Knowledge-based flexible workflow to support decision follow-ups

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Abstract

The importance of improving the quality of decisions in organizations has been a subject for several years in computer, management and decision sciences. Some results were reached, but still a lot of questions remain open. From the perspective of computer science, systems like DSS, GDSS and ODSS are examples of those results. This research proposes another approach, which is based on the concept of a post-decision phase and the technological support that could bring contributions for the decision-making process. Through this technological support we aim that part of the process that takes place during a post-decision implementation can contribute to improve the quality of decisions made within an organization. Some innovative aspects include the timing where it is supposed to be used, i.e., after a decision is made and also, it considers news perspectives as a combination of a flexible workflow system integrated to a knowledge repository.

Introduction

Presently, organizational scenarios demand a lot of interaction among team members to solve problems and daily processes. Independent of the hierarchical level, employees need to exchange information, to make decisions, to obtain information from different resources, to develop projects, to sale products and services, counting gradually more on group collaboration.

Nevertheless, the existing tools proposed up to this moment solve only part of this complex scenario. Examples of these tools are e-mail, videoconferencing, instant messengers and even text editors.

But we can argue, why these groupware tools are not sufficient? One reason is the lack of integration among them. There are many tools available, but one does not exchange information with the other. This work has to be done by the user, most of the time. Another point to be considered in organizational scenarios is the different demand that each group of user has related to technological supports. The great majority of successful tools available in the market aim to solve problems for the employees of low hierarchical levels within organizations. There is a lack of tools to support the upper management demands. Some successful tools were already proposed and are under an evolution process. Examples of these tools are Data Warehousing Systems, Datamart and Executive Information Systems. But, a common characteristic of these tools is the operational data dependency, which has a great value, but it is far to be enough. There is still a big gap to be filled considering other types of data, which also have value for the organization, as decision related systems, knowledge management tools and organizational learning support tools.

In spite of the big gap to solve organizational problems related to upper management users, this research, does not aim to be the solution for every problem. The focus of this proposal is on the process that takes place after a

decision is made, referred here as “post-decision” phase. The approach is to use a technological solution to support the documentation of a decision made, a formalization of the plans related to its implementation, a systematic control of the consequent tasks, the people involved, and documents generated, so that a knowledge repository is built helping the organization to improve new decisions, identifying indicators for best-practices, as well as enabling an organization learning process.

The next section presents the problem considered and the hypotheses for this research. Then, comes the proposed solution, with its respective information about the target audience. Further comes a section describing some related research and a list of commercial tools to provide a comparative view. The last two sections present, respectively, the challenges involved and the validation techniques considered. In the end of the paper the next steps of this research are presented.

The Problem

Problem’s Context

One problem that has been mentioned for a long time in several distinct researches is the scenario of decision-making process. How shall a decision-making be more effective, involving teams, complex problems and its consequent implementations? Problems related to capture, measure and improve the quality of decisions have been cited for several decades.

Since the 80’s authors suggest this complexity. For example, DeSanctis in 1987 makes a reference to previous researches that say, “*our society is experiencing the emergence of a post-industrial environment characterized by greater knowledge, complexity, and turbulence*” (cited by Huber 1984b) and “*one effect of this trend is that decision-related meetings are becoming more frequent and more important. At the same time, the decisions confronting groups are becoming more complex and must be more quickly, and with greater participation than in the past*” (cited by Huber 1986), see (DeSanctis, 1987). And still, this scenario has not changed expressively during these 18 years, in spite of the several initiatives proposed during the past years. Some examples can be found in (DeSanctis,1987), (Keen, 1987), (Sridhar, 1998), (Power, 1998) and (Power, 1999).

Another problem, which is also an open problem, is how to provide a follow-up of a decision-made implementation. The gap between the time a decision is made and its corresponding post-decision implementations may, in fact, turn several decisions inconsequent, due to the lack of appropriate support to the implementation follow-up. Post-decision activities have not had enough research within the decision-making cycle. Perhaps they have been considered trivial or not meaningful in the past. However, without an appropriate follow-up, important decisions made in the previous phase may get lost or be implemented wrongly.

Many researchers are interested in what happen during the process of decision making, but what happen after the final decision and its consequent steps? How are they related? How they can contribute to improve organizational processes or to help in new decisions? My proposal is to capture and organize the information and knowledge, involved during the post-decision implementation, and make

them available, so that new decisions can avoid to committing past mistakes and best practices can be discovered.

Problem Description and Related Hypotheses

The problem considered is: how one can improve the quality of decisions in an organization? Several researches were and still are done in the direction of capturing the rationale generated during meetings and interactions in a decision-making process.

This research considers another perspective, which is focused on the following steps after a decision is made. We think that the information and knowledge generated during a decision implementation, if captured, contextualized and put on disposal, can also contribute to improve the quality of decisions and to show directions for best practices.

This proposal is based on a set of technologies with seem to be adequate to contribute to the solution of this problem. Table 1 shows a schematic relation between three organizational scenarios based on citations of the related literature (see Ramesh, 2001; Stewart, 1997; Markulla, 1999; and O'Leary, 1998) and three hypotheses considered in the scope of this research.

Organizational Scenario	Hypothesis
Many mistakes are frequent in organizations and some of them are related to the lack of information and knowledge about previous experiences;	Learning with past mistakes and successful stories can improve organizational practices, organizational learning and to avoid recurrent mistakes;
Other mistakes are frequent because of the lack of planning and control of decision implementations;	Formalizing a decision implementation, using a workflow management system, allows planning, tracking and getting warning signals about problems, providing control over a decision implementation;
Knowledge and information are generated during a decision implementation;	The use of technology in organizing, storing and making available information and knowledge generated during a decision implementation can contribute to improve the quality of future decisions;

Table 1: Organizational scenarios and related hypotheses

The Proposed Solution

The explanation about the solution will follow ann organizational cycle that takes place after a decision is made and its relation with a knowledge repository (figure 1). Step1 is related to the timing a decision is made. After that, the creation of an expected plan should be done, which is represented by step 2. Then, on step 3, an execution plan can be implemented and finally another phase should take place to evaluate the whole process, represented by step 4.

Observe that these steps are not necessarily following a sequential line. For e.g. during the execution of a plan, maybe it is necessary to go steps backward and make a new decision, or during the execution of a plan it can be necessary to go backwards and make a new plan, or split the original plan into two different plans. Still considering figure 1, the rectangle that represents the knowledge repository has a different orientation, because it is a feature that can take place at any time within the cycle. For each different step the use of the knowledge repository can be served as input (for e.g. the description of a decision made on step1) or output (for e.g. recovery of data related to similar decisions in the past helping in creating a plan to a new decision).

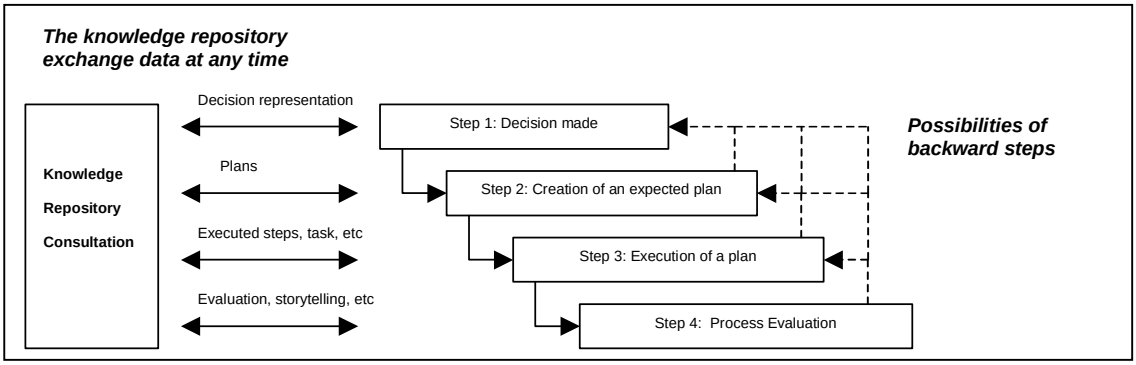

Figure 1 – Organizational cycle after a decision is made

Within this proposal, the group of technologies considered to solve the previously presented problem is: an electronic representation of a decision integrated to a workflow management system, a document management system, and a knowledge repository (see figure 2). These technologies are being integrated through another layer that works as a mediator, managing the communication between the layers, and also treats the input and output to the final user.

For the final users, the existence of these layers should be transparent. For them, the system should be a technological tool that supports documentations of decisions made, processes related to these decisions, activities related to the implementation of these processes and finally, consultations of a knowledge repository.

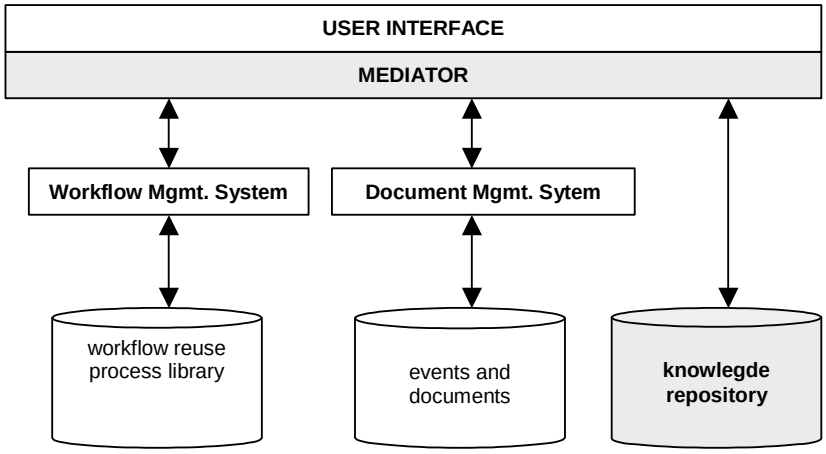

Figure 2 – macro system architecture

In the following paragraphs detailed information about each layer and how they will be used as well as some users roles involved will be shown and described.

Decision in the context of this research is typically made to achieve a goal, to solve a problem, or to implement a plan, following the definition proposed in (Balasubramanian, 1999). We can add to this definition that an implementation of any decision involves people, activities and deliverables.

Considering these facts, the solution starts after a decision is made (figure 1 – step 1). We propose that a responsible (referred here as ***decision chief***) for the

decision starts the process including in an electronic form the basic information about the decision:

- A decision description;
- A list of participants of its rationale;
- The expected main goal of the decision;
- A list of known risks;
- A list of unknown risks;
- The expected dates, and
- The expected deliverables.

This information can be prepared during the meeting where the decision was made. The only fundamental requirement about this simple step is the need that this form must be electronic integrated to the others technologies detailed in the next paragraphs. For the final user, this is just one step he/she has to do in the respective tool.

The second step (figure 1 – step 2), which should also be done by the *decision chief* is to choose from the ***workflow reuse process library***, those processes candidates to be reused in this context. This feature brings an innovation about workflow management systems, since workflows do not offer this reuse approach. If we think in a daily use of this system, the first users will be the ones who will create the processes candidate to be reused. After a certain period of time using the system and generating, good and bad plans, successful and unsuccessful processes, this base of workflow processes should provide more and more chances of reusability. Besides deciding for reusable processes from the base of decision processes, this user shall be able also to adapt these processes, or even to create new ones to attend his/her needs.

Up to this moment, the *decision chief* is preparing what we refer as an ***expected-post-decision-plan***. It does not mean necessarily that this plan is the one, which is going to be implemented, but it is a first plan of the implementations expected for a certain decision. The idea here is to relate this expected plan to the original decision and to the information provided in the form. With this relation the workflow will always be related to the decision.

For each process chosen to represent the plan of execution, the decision chief has to choose tasks, sub-tasks, dependencies, deliverables and responsible for the implementation. These people, who are going to implement the tasks, are going to be called ***performers*.** Finally, when this plan is created, the system makes available for all *performers* involved a *to-do list* with expected dates and deliverables, so that the real activities can be started and documented. One user can have in his/her to-do list, several tasks related to different decisions, with different deliverables and dates.

The system may also provide the possibility of adaptations on the expected-post-decision-plan by the final *performers*, creating an execution workflow different from the one planned (figure 1 – step 3). This kind of policy makes this workflow a flexible one.

This workflow is the base of execution for each task and plan control, but the users will generate their deliverables in different tools. We propose, in this case, a combination between this workflow and a document management system. Since a lot of information will be generated during the implementation of one

decision, and some of this information is subjective or not supported by technologies, our proposal aims to control the organization's deliverables (reports, spreadsheets, slides, documents, images, maps, multimedia files, discussions) inside a document management system that communicates with the workflow.

Through this document management system is expected that users can:

- Create private and public shared workspaces;
- Rate their deliverables;
- Control different versions of each object generated, and
- Document discussions and electronic exchanges.

Also, we expect to relate these actions to the planned stored in the workflow and to the original decision.

Another great opportunity for these users, through the use of a document management system, is the possibility of cooperation. Some features expected for supporting cooperation are:

- Document version control;
- Group calendar;
- Chat;
- Videoconferencing, and
- Story registrations based on text, audio, and video.

Through these collaboration features the users can promote knowledge exchange and possibly a better decision implementation, following the idea that the sharing of tacit knowledge demands different methods than explicit knowledge and that the most common way to share tacit knowledge is discussion and meeting (Markulla, 1999).

At anytime the users should be able to create:

- Notes;
- Comments, and
- Justifications for certain choices or changes.

These comments can be sent by email to the participants, as a notification process. Naturally, this feature of receiving a notification must be an option from each user profile.

Also, the system should provide some awareness mechanisms:

- To show the users which information is missing;
- To ask for a better description of a specific step, and
- To motivate users to give extra information every time a change to an expected result is done.

And, if this is considered overload of information, the user can turn the feature of notification off.

During a certain period of time, considering the expected final date for the implementation of the decision, the *decision chief* can consult the workflow execution to evaluate unfinished tasks, problems, deadlocks that are provoking great impact in the plan (figure 1 – step 4). Also during this time or after a plan is ended, the *decision chief* should provide rates for the whole part and for each

sub-part, or he/she can ask for ratings by the *performer* involved. Thus, in the end, the knowledge about what was or not successful and satisfactory is stored too.

Finally, the last proposed solution is a layer called the ***knowledge repository***, which has the "responsibility" of grabbing data from all the previous cited steps. Every time one of these involved users generate any data in the system, the knowledge repository is being automatically updated, primarily with the decision representation, then with the expected-post-decision-plan and its related objects, further with the implementation plan with its related objects and finally, with the quality evaluation of the whole process.

In the end of the decision implementation, the users will be able to return to the knowledge repository and see the whole picture of the process compared to what was planned or expected. Considering this, new procedures or best practices can be proposed within the organization. At this phase a user has the greatest possibility to learn based on previous experiences.

Another good opportunity to make use of the system is the time when a new decision comes. The managers can consult the knowledge repository for learning from the past decisions. For this phase of the cycle the planned queries will allow filters by subject, time period, document types, users, successful and unsuccessful stories.

Target audience

There are several people involved in this proposed solution and several beneficiaries.

The first group of user is the **upper management** of the organization. In this group are vice presidents, directors, managers, middle managers, project leaders, team leaders or any person involved in a decision-making process.

Then, after a decision is made, the **decision chief** is the one who is going to create the execution plan for a decision implementation. This person (or a group of people) will use the workflow module to make the plan and to receive follow-ups. The upper management is the group of people who are the best candidates for this role.

The third group of users is the **performers**. These are the users who are effectively executing activities, generating new information, deliverables, etc. They also can make use of the workflow if they need to change the expected plan proposed by the decision-chief.

Then comes the latest group which is composed by any user who is going to use the information stored either to study possibilities of organizational changes and best-practices or to learn for a new decision. This group not necessarily will generate or participate in creating any new knowledge, although this is also possible if this person is part of a decision process, planning or execution.

Related Work

Some companies are proposing solutions that integrate document management tools and knowledge based systems (see table 2). These tools are powerful ones

and help users in several activities. But still one of the problems encountered is the lack of integration with other tools. Another missing feature is the possibility of relating decisions made and the information or knowledge generated for their implementation, and the data these tools manage.

On the other hand, in the literature, we find less complete solutions, compared to these commercial tools in table 1, but with different approaches, or at least approaches that focus on sub-problems of decision-making processes, but none of them discuss the specific problem of post-decision follow-ups. Examples of such initiatives are found in (Balasubramanian, 1999), (Santhanam, 2000), (Aggarwal, 2001), (Basoglu, 2001) and (Courtney, 2001).

Company	Tool	Description
Lotus ®	***Lotus Discovery Server***	It is a tool that provides an expertise profiling and location, sophisticated cataloging and retrieval, comprehensive search and knowledge audits.
	Lotus K-station	It is a collaborative portal that allows the creation of workspaces, provides awareness and real-time chat.
Microsoft ®	***Microsoft Exchange 2000 Server***	A system that provides a workflow engine, content indexing, and search facilities.
Xerox ®	***Knowledge Broker***	It is a software application that helps users look for information in multiple, often incompatible databases.
	Knowledge Pump	It is a push methodology of sharing knowledge. Users can join communities that share similar interests. They are connected to each other by a central knowledge repository and e-mail.
	DocuShare	This tool makes knowledge and best practices available to everyone in an organization.
E-Vis.com ®	***E-Vis***	A Web-based workspace for sharing documents, applications and information. E-Vis users can store, organize and view project data from different sources, receive notification, track decisions and communicate via instant messages and virtual conferences over the internet.

Table 2: Some examples of available tools in the market that combine features of document management and knowledge management.

The Challenges

Besides the technological background and challenges involved in the ideas presented here, like performance, robustness, transparency for the user point of view of a workflow management system and the document management system, there are many other factors to influence the success of such a solution.

One of them is the acceptance by the users to use such kind of system. To solve this problem, the upper management of the organization must motivate its employees to use and to contribute for the success of this initiative. This problem has been pointed by Markulla (Markulla, 1999) through two interesting comments shown below:

A "knowledge-friendly" culture is one of the most important factors for the success of a knowledge management project.

"*Through e-mail, groupware, the internet and intranets, computers and networks can point to people with knowledge and connect people who need to share knowledge over distance. But, all these technologies do not create knowledge and cannot guarantee or even promote knowledge generation or knowledge sharing in a corporate culture that doesn't favor those activities*".

Another question is the real need to use such a system. All the efforts involved and technological background is justifiable for groups who deal with complex decisions and which involve many people. This concept can vary from one organization to another, but examples that would justify the use of these ideas can be the management of a software development project, or a market analysis of concurrent to improve the strategy changes in an organization. Similar examples and all decisions considered complex are the best candidates to show the help such a system can bring to organizations.

One important consideration is "*knowledge has economic value only when it is used and the value of knowledge increases the more it is used*" (Markulla, 1999). If this is achieved, then the compensation comes.

Validation techniques

This Ph.D. research is related to the activities in the context of the Fraunhofer Gesellschaft MILK project, in Bonn - Germany. This project aims to provide knowledge management support integrated to a web-based shared workspace tool (document management system), named BSCW (http://bscw.gmd.de). Through this project, several groups of people will evaluate the research using the prototypes for different purposes. This thesis, as an extension of this project, will also be evaluated in this context.

The intended method for validating these hypotheses and the proposed solution is to make a controlled use of the system in organizations and compare the results with organizations that do not make use of such a system. The scenarios of evaluation will be based on three different types of decisions proposed by Balasubramanian (Balasubramanian, 1999): to achieve a goal, to solve a problem, and to implement a plan.

Besides that, there is an intention of creating usability lab experiences to evaluate different parts of the system, for e.g., the workflow reuse library and the consultation of the knowledge repository.

Next Steps

This research is under development and the author is in the phase of modeling the modules and API's that compose the final solution.

Some choices were already made, for e.g., the use of BSCW as the base technology, which is going to be extended. The workflow module will be developed as an extension of BSCW, and the queries to consult the knowledge repository will be created. To the final users, the system will look like a web-based tool that supports all the steps and features described previously.

Up to this moment, the decision is going to be represented by a simple form, but in the future it could be interesting to integrate a Group Decision Support System to the proposal so that the rationale of a decision could also be part of the knowledge repository.

Another extension that is still under analysis is the development of more specific awareness mechanisms for the workflow and for the document management system, and also for the consultations of the knowledge repository.

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