# Bridging the Gap Between Decisions and Their Implementations

Marcos R.S. Borges[1], José A. Pino[2], and Renata M. Araujo[1,3]
[1] Post-Graduate Program in Informatics, NCE&IM, Universidade Federal do Rio de Janeiro
PO Box 2324, CEP 20001-970, Rio de Janeiro, Brazil
{mborges,renata}@nce.ufrj.br

[2] Department of Computer Science, Universidad de Chile
PO Box 2777, Santiago, Chile
jpino@dcc.uchile.cl

[3] School of Applied Informatics, Universidade Federal do Estado do Rio de Janeiro
Av. Pasteur, 458, Rio de Janeiro, Brazil
renata.araujo@uniriotec.br

**Abstract.** Decisions are frequently sent to implementers without much detail. It should not be a surprise, then, that results are not as expected. The lack of accompanying information and a common context produces wrongly implemented or lost decisions. This paper proposes a solution to this problem based on computer technology. In particular, a combination of tools including shared workspaces, process modeling with workflow and a discussion tool, is proposed. A case is used to illustrate the problem and its solution.

Keywords: Meetings cycle, decisions implementation, cooperative technology, decisions awareness

## *1 Introduction*

There has been much emphasis on improving the decision making process but little attention has been paid to the implementation phase following a decision. The gap between the end of a decision making process and its implementation activities may, in fact, turn the decision inconsequent, due to lack of interaction and negotiation between decision makers and those who will implement the decision. Often, decisions that are implemented without the necessary clarification and negotiation may generate outcomes, which are different from those planned at the time of the decision. This paper addresses the gap that exists between decision makers and implementers around the complete understanding of a decision context and the form of implementation. It discusses why linking decision implementation activities to the corresponding decision meeting is essential to make the meeting cycle fully successful. We claim supporting such link with a computer system is both efficient and effective. Meetings rarely die. That is how Oppenheim [1] summarizes the cycle in which decision meetings occur: preparation of a meeting (pre-meeting), meeting itself and implementation (post-meeting). The post-meeting results and follow-up in turn may
motivate the preparation of the next meeting, thus closing the cycle [2].

The complete meeting cycle can be computer supported. Pre-meetings can be advantageously supported to encourage careful pondering of arguments in favor or against decision options before the meeting [3]. Brainstorming, voting and other meeting activities can be supported both in distributed or face-to-face situations [4, 5]. Follow-up activities can be tracked with a workflow system [6].

Although the need for relating decision meetings and the activities following them may seem obvious, cultural barriers and lack of appropriate tools induce just informal and very incomplete links. As a result, important decisions are not properly or timely implemented. It appears, then, that all efforts to make good decisions with Information Systems and/or Operations Research models and techniques are threatened by deficient implementation. Therefore, there is a missing link between decisions and their implementations, which needs to be well understood and supported.

We identify three problems in the connection between decision and its implementation. The first and possibly the most visible problem is when decision makers detect implemented results differ from what they expected. A second problem is the typical insufficient information attached to the decision. The third problem concerns the different contexts decision makers and implementers have. Each of these three problems is studied below.

The approach we chose for the proposed solution is the use of a combination of tools. These tools are: a shared workspace, a discussion supporting tool and a process-modeling tool. The later will be used to represent the decision as viewed by the implementation team. The implementation process will enable decision makers and implementers to discuss over a common basis. The discussion supporting tool will enable the clarification of issues which may arise during the implementation process. The shared workspace will enable both teams to bring their specific contexts to a common understanding.

The paper is composed of six sections. Section 2 presents a case, which will help us to understand the problem and to illustrate the proposed solution. Section 3 analyzes the requirements for the link between the decision meeting and its corresponding implementation for the case. Next we present the functionality of the proposed solution and how the solution can be implemented. Section 5 has a general discussion on the suitability of the approach. Section 6 concludes the paper.

## *2 The Problem*

The Trucco Company needs to install a Call Center to support one of its marketing campaigns to be launched next month. The project requires 10-12 work desks and the Project Manager decides to request 14 workstations to support the operation. She justifies the two additional pieces of equipment as back-ups in case of failure. She sends the request to the company Board. The request includes the equipment specification, an estimate of the cost and a justification for the number of workstations. She also informs the Board the Call Center operation will start operation within 35 days from that date.

The Board discusses the request on its weekly meeting. It decides to approve the request and establishes the amount of US$14.000 (the estimated amount) as the project budget, after a brief discussion on the need for the two additional workstations and the cost estimate. The decision is passed to the Purchasing Department together with the original documentation prepared by the Project Manager.

The Purchasing Department sends a RFP to its traditional suppliers. In view of the project deadline, a Purchase Officer defines that the equipment must be delivered within 15 days. The RFP contains the specification, deliverable conditions and the cut-off date, i.e., when the company expects to receive the proposals. Two of the three

conditions have been established: the specification and the delivery date. The third condition - the budget - will be verified when the proposals are known.

After 3 days (at the cut-off date) the Purchasing Department received four proposals. Proposal A agrees to deliver the equipment as specified within 15 days, but presents a price exceeding the budget in 20%, i.e., US$16.800. Proposal B also agrees with the deadline but offers an alternative supply more powerful than specified, with a price exceeding the budget in 50% (US$21.000). The third proposal (C) presents the exact specification at a price within budget, but it requires 30 days to deliver the 14 workstations. Finally, Proposal D requires 20 days to deliver the equipment, it offers a very attractive price (US$11.200) but it does not comply with the specification (it offers a 20 MBytes hard disk, while the specification asks for 40 MBytes).

What happens next? There are several possible outcome scenarios. We describe three of them below. In scenario I, someone from the Purchasing Department believes the budget and the specification are the most important constraints and decides in favor of Proposal C. Projects are frequently late. The Purchasing Officer also reasons the Purchasing Dept. arbitrarily established the 15-days, anyway. After two weeks, the Call Center Project Manager asks the Purchasing Department about the order and finds out the project will be late. Knowing she will not be able to accomplish the project goals, she angrily complains to the Board. She also tells them the campaign will probably be a fiasco.

In scenario II, the Purchasing Dept. concludes no proposals match the project requirements and decides to check with other suppliers, strengthening the deadline and the specification constraints. After three days it receives proposals very similar to the first round. As a result, this scenario turns to one of the others, three days late. Another variation of this scenario is as follows: suppose one of the new suppliers has a proposal satisfying all requirements. The purchasing order is awarded to this supplier. It is not clear the equipment will arrive within 15 days (it is an unknown supplier). Let us assume the equipment arrives within that period. However, there still may be problems: the Technical Support Dept. may find the quickly estimated time for installation to be too tight (the 15 days period was an arbitrary decision by the Purchasing Officer).

Scenario III is complex. The Purchasing Dept. believes Proposal D – low price, but with insufficient features – is a good opportunity, but before making a decision, it puts together all proposals and asks the Technical Support Dept. and the Call Center Project Manager whether the specification can be relaxed. Technical Support is not aware of the purchase and is not able to respond, but it sees Proposal B as a good opportunity to deal with a request from another project for upgrading its equipment. The Technical Dept. envisages a plan in which Proposal B equipment could be acquired for this other project and its equipment, in turn, could be transferred to the Call Center Project. By coincidence, the specification matches the requirements. The Call Center Project Manager, on the other hand, prefers the simplest option, i.e., Proposal A. She thinks she can get a quick approval to increase 20% the project budget. A higher authority should then decide; this takes time (e.g. the Board meets once a week) and thus, some of the Proposals may be unfeasible by then.

In this example, extracted from a real case, we can observe the gap problem between a decision and its implementation. If people implementing the decision were the same who initially made the request, then probably no misunderstanding would have occurred. But of course, a small group of people cannot do everything within a company. Next section will examine this problem in further detail.

## 3 *Analyzing the Problem*

The problem we described in the previous section can be generalized to many situations occurring in Organizations. In these cases, there is a gap between the decision made by a group of persons and the implementation of that decision, probably carried out by other people. Lack of good communication is the main culprit for this gap.

The typical way of realizing something is wrong with the implementation of a decision appears when the results are different from those expected by decision makers. In our example, suppose the outcome scenario is No. I. There is not much to be done: the campaign will be late and probably it will be a failure.

Let us further explore this assumed outcome. The Head of the Purchasing Dept. will probably punish the person from his Dept. who chose option C. Is that right? Perhaps not: it was not totally his fault to be unaware about the importance of launching the campaign on time. Moreover, punishing him will probably hurt his own confidence at work and thus, his initiative to make decisions will be reduced. Perhaps no one was guilty; what everyone seems to ignore is that the environment is not facilitating people to make the right choices.

The symptom – results different than expected – is not all the sickness within the company. There may be lack of detailed information in what was required from the Purchasing Dept. If the request had specified the deadline was extremely important to be met, then obviously the outcome would have been different. Sometimes, then, detailed information from decision makers to implementers may help to fill the gap.

In some cases, however, even detailed information is not enough. Decision makers cannot imagine all the implementation choices there may occur and thus, they are unable to produce all possible information that may eventually become relevant. What is actually happening is people have different contexts and therefore, they do not work coherently.

What is context? Context may be defined as a complex description of shared knowledge about physical, social, historical, or other circumstances within which an action or event occurs [7]. For a step of a task, Brézillon and Pomerol [8] distinguish the part of the context being relevant for the current performer's focus of attention from the irrelevant part. The latter part is called external knowledge. The former part is called contextual knowledge because it has strong relation to the current focus although it is not directly considered in it. Always at a given focus, part of the contextual knowledge is proceduralized. This proceduralized context is a part of the contextual knowledge, which is invoked, organized, structured, and situated according to the focus and used while performing the task at this focus.

Context evolves with focus. This dynamics of context can be observed by the movement between the contextual knowledge and the proceduralized context. Thus, a part of the context is static, e.g. the context at a step of the focus of attention is defined by a fixed number of contextual elements and a fixed proceduralized context, but the overall focus of attention is associated with a dynamic context through this movement between the contextual knowledge and the proceduralized context. Static and dynamic parts of the context are intertwined and must be considered jointly.

Brézillon [9] points out it is possible to organize various types of context in a two-dimensional representation: in depth first, from the more general to the more specific, and in width first as a heterogeneous set of contexts at each level. In "depth first", contexts differ by their granularity. For example, a company context (with its tradi-

tion, habits, rules, etc.) is more general (at a higher level) than the context of an employee. In this case, context has strong relationships with the enterprise organization in terms of roles [10]. According to its depth, a context contains more general information than contexts at a lower level. However, context at one level is not a simple instantiation of the context at the upper level [11]. A context is like a system of rules (constraints) for identifying triggering events and for guiding behaviors in lower contexts. A context at one level contains contextual knowledge when the application of rules at the lower levels develops proceduralized contexts. A context (the contextual knowledge part) is like a frame of reference for the contexts below it. For instance, a person visiting Costa Rica knows the language spoken there is Spanish (contextual knowledge in the context of the country), and he pays attention to speak this language there, assuming he knows it (proceduralized context in his individual context).

In "width first", each actor has its own context. An actor's context contains information on the reasons for his actions, the results of his activities, etc. The context of the software agent possesses information on the available means for the accomplishment of the task, the access restriction to the databases, a user model, etc. For a given granularity of the context, there is thus a set of contexts rather heterogeneous, and the horizontal movement from one individual context to another one goes through either the upper context (e.g. the group context) or a lower context (e.g. the project context). Note that at the group level, a group is, recursively, like an actor with his individual context and interacting with other groups in other contexts.

Pomerol and Brézillon [12] discuss the transformation of contextual knowledge into some functional knowledge or causal and consequential reasoning in order to anticipate the result of actions. Data are facts, which have not been analyzed or summarized yet (e.g., see Watson [13]); information is data processed into a meaningful form, and knowledge is explained as the ability to integrate the information in his body of knowledge.

We can easily explain the behaviors of some of the Trucco Company people in the case we are analyzing considering the context. In Scenario I, the Purchasing Officer has a context including mainly previous purchases (impact, results, typical flexibility in delivery times), knowledge about the current suppliers (reliability), knowledge on the Technical Support Dept. (time to install computer-related equipment). With this context, he chose option C, thinking that would be the best for the project and the company. In Scenario III, note personal contexts influence choices. The Technical Support person looks for optimizing equipment for all his clients; his context includes the equipment features required by all projects he is currently supporting, previous experiences, etc.; it is not clear he is taking into consideration the urgency for the current project. The Call Center Project manager's context has knowledge about campaign effectiveness, competitors' actions, campaign messages, customers' requirements, etc.; for her, the equipment purchase should be trivial, an almost automatic activity, and differences in equipment costs are secondary. For any of the scenarios, it is not clear the Board context: how important is the project for the company? How does it relate to other company efforts? How relevant are these procurement budgets?

## *4 A Solution to the Problem*

A solution to the described problem necessarily includes people to be aware of it. It is useless to provide technology if people do not believe there is such a problem: they

simply will not use the systems. A second requirement is a collaborative attitude from workers, in particular, some appreciation concerning what others do for the company success. We can then consider technology. Our proposal calls for a combination of supporting tools, as described below.

### 4.1 The Use of Workflow Technology

Workflow has been used to represent processes and to provide a control of its execution. By modeling the process, it provides both users and process players with a general view, yet abstract in some cases, of the activities involved to achieve job completion. It provides managers with the evolution of the work by controlling process execution, so they can take action in the presence of an unexpected behavior. WfMSs (Workflow Management Systems) have been used mainly in production processes. A production process is one repeatedly occurring with little variation from its expected flow. When the variation can be predicted, the process designer represents it in the form of optional paths generated by decisions during the process.

In our solution we make use of the process model and the workflow technology in order to represent the implementation steps, which materialize a decision. As discussed in [6], a proposal can be submitted together with the process description that supports its implementation. Decision makers can also generate the process model to represent how the job should be done. Alternatively, the implementation team can provide the process model under request from the decision makers. The decision implementation model is a way to achieve a common context and to support interaction, through a shared workspace among the people involved in the decision [14]. The different contexts in this situation are the one that comes from the decision makers and on the other coming from those who implement the decisions.

Figure 1 shows an example of an initial process model representing the steps and the people in charge to purchase a product in response to a request from the Project Manager. We can note that in this model, the Technical Dept. is not involved because the Board assumed it has been done by the Project Manager before requesting the purchase of the equipments. Also, there is almost no interaction among the three groups involved.

The advantages of this approach are two fold. First, the implementation plan is a starting point for the negotiation, in case one does not agree with the plan. The plan can be annotated and modified in response to the issues raised by people involved. Second, all divisions involved in the decision have a clear view of the entire implementation plan and their responsibility in it. Besides, decision makers can learn from mistakes in the past and include the necessary adjustment in future decisions. In some companies, the plan could also serve as the input for process enactment, which will provide implementation follow-up [6].

We claim the implementation process model is a better way to bridge the gap between decision makers and implementers than the traditional forms: textual messages or informal communication, e.g. by the phone. Besides, it provides persistent memory and awareness to people not directly involved in the interaction. A process model is intuitive and its adoption does not require extensive training. A modeling tool associated with a discussion support such as that implemented by Mendes in Lotus Notes [15], is a good example of a shared workspace aimed at providing common context.

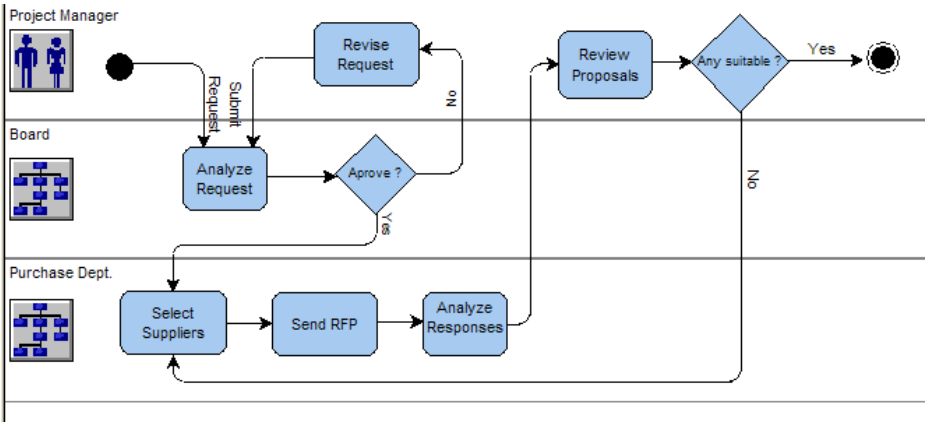


**Fig. 1.** Initial Process for Purchasing Equipment

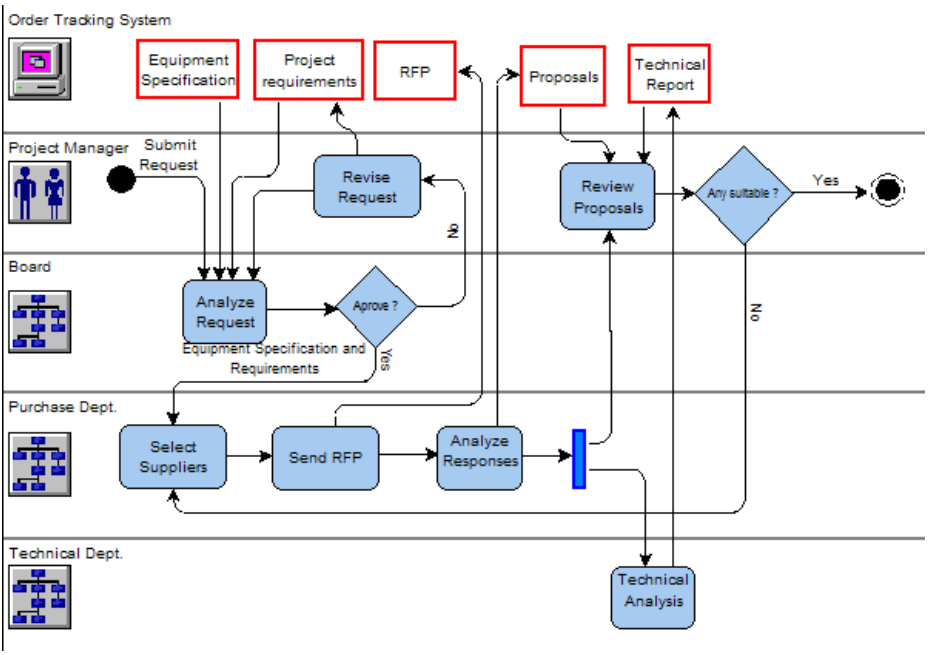


**Fig. 2.** The Equipment purchase implementation plan revisited

In the Trucco company case, an implementation plan such as the one depicted in Figure 2 could have been designed and have its execution controlled by a WfMS. Instead of passing the decision implementation only to Purchasing Dept., the Board would activate this implementation plan. Based on previous experiences, the plan predicts at least some of the scenarios, preventing some undesirable outcomes, such as Scenario I. The same would happen with Scenario II, unless agreed by Project Manager. As for Scenario III, the plan would support the discussion around the four proposals.

### 4.2 The Use of Discussion Supporting Tools

The case shows four initial options are possible. With additional information we can perhaps discard some or all of them, at the same time we create new ones, such as the variant generated by the Technical Support Dept. How do involved people argument around these options? How do they document that?

Again, a shared workspace is our preferred solution. The IBIS-based discussion forum [16] used in several implementations [3, 17] was the underlying communication model. Although the IBIS model does not support the decision itself, it documents the discussion in such a way the decision process becomes a straightforward activity.

There are several IBIS-based tools. The one we used to illustrate our example was the QuestMap tool [18]. We used this tool to illustrate our example due to its convenient graphical representation of the discussion, but in our implementation we used Lotus Notes [19]. Figure 3 reproduces the discussion diagram generated by QuestMap. Initially, there are four options represented by the four proposals. The fifth option was suggested by the Purchasing Dept. in view of the unsatisfactory results obtained in the first round. Finally there is the sixth option raised by the Technical Dept. All options have advantages and disadvantages, as shown by the QuestMap diagram in Figure 3. With this information at hand, the Board can decide faster and wisely, based on organizational policy.

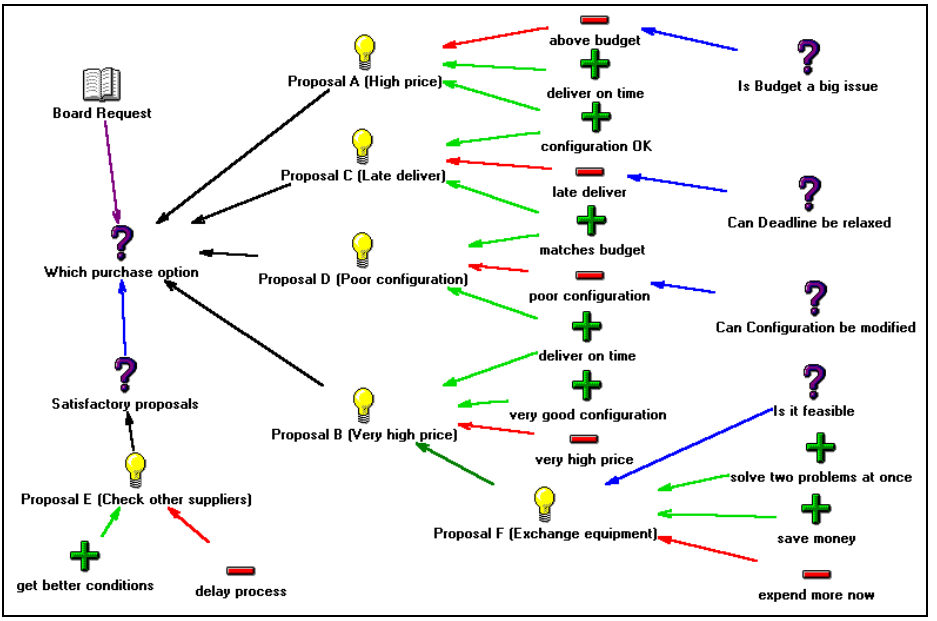


**Fig. 3.** The discussion around the purchase options

### 4.3 The SUPRE Implementation

The SUPRE (Post-Meeting Support) System has been developed using Lotus Notes technology. The system consists of two environments. The first supports the interac-

tion necessary to model the implementation plan. The second, which is out of the scope of this paper, supports the implementation follow-up, which is the actual execution of the plan. The implementation plan is designed using the Lotus Workflow Architect [20] and the discussion around it is supported by Lotus Notes.

The initial implementation plan is described using the Lotus Workflow Architect with the aid of pre-defined process - the process beans. Those pre-defined processes are drawn based on the analysis of typical decision plans within the domain of the organization. In our case, the purchase process could have been designed as a result of previous purchase operations. In any case, the environment allows the use of the entire process or part of it. It also allows, of course, the design of a completely new process. An example of the Lotus Architect environment augmented by a set of process beans is reproduced in Figure 4.

Associated with each process, there is a discussion forum, implemented using Lotus Notes. The advantage of having both the process design and the discussion forum under the same environment is that associations between elements of these tools can be easily made. Besides the organization structure used to represent the roles in the process design is the same used for the definition of members of the discussion group.

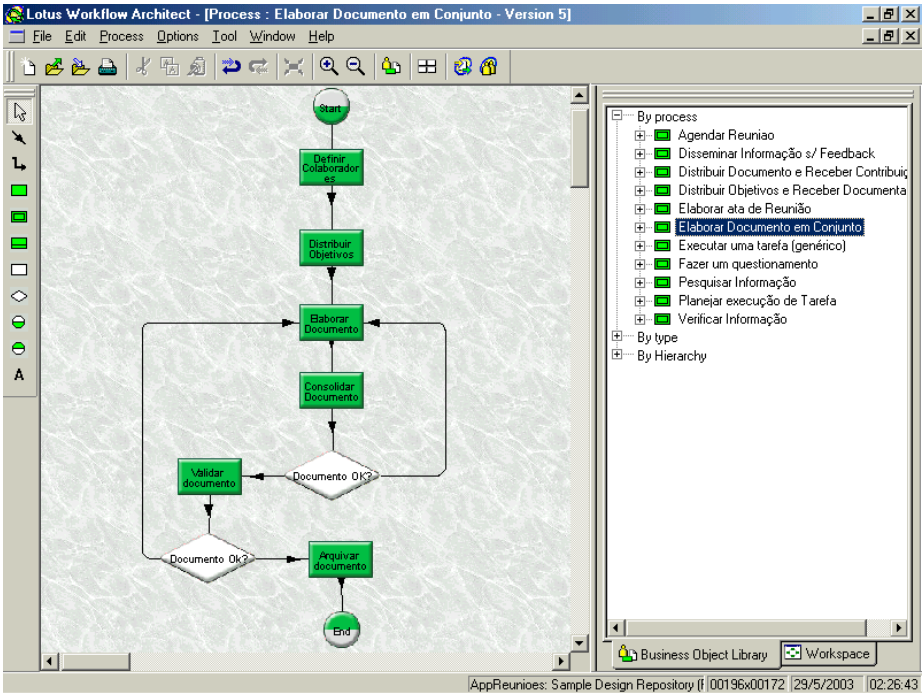


**Fig. 4.** The Lotus Workflow Architect augmented by Process Beans

## 5 *Discussion*

The previous sections have described some situations where there is a clear gap between the environment where the decision process takes place and the environment

where the decision is enforced and implemented. Lack of good communication is thought to be the main cause for this gap, but a number of other reasons can be also associated with this chasm [21]:

- The decision makers weren't really addressing the right problem;
- The decision makers had no real interest in or commitment to solving the problem, anyway;
- Whatever the decision makers thought they decided satisfied their needs for finishing the meeting, but was not detailed or clear enough to be called a real solution;
- The decision makers have the false belief that only policy is important and that the details are someone else's problem;
- The decision makers realize that execution is important, but reserve all perks and privileges for the decision makers themselves.

The reasons listed above show that not all decision problems in organizations could be solved with good communication. In some, communication might play an important role to putting these problems in evidence, but their solution should come from management procedures. Although we recognize the veracity of these situations, our work focus on the problems that people are willing to cooperate to their solution, but do not have the means or the adequate support to address them.

The approach presented in Section 4, based on process modeling and discussion support, is a possible solution to fill this gap. The first question to be answered is what impacts these two technologies would produce in the decision life cycle. We try to demonstrate the advantages of our approach, but some disadvantages can be foreseen. This section presents a discussion on the trade-offs of our approach.

Process modeling of an implementation plan is not an easy task. It is unrealistic to assume that members of a Board of Directors would be able to generate such model from scratch. Although intuitive, the process model requires some expertise both on the modeling techniques and on the domain, i.e., on decision implementation issues. Two solutions are suggested to overcome this problem. First, all proposals should carry an implementation plan, prepared in advance jointly by the proponent and the implementation teams. Second, a library of typical implementation processes could be built based on previous experiences from similar decisions. In the latter case, the process stored in the library may not fit exactly the decision, but can be used as a starting point towards the actual process. An interesting approach, based on a library of process beans has been proposed by Borges et al. [6]. Besides storing complete processes, this library also stores sub-processes, called process beans, which can be assembled together to form a new process.

A library of typical implementation processes may also work as an organizational memory. Like many libraries it is difficult to start, but, given time, it may become an important source of knowledge, where much (many) informal knowledge (procedural contexts) are captured and saved. This long-term advantage counterbalances the initial efforts and possible delays caused by the introduction of a new procedure.

Cultural barriers also raise an issue; people naturally prefer the easy way. Support from managers and pilot projects are part of the suggested prescription. Based on ethnographic observations, we identified another obstacle. Decisions are not always as rational as one would wish. In many cases, the rationale behind a decision is not explicit. In our case, e.g., the Call Center Manager may have the power to persuade the Board to approve Proposal A, because she does not want additional problems

(uncertainties, complications): she has had enough already. Or, on the contrary, she may insidiously favor Proposal C because the project is late anyway and she may use the delay on the equipment purchase as an excuse for the project failure.

The discussion support technology also raises some interesting issues. The argumentation model reproduced in Figure 3 gives us a clear view of the options and their pros and contras. On the other hand, would not it be easier and quicker to discuss the options over the phone? Again, the advantage of having a retrievable memory is a clear-cut. In the Call Center case, the impasse would be sent back to the Board. The discussion map provides a good way of presenting the current situation without additional effort. It also serves as a documentation to justify decisions and to avoid discussion over the same topics, as it has never occurred in the past.

Several IBIS-based systems have been built and used to support discussion [3, 17, 18]. Although the discussion map represents the essence of the discussion it presents at least two drawbacks. First, it is not easy to impose the required discipline to discussion participants. People often mix the three elements (question, position and arguments) in the same statement. This indicates that an intensive training on the model is suggested before starting a real discussion. In some cases, they want only to comment on one element and not add a new element. In our example, the decision made by the Purchasing Dept. about the delivery deadline was not explicitly represented. In order to give room for these requirements, some systems have modified the original IBIS model [3].

The second problem relates to the dynamics of the discussion. The resulting discussion map does not show how and why some elements have been added. For example, Proposal E resulted from the unexpected outcome generated by Proposals A-D, while Proposal F resulted from the later involvement of Technical Dept. By the way, the attempt of the Technical Dept. to find a common solution to two problems is also implicit. This suggests that the discussion stages have to be associated with the activities of the implementation process, providing context to its evolution.

From the contextual point of view, notice our solutions try to build a large shared context to all involved actors. Both at the group level and inter-group level, a shared context allows coherent decisions. Instead of attempting to diminish the number of decisions the implementers make, our approach tries to enable implementers to make the right decisions.

## *6 Conclusions*

A solution to the gap between decisions and their implementations has been presented. It represents a cooperative approach involving technology, which supports people to achieve the common goal of obtaining rightly implemented decisions for the Organization. As such, it needs people willing to collaborate with other employees.

The solution involves using process modeling, shared workspaces and discussion tools. These tools may be used in conjunction with other tools intended to support other parts of the decision meetings cycle, such as the meeting preparation and the decision making support itself.

A number of issues remain open. While the discussion map eases documentation, there is also a danger of information overload for those who later have to relate to this material. Besides, there is also the issue of who should submit the implementation

plan in the first place. Sometimes, new options arise when the implementation is in progress. An important functionality of the WfMS would be the support for changes emerging during running processes.

The approach needs to be tested in real settings. We must find an appropriate environment to start a pilot project and observe benefits and drawbacks of the proposed solution. What type of evaluation will take place? We can qualitatively measure results as a first step. As we mentioned above, many of the benefits will be obtained only after a period of intensive use.

## *Acknowledgements*

This work has been partially supported by a grant from CNPq (Brazil) Prosul Program No. 490187/2003-0 and a grant from Fondecyt (Chile) No. 1040952. The Workflow Architect software was used under the IBM Scholars Program. We would like to thank the three anonymous reviewers for their insightful comments on this paper.

## *References*

1. Oppenheim, L.: Making meetings matter: A report to the 3M Corporation. 3M Meeting Management Institute, Austin, TX, USA (1987)
2. Bostrom, R., Anson, R., Clawson, V.: Group Facilitation and Group Support Systems. In L. Jessup and J. Valacich (eds.): Group Support Systems – New Perspectives. Macmillan Pub. Co., New York (1993) 146-168
3. Borges, M.R.S., Pino, J.A., Fuller, D., Salgado, A.C.: Key issues in the design of an asynchronous system to support meeting preparation", Decision Support Systems, Vol. 27 N. 3, (1999) 271-289
4. Nunamaker, J., Dennis, A., George, J., Valacich, J., Vogel, D.: Electronic meeting systems to support group work. Communications of the ACM Vol. 34 N.7 (1991) 40-61
5. Romano, N. & Nunamaker, J.: Meeting analysis: Findings from research and practice. Proceedings of the 34th Hawaii International Conference on Systems Science, Hawaii, USA (2001) In CD-ROM
6. Borges, M.R.S., Pino, J.A., Valle, C.: Support for Decision Implementation and Follow-up. European Journal of Operational Research (2004) (in press)
7. Brezillon, P., Borges, M.R.S., Pino, J.A., Pomerol, J-Ch.: Context-Based Awareness in Group Work, Proc. of the International FLAIRS Conference, Miami Beach, FL (2004)
8. Brézillon P. and Pomerol J-Ch.: Contextual knowledge sharing and cooperation in intelligent assistant systems, *Le Travail Humain Vol.* 62 N. 3, PUF, Paris (1999) 223-246
9. Brézillon, P.: Individual and team contexts in a design process. Proceedings of the 36th Hawaii International Conference on Systems Science, R.H. Sprague (Ed.), Los Alamitos, USA (2003) In CD-ROM
10. Brézillon, P. and Marquois, E.: Une approche centrée contexte de l'activité. Symposium "Tâche, Activité et Contexte" (TAC). In: J.M.C. Bastien (Ed.), Actes des Deuxièmes Journées d'Etude en Psychologie Ergonomique – EPIQUE, INRIA, France (2003) 263-268
11. Brézillon, P.: Using context for Supporting Users Efficiently. Proceedings of the 36th Hawaii International Conference on Systems Sciences, "Emerging Technologies" Track, R.H. Sprague (Ed.), Los Alamitos, USA (2003) In CD-ROM
12. Pomerol J-Ch. and Brézillon P.: Dynamics between contextual knowledge and proceduralized context. In *Modeling and Using Context* (CONTEXT-99), Lecture Notes in Artificial Intelligence Vol. 1688, Berlin Heidelberg New York (1999) 284-295

13. Watson, R.T.: Data Management. *Databases and Organizations.* John Wiley and Sons, Inc., Second edition, New York
14. Gutwin, C., Roseman, M. and Greenberg, S.: A Usability Study of Awareness Widgets in a Shared Workspace Groupware System. Proceedings of ACM Conference on Computer Supported Cooperative Work, Boston, Mass., ACM Press, New York (1996) 258-267
15. Mendes, C.D.L.: Post-meeting Support using Workflow Technology . M.Sc. Dissertation, Informatics Program, Federal University of Rio de Janeiro, (2003) (In Portuguese)
16. Kunz, W., Rittel, H.: Issues as Elements of Information Systems, Working paper #131, Institute of Urban and Regional Development, U. of California at Berkeley (1970)
17. Guerrero, L.A., Pino, J.A.: Preparing Decision Meetings at a Large Organization, Proc. of the Decision Making and Decision Support in the Internet Age, F. Adam, P Brézillon, Patrick Humphreys and J-Ch. Pomerol (editors), Cork, Ireland (2002) 86-95
18. Compendium Institute: Questmap, Available at http://www.compendiuminstitute.org/tools/questmap.htm Acessed on 13 April, 2004
19. IBM Lotus Notes: Available at http://www.lotus.com. Accessed on 30 March 2003
20. IBM Lotus Workflow: Available at http://www.lotus.com. Accessed on 30 March 2003
21. Unknown author: Referee's comments on the submitted version of this paper