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ORGANIZATIONAL MEMORY : THE PRODUCT OF A REFLEXIVE ACTIVITY

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Organizational Memory:
The Product of a Reflexive Activity

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Developing an organizational memory (OM) has become a necessity because of the constant and fast evo. lution of organizations. OM is the result of the process of organizationallearning, defined by its temporal characteristics and by ways of its circulation. Building of OM requires a reflexive activity. A field study sug. gests that during therapeutic decision making, the reflexive use of criteria is a critical issue: allotting val. ues to criteria allows one to build knowledge. Decision making mobilizes knowledge for mutuallearning, but also changes knowledge. This mechanism needs tools: organizational tools and reports for keeping track of decisions.

Knowledge management is now perceived as a key factor of organizational development. However, man y questions still remain unclear: Where is knowledge in organizations? Where and how does knowledge get elaborated? How is knowledge building connected with functional activity? What tools are useful for knowledge building? This paper aims to address these questions. It presents a theoretical framework, a field study, and proposals of tools for assisting the reflexive activity.

Organizational memory (OM) will be seen here as the result of a proactive and determined effort to formalize knowledge. Four different points of view on expected benefits of organizational memory can be identified:

- OM as a project management tool: this is relevant for long and complex projects.
- OM as a tool for on-going design: in some cases, there is no clear separation between the end of one project and the beginning of the next.
- OM as a tool to facilita te reuse of knowledge: an adequate memory of a given solution and problem can prove useful in the future, when operators are faced with a similar problem.
- OM as a tool for building new knowledge: OM can be initiated by the explicit objective of creating new knowledge. This is the position argued in this paper. In that case, the activity of the organization is se en as a whole: knowledge building is articulated with the functional activity.

Organizational Memory: A Theoretical Framework

Two concepts are often put forward: organizational memory and organizational learning. Although related, these concepts are different. Our purpose in the next sections is to clarify the two concepts.

Organizational Memory

The terms "organizational memory" (OM) are broadly use d, fitting with different realities. It is possible to distinguish roughly two fields of study: information sciences, concerned with gathering and sharing common pieces of information; and organizational science for which knowledge is a resource.

OM can be seen as resulting of routines: day-today operations produce rules that ensure the coherence of the organization. Another point of view sees OM as a support for innovation, a cognitive resource. This point of view overshadows the others: OM is necessary because of the constant evolution of organizations. Production is more and more driven by the demand, and then flexibility is more and more needed. Foreseeing for a continuous evolution is therefore a necessity: "Successful organizations embed their adaptation activities in standard operating procedures" (Walsh & Ungson, 1997, p. 72).

Cognitive functions, in the past unknown or underestimated, are now recognized and encouraged (Barbier, 1996). Some people even consider that knowledge building is the main goal of the firms. This activity is seen as a source of competitiveness,

as knowledge building implies innovating for products, process, and organization.

Organizational Learning

Here, "organizational learning" is understood as the process of building and maintaining memory. Considering knowledge building, two main ideas are stated: knowledge building is going on during action, and this building needs appropriate conditions.

Then, knowledge is considered as a process: the emphasis is set on elaboration processes and on mechanisms of knowledge transfer. The issue is not the use of existing knowledge, but the definition of ways of developing and sharing knowledge (Hatchuel & Weil, 1992). It is more important to help experts rebuild and exchange their knowledge than try to gather and store this knowledge.

In the proliferating literature on organizational learning, it is possible to identify three consensus areas: the role of individuals, the coexistence of three levels of learning, and the necessity to set organizational learning in its real environment (Ingham, 1994).

Learning is an individual process; that is why Charue (1991) puts forward objections to "organizational intelligence." Midler (1994) defines organizational learning by three characteristics: it is based on individual experience; it aims to build knowledge on action; and it is a progress in rationality.

Then, organization is seen as a place for interactive learning, and not only as a structure aiming only at financial or functional goals. Two questions are raised: Who is learning? What is the learning level? The next two sections consider these questions.

Temporal characteristics of organizational learning

One can distinguish three modes of learning:

- Short-term learning: according to some authors, this consists in adapting rules (Cyert & March, quoted by Charue, 1991) or in correcting deviations without changing performance rules. This is the "single loop learning" described by Argyris and Schon (1978). This learning does not concern prescribed rules, but actual collective rules; it goes from the team to the team (Midler, 1994).
- Long-term learning: according to Cyert and March, this is a matter of a long evolution; for Argyris and Schon, this "double loop learning" results in modifications of the rules.

Meta-learning process: Argyris and Schon coin the words "deutero learning" to identify this third level. It is a matter of reflexive activity about the first two levels.

The circulation of organizational knowledge

Official circulations of information are sequential, following a succession of predetermined steps. Pieces of information may be put into circulation by the top hierarchy, but it also may be conveyed from down to top.

Non-official circulations, as described by Girod-Séville (1996), are manifold and separate; they originate in local processes, concerned with various tasks. In the course of their activity, operators build knowledge, individually or collectively, and share it with others. Cooperation is thus a fundamental aspect of knowledge elaboration and spreading. Operators confront their points of view and c1arify their knowledge. This activity needs time and organizational prerequisites. Building and managing knowledge need to be granted organizational status if one takes it seriously; that is, as a necessity for the organization.

The Reflexive Activity

This activity corresponds to the highest attainable level of abstraction, for which Piaget (1977) defines three successive levels:

- action without conceptualization, in which the schema system consists of sophisticated knowledge units, enabling immediate adaptation to objects encountered;
- conceptualization, i.e., the capacity to understand what can be modified in order to undertake new activities;
- reflexive abstractions, enabling the individual to innovate.

Reflexive thought and therefore knowledge evolution and conceptualization require to become aware of one's knowledge, which represents the ultimate step in building knowledge which has been worked out through action. As Piaget states: "The issue of awareness is one of increasing interest for scientific psychology, since it has been accepted that, contrary to c1assical behaviorism theories, there is neither a dichotomy or a basic opposition between behavior and consciousness. This is because "awareness" represents per se a form of behavior which interacts with all others...awareness requires...the intervening of specific activities...in reality, it is a genuine construct" (Piaget, 1974, pp. 7-9, our translation).

Therefore, awareness is a deliberate and truly specific activity. There are cases where this activity does not occur, and therefore does not contribute to knowledge building. Furthermore, its very existence requires specific conditions. In the case of knowledge building within an institution, Piaget's theory

leads to believe that reflectivity and therefore becoming aware of one' s knowledge must be perceived as an activity, in the full acceptance of the term.

Building knowledge in view of a future activity requires that professional activity is not perceived as a succession of issues to be dealt with, but rather as building a semantic memory, following an abstraction process. For reflexive activity to take place, a second step is necessary: skills developed through activity can only be used for knowledge building if individuals are aware of these skills, and if skills are evaluated.

This requires that individuals, or teams, take (and are given) time to analyze their own activity. Activity then becomes, for some time, an object of analysis. We have proposed the terms of "metafunctional activity" (Falzon, 1994) to describe that reflexive activity. The concept of metafunctional activity promotes the integration of all the activities that in the course of a functional activity enables the simultaneous establishing of knowledge for future use.

The Field Study

The field of this study is the making of decisions for treatment, in the field of cancerology. It was carried in a center for the treatment of cancer diseases.

In oncology, treatment decisions are usually based on established protocols: these are rules elaborated by experts of the field through an analysis of scientific literature (large sc ale experimentations validated by statistical studies). The protocols specify the criteria for including cases in categories, which refer to tumor and patient characteristics. The decision, in each case, is reached by comparing case characteristics with the protocol criteria for case inclusion.

The use of these protocols enables a practitioner, working on their own, to make a decision for most cases. However, cases can also be submitted to a committee for decision on treatment (CDT) when a solution cannot be found based upon the protocols, either because of the cancerous disease itself, or because the patient presents a special characteristic. Submission of a case to the CDT is voluntary. The proposition of a course of action by the CDT is not mandatory for the practitioner; it is an advice.

During CDT meetings, the criteria for including the case in a protocol are established on the basis of the information provided by the practitioner, spontaneously or on request. The first phase of the decision making process thus consists of a case description and of an evaluation, implicit in most cases, of the differences between this particular case and the protocol categories. The second phase corresponds to the decision making itself. In fact, two different processes occur simultaneously during the discussion of each case: an exchange of information concerning the case and its treatment, which are the criteria for inclusion, and an exchange of points of view on validity of treatments and scoring of symptoms, which gives rise to a mutual learning process. This second process allows the CDT to adjust their knowledge. During this phase, values are allocated to criteria.

The CDT that was studied here focuses on breast cancer and meets once a week. It includes senior specialists of each relevant discipline (radiotherapy, oncology, surgery, hormone therapy, and gynecology). The attendance of the committee varies from 7 to 15 participants. In the meetings that were observed, the number of cases reviewed each time varied from 1 to 7 cases. We have studied several CDT meetings, during which 47 cases were reviewed.

Criteria for Decision

Categories of criteria have been defined and counted, allowing a first understanding of therapeutic decision making. A criterion is an utterance aiming towards a decision; it is different from information about the case, not in its nature, but in its role during the decision making process.

Methodology

Three categories of criteria are distinguished:

- characterization criteria are related to characteristics of each case; it may be criteria used in the rules, as size, number of nodes or metastasis; it may also be frequently used criteria as hormonal status, or criteria related to features of a particular patient;
- action criteria are related to past or future therapeutic action (for example, radiotherapy quantity);
- rule criteria are explicit use of a rule item for decision making: "before fort Y years, this therapeutic action is possible."

Results

Table 1 shows the frequency of each class of criteria. Most of the criteria are characterization ones. Rule criteria are the less used. These results suggest that characterization is the main resource for decision making, with or without explicit rules. The second task is examining possible action.

Discussion

These results suggest that characterization is the main task for decision making, with or without

Characterization	**Action**	**Rule**	**Total**		386	225	66	677

(57%)	(33%)	(9%)	

Table 1. Humber of criteria of characterization action, and rule

explicit rules. The second task is examining possible action. Then decision making is mostly made for each particular case, without reference to common knowledge of the rules.

The Main Phase of Decision Making: Allotting Values to Criteria

During the meeting, criteria are accompanied with values, which are crucial for decision making.

Methodology

Encoding values allotted to criteria necessitates the segmentation of utterances. Units " criterion values" are defined with elements from several utterances. A value allotted to a criterion may be from the same utterance or from another, expressed by the same speaker or by another. Then, a value allotted to a criterion is an utterance adjacent to the criterion or connected with the criterion.

Three categories of values are distinguished - qualitative, quantitative, and critical values:

- qualitative values; for ex ample, in "she has lombar and pelvic pains," the criterion is "pains," and the qualitative values are "lombar and pelvic;"
- quantitative values allocate a numerical value to the criterion;
- critical values assess relevance of the criterion.

An example of rule criterion, exposed par Pl and critically assessed by P2 (Pl and P2 are two physicians): Pl: "the rule needs ten nodes to be applied;" P2: "yes, for women; for men, decision is made without number and size of nodes."

Results

Table 2 shows that qualitative values are more frequently used. Allotting values to criteria involves two different cognitive processes: instantiation and

Qualitative	Quantitative	Critical	Total
398 (60%)	148 (23%)	113 (17%)	659

Table 2. Number of the values in the three teams

critical assessment. Instantiation allocates a value to a criterion; it may be a quantitative or a qualitative value (big, small...). Critical values assess the relevance of the criterion.

Decision making using rules is used as much as possible. Cases are classified in a established space of criteria; the mechanism of allotting values allows inclusion of the case in rule category. Qualitative, quantitative, or critical values have different meaning: qualitative assessment specifies the case; quantitative assessment places criteria on a sc ale of numerical values; and critical assessment judges relevance of criteria and their space of using.

Discussion

Allocating values to criteria is a matter of two different cognitive process: instantiation and critical assessing. Instantiation allocates a value to a criterium; it may be a numerical value or a qualitative value (big, small...). The matter is making decisions for one particular case. Critical value assesses relevance of the criterium; the matter is assessing a criterium in a particular case, but this allows assessing also general value of the criterium and needs a reflexive activity.

Conclusion: Inclusion as a Tool for Decision Making

Decision making using rules is a way used as soon as possible. Cases are classified in a established space of criteria; the mechanism of allocating value allows inclusion of the case in rule category. Qualitative, quantitative, or critical values have different meanings. Qualitative assessment draws the case. This allows one to know that each case is similar to one category, and then a better knowledge about what is each category. Quantitative assessment places criterium on the scale of numerical values; this allows to know quantitative boundaries of the categories. Critical assessment judges relevance of criteria and their space of using. Assessing relevance of a criterion is seeing it as a concept. Critical judgement has a functional outcome: validating or invalidating a criterium used for decision ma king; but critical judgement has a metafunctional outcome: clarifying space of validity of all the criteria, according the category of criteria. Relevance of characterization criterium is a matter of the conditions of certainty; relevance of action criteria refines conditions of use of therapeutic; and relevance of rule criteria precises conditions of applying the rule.

Building Knowledge During Collective Medical Decision Making

This part describes the twofold effects of the collective decision making on knowledge: collective processing requires explicitation of knowledge; col-

lective decision requires the adaptation of knowledge.

Decision Making Mobilizes Knowledge for Mutual Learning

Mutual learning concerns knowledge exchanged during discussion and also the use of rules.

Mechanism of mutual learning

Exchanging knowledge during collective decision making does not insure that the others learn something. But the theoretical framework of communication allows one to think that speaking may improve knowledge of each speaker. On one hand, speaking may be seen as acting, by changing cognitive environment (Sperber & Wilson, 1983). On another hand, a dialog is set in a context made of knowledge more or less shared (Karsenty & Falzon, 1992): only pieces of knowledge supposed unknown are stated.

Learning the use of rules

Examining the rules for using it allows a better awareness, even if this better awareness is difficult to formalize. When a protocolar decision is made for a borderline case, the rule needs to be checked and collectively examined. This is a first mode of learning.

The question is to know whether the assessment mechanism provides an occasion for learning: the inclusion task increases the knowledge about the tools used for decision making. The three categories of values are related to three different mechanisms for the learning of categories: recognizing that an object belongs to a category by allotting a qualitative value to a criterion; knowing the quantitative boundaries of a category by allotting quantitative value; and viewing a category as a concept by allotting a critical value.

Decisions Change Knowledge

When the CDT decides that the rules cannot be applied as they are, rules have to be adapted. Rules are adapted through two mechanisms of specialization: refinement and addition.

Refinement of the rule

Refinement of the rule allows the rule to be used even when it is not strictly applicable. The rule can be seen as a schema with variables and links. It can be tuned by establishing new connections between variables and by modifying constraints on values of variables: associations of criteria define new links between two criteria; and constraints on values are strengthened or relaxed by quantitative or critical evaluation.

Additions

Adaptation consists in creating an ad hoc rule when the prescribed rule cannot be use d, by adding new criteria. The schema of the rule is changed and a new schema is created. As indicated by Rumelhart and Norman (1978), schema to may evolve in three ways: by accretion (the schema is checked and then used); by tuning (the schema is used with refinement); and by restructuring (a new schema is created).

Tools for Organizational Learning

Organizational learning needs organizational conditions and tools for developing and keeping track of organizational memory.

Organization Requirements for Collective Reflexive Activity

Knowledge management policies are grounded on actual practice: knowledge comes from people daily using it. Managing the knowledge of an organization by helping reflexive activity is the best way for helping rationalities to evolve, using the lessons of practice. This requires a real cooperation between involved partners. Debates must then have two features. First, everyone has to contribute; in an evaluation dialogue as those described previously, several partners intervene in the same evaluation sequence. Second, and more important, it must be a real debate, that is to say that it should allow the partners to assess the relevance of the criteria. In that sense, the presence of critical evaluation can be seen as a trace of a reflexive activity.

Tools for Keeping Track of the OM

The choice of a formalism for keeping track of decisions is itself a design issue. This is why a field of research emerged, seeking to detect the reasoning which supports" design rationale" decisions (McLean, Young, Belloti, & Moran, 1991) and to keep track of these decisions as well as of the debates surrounding the latter. The tools that are initially developed at the design process phase have a broader general interest and could enable keeping track of all discussed decisions, whatever the field is.

Choosing the right form or using it appropriately are not obvious tasks. The content of a design process memory could be defined in terms of spaces (Lee & Laï, 1991). Thus, one can distinguish between the pros and cons space, alternatives space, evaluation space (to evaluate the alternatives but also to qualify an object as a possible alternative), criteria space and the queries spaces. Some believe that it is

important to identify how knowledge and decisions originate. The sources of new knowledge are error analysis, process improvement, expert initiative, and user response (Terveen, Selfridge, & Long, 1995).

Another solution is to create a conceptualization space through a descriptive process, in network form, such as the QOC formalism (questions, options, criteria), designed by McLean et al. (1991); this formalism stresses the fact that a decision results from a combination of more or less explicitly formulated questions, the generating of different possible options and evaluations, thanks to explicit or implicit criteria. Preserving these elements under one form or another enables the preservation of knowledge, useful for the decision concerned. This means drafting new process design documents, to ensure repeatability and provide traceability of design requirements as well as background documentation for the design approach. Within organizations, the drafting of such documents is a recent function (Karsenty, Attipoe, Durstewitz, & Lafrique, 1995), involving specific activities.

Preserving the traces of design choices, and more generally, of decision making, cannot be interpreted as simply preparing records. A study on the use of the QOC formalism has shown that this is, in effect, a design task (Sauvagnac, Falzon, & Leblond, 2000), because of the work involved in researching and identifying three categories of elements. As a matter of fact, the questions are not always expressed, the possible options are not systematically listed, and criteria may be implicit.

Writing such a report can be perceived as a conceptualization task, inasmuch as it requires making choices in order to obtain a result, of which the status is not specified ahead of time. But it is also an activity that presupposes understanding the structure of the action of "decision making," i.e., requiring that the person in charge of the report also undertakes a reflexive activity. In doing this, the report writer is simultaneously carrying out a functional activity, Le., drafting a report as well as a metafunctional one, Le., building knowledge useful for eventual future decision making.

Conclusion

To summarize our perspective, the knowledge of an organization is made of each actor's knowledge, and organizational memory is the result of a collective reflexive activity. This reflexive activity supports both short-term and long-term learning: local adaptations of the rules can also be the basis for changing the rules.

The collective reflexive activity may be led during the functional activity itself. The field study suggests that collective decision making encourages knowledge building: allotting critical values to criteria is the basis of a reflexive activity. Then knowledge may evolve by refining or adapting rule. However, it is too often the case that knowledge building, although often praised as a necessity for the organizations, is not given appropriate recognition and support by the organizations. Knowledge building does occur, but it is often more or less by chance, thanks to the spontaneous behavior of members of organizations. As a matter of fact, this is not enough: knowledge-building activities need specific organizational and technical conditions. The future lies in the development of knowledge management tools that will support debative and reflexive activities.

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