.
(Khoshafian, 2008) gives examples about synchronous and asynchronous networking, which are represented in this situation by the forum and email. The forum is an asynchronous and allows knowledge workers to post their findings at any given moment and also respond to other messages when they like. To make sure they do not receive too much messages from the forum the added messages and changes can be bundled into a onetime per week email with a structured format for clarity. This to prevent information overload by emailing which nowadays often happens, because of the ease of use of emailing and the normality of using email in organizations (Whittaker & Sidner, 1996; Schuff, Turetken, & D'Arcy, 2006). Additionally the forum also allows for synchronous networking, which is necessary when ad hoc situations occur. When an ad hoc activity occurs a special message should be spread through an email around the knowledge workers, so the person engaging the situation can discuss with other knowledge workers what to do. This possibility to engage in synchronous networking is also supported by the framework, because when there are no best practices available in the knowledge base the knowledge worker can discuss with colleagues what the best approach is.

2.4 Knowledge base

The term knowledge worker implies the importance of the knowledge involved. In BPM systems the coherency of business processes is important and knowledge workers are necessary to support these processes. Knowledge workers only have their own knowledge to deal with (ad-hoc) situations. Having access to more of the knowledge available in the organization could make dealing with (ad-hoc) situations more easy.
To save the data of the knowledge workers a knowledge base or a knowledge based system could be developed. A knowledge base or knowledge repository is storage for organizational knowledge, the corporate memory. When using a knowledge based system a problem situation can be entered and mapped to similar problem situations which allows the knowledge worker to make a more informed decision to solve the current situation (Helms, 2009).
Advantages of knowledge base systems are the wide distribution of scarce knowledge, ease of modification, consistency of answers, perpetual accessibility, preservation of expertise, solution of problems involving incomplete data and the explanation of solutions. Disadvantages are that answers may not always be correct, limits may not always be recognized and they have a lack of common sense. After an introduction of these fundamentals of the framework a visualization of the internal communication process can be presented. Together these elements will form the basics of the framework developed.

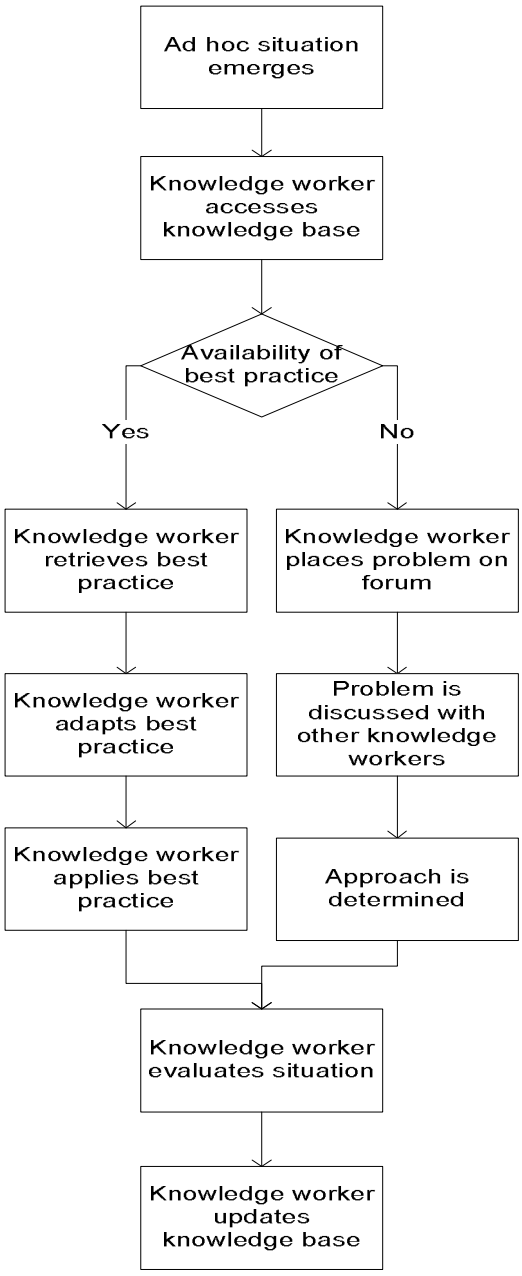

Figure 2 Ad hoc situation approach

2.4 Visualization of internal communication process

A visual presentation of the ideal process of internal communication was created. Figure 3 is based on the authors' point of view on how ad-hoc situations should be handled, to which several activities are added to improve internal communication. Internal communication is improved by connecting with other knowledge workers during an ad-hoc situation by enabling the discussion of an ad hoc situation on the forum and the updating of the knowledge base. Based on this visualization a framework is developed to enable the internal communication between knowledge workers. This framework is described in table 1.

Phase		Description	Situation features	Knowledge base
1	Scenario	Scenario description	Extract general features	Submit features
2	Solution	Solution description	Extract general features	Submit features
3	Practice	Practice description	-	Submit practice
4	Evaluation	Evaluate practice	Submit features	Update knowledge base

Table 1 Activities in the ad hoc approach

The identification of these four phases is based on the e-Framework Charter (e-Framework Partners' Strategy, 2008). In this framework six entities are presented i.e. commission activities, community activities, e-framework working groups, wiki, quality assurance and control and e-framework knowledge base. Analyzing this framework it is notable that there are three kinds of activities identified by the authors, i.e. commission, community, e-framework activities. In our view it is recommended to merge them into one entity: 'Scenario'. This adjustment results in a better applicable entity because all the activities, events, etc., are combined into one entity. Furthermore it results in a deduction of two phases, which saves time. When during the solution activity, it is clear the scenario has to be solved, everything that involves the solution is united within one phase. The reason for this is time saving. Now all knowledge workers know what phase they are in and who is responsible. All activities involving the solution are combined into one phase i.e. "solution" which results in clear responsibilities. After the solution is formulated it has to be executed, therefore the third phase is initiated. The last phase is 'evaluation' here the practice is evaluated and if necessary updated in order to assure quality.

In contrast with the framework of e-Framework Partner's Strategy (2008) quality assurance is the last activity in our approach, this because practices can only be evaluated if they are used. In order to evaluate a practice, it first needs to be executed. Also this framework is made for ad hoc situations, which means first the scenario (issues) have to be dealt with and other phases are secondary. In the next section the framework is further elaborated on and an example is given.

3. A FRAMEWORK TO SUPPORT KNOWLEDGE WORKERS IN AD HOC ACTIVITIES

As described in section 2, the framework consists of four phases with three activities, see table 1. In this section the activities are further explained upon.

3.1 Phase: Scenario

The first phase is called "scenario", during this phase a scenario description is created. The description consists of an analysis of the situation that has occurred and features like trigger, type of situation, responsibilities, consequences etc. After the scenario description is created, general features of the scenario are extracted. This can be done by taking a high level approach which results in a collection of general applicable features and principles, which can also be used in other situations e.g. responsibility management or communication patterns. The final activity in this phase is the submitting of features to the knowledge base.
To recapitulate, a scenario is developed where general features are extracted and stored in the knowledge base. Over time more scenarios are described and more general features are extracted and stored in the knowledge base. In order to make these stored features usable the next phase is initiated.

3.2 Phase: Solution

The second phase is called "solution", this phase starts with the description of the solution. The description results in a detailed document consisting of all steps and variables used for the solution described. When the solution is executed the knowledge worker has to extract the general features of

Figure 3

the solution executed. These features can consist of time, costs and knowledge needed. After the details are extracted they are submitted into the knowledge base and connected to the scenario features described earlier. The knowledge base now consists of features about different scenarios and solutions, combining these two types of features results in a practice which could be used in other situations. In order to give a knowledge worker more insight into the different practices and possibilities, as well as the quality of the practice a ranking has to be formed. This initiates the third phase, called practice.

3.3 Phase: Practice

Phase three starts with the description of practices. A practice is "the knowledge of how something is usually done" (WordNet Search - 3.0, 2010). More explicit, it is a combination of the features extracted from the scenarios as well as the features extracted from the solutions. During the activity 'description' the combination of the two features is described. This means that when an ad hoc situation emerges, a knowledge worker will consult the knowledge base. The knowledge base is searched for similar scenario features and solution features that fit, which in combination result in practices from which the knowledge worker can choose. Note that if the situation that occurred shows no similarities with other situations, a knowledge worker will have to place the ad-hoc situation on the forum and discuss with other knowledge workers what the best approach to the situation is. As shown in table 1 there is no extraction of features because these features are already present in the knowledge base. The second activity is the implementation of the practice, which is similar to the implementation of the solution. This because a practice is the combination of features derived from scenarios and solutions.

3.4 Phase: Evaluation

The fourth and final phase is 'evaluation'. During the evaluation the practice is evaluated, the practice receives a ranking for usability and the knowledge base is updated. The features are updated and after that they are submitted to the knowledge base, in order to use the features again when a similar situation occurs. These activities of the ad hoc approach are summarized in the following framework, see figure 4.

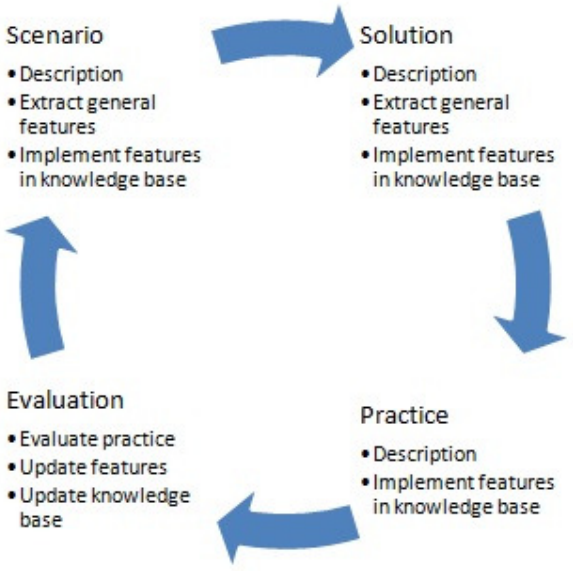

Figure 3 The activity framework of the ad hoc approach

3.5 *Example*

In order to make the framework, as is presented in figure 4, more explicit an example will be provided in this paragraph. The ad-hoc situation at hand is about the acceleration problems that a large amount of Toyota cars experienced and is now widely discussed in news all around the world. This scenario is chosen because it represents a production process that encounters a serious problem for which it needs knowledge workers to develop a solution, because they need to look at different aspects of the production process in order to find where the problem originates. The data used to fill the framework is retrieved from both Dutch and international news websites.

According to figure 3 the first thing a knowledge worker should do, is access the knowledge base in order to search for possible practices. When no practices are found the knowledge worker should solve the situation without help retrieved from the knowledge base. When there is a practice present the knowledge worker should adapt the practice and apply versioning. When the direct threat is eliminated the practice should be evaluated in order to make the practice more accurate for future use. This example describes an ideal situation, if there is no practice for the situation at hand the knowledge worker will have to solve the situation without best practices to support him. After this the knowledge worker will post the situation at the forum and together with the other knowledge workers in the company a solution for the situation at hand will be developed.

3.5.1. Activity Scenario

Step 1: Scenario description

Scenario	**Description**
Acceleration problem	During March 2010 there were several news reports about Toyota cars that suddenly started accelerating and wouldn't slow down. This resulted in several crashes, during one of these accidents a man was driving on the high way when his car started accelerating and he needed assistance from the police to get his car back in control. During another accident a 56 year old woman got injured when her car started accelerating and she drove into a wall. After this Toyota has recalled cars and made repairs, but even then some cars showed unwanted acceleration problems.

Table 2 scenario description

Step 2: Extraction of general features

Scenario	**Extraction general features**
Acceleration problem	Toyota cars Mostly the Prius, but also some other types of cars encountered problems Unwanted acceleration Accidents Slowing down with assistance

Table 3 scenario extraction of general features

Step 3: Submit general features

Scenario	**Submit general features**
Acceleration Problem	The features are submitted to the knowledge base.

Table 4 scenario implementation of features in knowledge base

3.5.2. Activity Solution

Step 1: Solution description

Solution	Description
Acceleration Problem	Assemble a team of knowledge workers from different technical and research and design areas within Toyota and let them review all development elements of the Prius and also research several of the cars with acceleration problems and compare them to other Prius cars. Together with the research of the Prius also other types of Toyota cars that experienced acceleration problems need to be researched and their development process should be analyzed again to presumably detect weaknesses. Also a comparison between the different types of Toyota cars needs to be made to look for common elements that may indicate where the problem originates from. To provide the outside world with details about the research and to communicate the progress, a spokesman should be assigned.

Table 5 scenario description

Step 2: Extraction of general features

Solution	Extraction general features
Acceleration Problem	Assemble teams of knowledge workers Analyze technical but also research and development aspects and actual cars to find the problem Compare different cars to find common weaknesses One point of communication with the outside world

Table 6 scenario extraction of general features

Step 3: Submit general features

Solution	Submit general features
Acceleration Problem	The features of the problem as described in the research are submitted to the knowledge base.

3.5.3. Activity Practice

Step 1: Practice description

Practice	Description
Acceleration Problem	10 minutes before police was present at the station 20 minutes before bomb squad was present 7 hours before situation was normal Communicate one story to the press and give frequent updates

Table 7 scenario description

Step 2: Extraction of general features

Practice	Submit general features
Acceleration Problem	The features are submitted to the knowledge base.

3.5.4. Activity Evaluation

Step 1: Scenario description

Evaluation	Description
Acceleration Problem	Communication to the outside world was good, but there could be more insight into the actual progress about technical details to provide the public with more insight into the details. The recall of a large amount of cars was good to guarantee the safety of the public, but next to recalling cars a clear insight had to be available into what the actual problem was.

Table 8 scenario description

Step 2: Extraction of general features

Evaluation	Extraction general features
Acceleration Problem	Good communication Recalling cars was good Insight into the actual problem was not clearly available

Table 9 scenario extraction of general features

Step 3: Submit general features

Evaluation	Submit general features
Acceleration Problem	The features are submitted to the knowledge base.

4. VALIDATION

The use of experts for the validation of research is an accepted means of validation. In Beecham et al. (2005) Lauesen and Vinter (2001) and Kitchenham et al. (2002b) are referenced for stating that the use of experts for validation of research can be seen as a reliable method. Research by Kitchenham et al. (2002) also emphasizes the reliability of expert judgment when evaluating research even though the focus is in another research area. According to Adomavicius and Tuzhilin (2001) "a common way to perform post-analysis of data mining results is to let the *domain expert* perform this task, and several data mining systems support this capability". These sources indicate that using experts from the research area investigated are able to provide a reliable validation.

During this research the validation of the framework was also executed by expert validation. Although several experts were contacted for their input there was only one response and due to the limited timeframe the research was conducted in it was not possible to do additional expert validations. The expert read the research and analyzed the framework based on the literature provided in the paper and his own experience. Based on this he concluded whether or not the framework could be applied in real life situations.
The respondent is an expert in the area of BPM for over 10 years. He is an independent analyst, strategist and visionary in BPM and is the founder of the analyst research firm Redux (www.bpmredux.com).

The expert found that there is a need for more attention on the interaction of the knowledge workers and peer groupings, and how conclusions or results are fed back into the system to improve the best practices stored in the knowledge base. The respondent stated that: "In figure 3 an important point made by the authors is that the knowledge base must contain a feedback mechanism so there is a continual refresh of best practices as situations arise." This type of support is lacking in many forums. For example on LinkedIn there are discussions but nothing is fed back into the subject matter to evolve it. When more is drawn out in terms of an evolving discipline, the feedback mechanism is the most important part to evolve the best practice otherwise it becomes just a forum with no purpose.

Furthermore the expert found the knowledge base to be an important concept: "The operation of a knowledge base and framework which allows the continual access and dissemination of information for all knowledge workers implies the creation of what is known as ambient awareness in an organization. That is to say that information is constantly available and the knowledge worker is aware of its existence."

Finally the respondent supported the notion that this research is of practical value: "The research touches on both Social BPM and Dynamic Case principles, where (a) unstructured processes and unanticipated scenarios are dealt with where structured process modeling cannot accommodate and (b) collaborative environments promote knowledge sharing and discovery. This will become more and more important over the next 2 years as this paradigm emerges so this area of research is important and relevant today. It will be good for the authors to follow through this research with these concepts in mind and see where it brings them."

5. CONCLUSIONS AND FUTURE RESEARCH

In the introduction the following research question was formulated: *"How can internal communication between knowledge workers in ad hoc situations be improved with the use of a knowledge base?"*. This resulted in the need for a framework to support communication between knowledge workers in ad hoc situations, by making knowledge available throughout the organization by using a knowledge base and the development of a forum to enable solution development in ad hoc situations.
The framework developed in this paper is based on elements from prior research that together allow for a good internal communication between knowledge workers. Additionally it captures and saves this knowledge into a knowledge base which allows for the reuse in other situations to support the knowledge workers in dealing with ad hoc situations. Based on the example provided and the validation of the framework it is suggested that the framework is useable. However it needs to be applied in practice to determine if an adjusted/extended version is needed for knowledge workers in dealing with ad hoc situations.

Advantages of implementing this framework are that the knowledge of the knowledge worker is made available for all other knowledge workers in the company. Additionally this knowledge can be used by future knowledge workers, because it is externalized and put into the knowledge base. It is the specific knowledge that knowledge workers possess that can result in serious loses for the organization when an employee retires or leaves the company. Also the use of a forum and making the knowledge workers into a community of practice can stimulate internal coherency and result in better solutions to ad-hoc situations. The active sharing of knowledge and best practices can stimulate knowledge workers to be more supportive when other co-workers need help in an ad-hoc situation, which in turn can result in the returning of the favor.

Although the framework was only validated by one respondent it did proof the value of this research. However it also showed that more focus and research should be done to improve the forum concept.

The interaction of knowledge workers and the conclusions that result out of the feedback should have a more prominent place in the ad hoc situation approach as shown in figure 3 and also be more explicit in the associated framework.
Future research should be further focused on its application in case studies to determine if the framework will support knowledge workers in ad hoc situations or that more adjustments need to be made before the approach can be used. Also in this research we used a forum for communication, however this can also be replaced by another, more accessible or easier media technology for knowledge workers.

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