Definitional and Contextual Issues in Organizational and Group Memories

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Organizations are looking to augment their memories through information technologies. Organizational and group memories can include a wide variety of materials, including documents, rationales for decisions, formal descriptions of procedures, and so on. This paper discusses findings from case studies of six organizations using or attempting to use the Answer Garden, a type of organizational memory system. Two major issues in the implementation of such systems are examined: (1) the gap between the idealized definition of organizational memory and the constrained realities of organizational life, and (2) the effects of reducing contextual information in computer-based memory.

1. Introduction

Organizational memory is an evocative metaphor, suggesting the promise of infinitely retrievable knowledge and experience. Organizational memory systems (OMS) offer the possibility that computer systems can better serve the information storage and retrieval needs of an organization's memory than can present technical and social methods. But in order to augment organizational memory with computer systems, we need to better understand the critical organizational issues facing such augmentation efforts.

Many of these critical issues will be standard information technology issues: the nature of performance improvement with new types of systems, the political nature of information systems, and so on. Some of these issues, however, have a unique "spin" resulting from the organizational and technical questions inherent in organizational memory systems.

This paper examines two major issues that have an additional emphasis in organizational memory systems.

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The discussion is based on case studies of organizations using a specific OMS, Answer Garden. Following a brief discussion of the Answer Garden and the study sites, I examine the first organizational issue, the tension between an idealized conception of organizational memory in most study sites and the constraints that exist within organizations. Since organizational memory is defined within an organizational setting, the organizational constraints are pervasive and critical. Frame of reference, organizational context, and technical feasibility are identified as the major constraints. The second organizational issue is that of managing the correct level of context, providing the correct level of implicit knowledge and social assumptions about the author and reader. This is a critical problem in retrieval and use of the stored material.

2. Answer Garden case studies

Over the course of ten months, I examined the use or attempted use of a specific organizational memory system, the Answer Garden, in a variety of organizations. Answer Garden ([3], [2]) supports organizational memory in two ways: by making recorded knowledge retrievable and by making individuals with knowledge accessible.

In the standard configuration, users seek answers to commonly asked questions through a set of diagnostic questions or other information retrieval mechanisms. If the answer is not found or is incomplete, the user may ask the question through the system. Answer Garden then routes the question to the appropriate human expert. The expert then answers the person via electronic mail, and if the question is a common one, can insert the question and its answer back into the database. Thus, users are not limited to the information in the system; if the information is not present, they can tap the social network in a natural

way. As a result, the construction of the information is iterative, and the corpus of information grows over time.

I examined six organizations that used or attempted to use the Answer Garden for periods ranging from one to six months (see Table 1). Only one of these organizations had a successful implementation of the Answer Garden and used it extensively within the organization. The other five sites built or partially built Answer Garden information databases. (Another group of usage sites, including some successful sites, allowed little data collection.) Another two sites evaluated Answer Garden and offered corroborative data. Perhaps because of Answer Garden's technical requirements (an X Window System and Unix platform), all of the sites were either in the computer industry or could be considered early adopters of computer technologies.

Because of Answer Garden's fit, many of these field sites were evaluating, constructing, or using Answer Garden in the context of help desks, customer support, technical support, or systems administration. These applications are particularly interesting because they use information intensively, and new problem domains arise naturally. While the diagnosis tends to be skilled, the solutions tend to be repetitive. Answer Garden was particularly interesting for these groups, and one should note that organizations are more willing to consider new technologies when they have a clearly present need and little existing infrastructure. On the other hand, two of the Answer Gardens did provide access to archival documents.

The primary purpose of these case studies was to explore the use of Answer Garden in natural settings [32]. Minimal assistance was provided in order to observe what would happen naturally. Participants were primarily technical staff and managers, and much of the data collection concerned technical considerations specific to Answer Garden: the difficulties in using the software tools, the branching characteristics of the diagnostic questions, the revisions required in the classification network for the information database, and so forth. Nonetheless, participants in all sites were encouraged to view their participation as an occasion to reflect on their organizational needs and possibilities for memory systems. In most respects, I considered situations where the organization found a mismatch between the possibilities of Answer Garden and their organizational realities to be the most interesting since these situations highlighted the actual practices of organizational memory.

Table 1: Research sites

site	group	sizeof firm	use for Answer Garden	progress
computer hardware and software manufacturer	system administration	> 10,000 with multiple multi-state locations	systems administration questions and answers	database construction
computer consultants and software company	product support	< 150 with one location	product questions and answers for two products and consulting	database construction
computer hardware and software manufacturer	internal support (help-desk) for systems software	about 2,500 with two major locations for software staff	technical questions and answers	database construction
national laboratory	systems administration	about 500 in one location (four buildings)	systems administration questions and answers	database construction
	scientific group	included representatives of aero-space companies as well	documentation for complex scientific mission	prototype
university	consulting desk	about 15,000 students	computer questions and answers, mostly software systems	operational
computer hardware and software manufacturer	advanced development group	> 10,000 with multiple multi-state locations	group information	database construction
Wall Street company	internal support (help-desk)	> 10,000 with multiple locations	technical questions and answers	evaluation only
national laboratory	internal support (help-desk)	> 5,000	PC and systems software questions and answers	evaluation only

A number of interesting patterns emerged from the data. While the number of sites is small, the data suggest that many participants fell into a mismatch between the idealization of organizational memory and its embodiment in technical systems. Furthermore, context is a constant problem in memory systems. I will cover each of these in turn.

3. Memory in the ideal and in practice

Certainly organizations can be said to have some form of memory[1]. Indeed, an organization must retain knowledge of its past efforts and environmental conditions. For example, if an organization learns, then the result of that learning should be available later ([14], [22]). Walsh and Ungson [28], in their review article on organizational memory, make the following argument: "To the extent that organizations exhibit characteristics of information processing, they should incorporate some sort of memory, although not necessarily resembling human memory" (p. 57).

The exact definition of organizational memory is rather hazy in the literature. Two basic categories of definitions can be seen in the data. I call these the "ideal" and the "constrained."

3.1. Organizational memory as idealized

Organizational participants in this study clearly wished for an idealized organizational memory. In their minds, all information that came through their organization would be ground into organizational knowledge and stored. Little consideration was given to the organizational or technical realities of such an organizational memory.

One participant in a small high-tech company reflected wistfully:

> There's a lot of knowledge in this company
> that goes to waste.

His example was building a new version of one of their products:

> Someone else built R5, and ran into
> problems and stuff. I know about
> FixTrackers, why don't they? ...Having

someone on the staff that knows ... is valuable, but you have to transmit it.

Other participants echoed this. Two help desk managers in large companies said:

> Answers we have; knowledge comes and
> goes because the people leave. ...What we
> want to do is log it [the question and
> answer], track it, and get the knowledge.

> We use a mainframe database, heavily
> tailored, to track calls and their resolution.
> ...It's not the same as organizational
> knowledge - call tracking doesn't build up
> the organizational expertise. ...You know
> that someone else has answered the question
> before, you haven't, and you'd like to find
> out what they've said.

This idealization tends toward the anthropomorphization of organizational memory. This anthropomorphization notes the similarities with and differences from human memory. Writers, including Walsh and Ungson, have noted the problems in any memory such as corruption and decay over time. The anthropomorphic metaphor has an important role, I believe, in providing an analogy for understanding a living system such as an organization. Participants would often refer to human memory when explaining themselves:

> Well, yeah, that's the neat thing about our
> memory. It's always available. You can get
> to it at any point and pull out what you need.
> At least you'd like to.

This anthropomorphization becomes idealized at the extreme. Human memory, in the ideal, is immediately retrievable with a known context; similarly, we would like organizational memory to function the same way. From the analogy, we would like organizations to learn from experience while avoiding the blindness that may result from following that past experience slavishly. Using human memory as an analogy results in an easily understood metaphor, one offering promise. When it becomes idealized, however, systems based on this metaphor may be oblivious to serious organizational and technical issues.

3.2. Organizational memory as constrained

However, real organizations do not function in the ideal, and neither do computer systems. A more realistic

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[1]I will not distinguish between group, organizational, and community memories in this paper unless the level of analysis is critical to the argument. I will use the term "organizational memory" to denote all types of memories unless the distinction is important.

view, one based in an organizational setting, is required for organizational memories.

The second definition of organizational memory grows from the constraints of organizationally- and technically-based storage and retrieval. This definition considers organizational memory as organizational knowledge with persistence.[2] In the Walsh and Ungson model, organizational memory can be retained in six places: individuals, organizational culture, organizational transformations, organizational structures, organizational ecology, and external archives. (External archives are data external to the organization, not its own archives.) This list, however, should be expanded to include information repositories such as corporate manuals, databases, filing systems, and even stories (see [24], [27], [29], [30], [31]).

There were three types of constraints, organizational, technical, and definitional. The organizational constraints fall out of the rational models of organizations; the technical constraints follow from a consideration of current technical capabilities. The definitional constraints largely result from participants' connotations on the term "organizational memory system."

3.3. Organizational memory as organizationally constrained

What does it mean for knowledge to persist, especially knowledge within an organizational setting? If organizational knowledge is *now*, organizational memory is just before *now*. What then is the memory? Historiography has considered this question in detail (e.g., [8], [9], [11], [12]) Organizational memory, like any remnant of a past, faces three standard historiographical issues: temporal distance, point of reference, and context. However, the placement of these historiographical issues within an organizational setting differentiates organizational memory from professional history.

Organizational memory may be arrayed along a dimension of time, with one endpoint being archival and the other endpoint being the knowledge of just shortly before *now*. That is, an organizational memory system may store organizational knowledge for any time period.

However, organizational memory is situated in an entity that is concerned with achieving its goals in a manner that minimizes the drain on its limited resources. This is a critical shift from the needs of professional history since professional history does not exist to aid such goal-driven behavior. The goal-driven nature suggests that an organizational memory that is immediately tied to the on-going processes and considerations of an organization will be more important and useful to an organization than one that is archival. An organization's interest is much more in the immediate than that of a professional history. Furthermore, it argues that systems that facilitate that type of immediacy of effect in augmenting organizational memory will be more useful. As one participant reported about his systems administration information database: "We don't really need to go more than four months back to find out what is interesting."

Frame of reference is the second historiographical issue. To a historian, history is selective; the human observer selects and filters the data according to his needs and current understandings. Organizational memory, like any historical record, is fragmentary, but provides access to an understanding of the historical causes behind common assumptions, beliefs, and processes. To garner access to this understanding, professional historians view their histories from the inhabitants' points of view, attempting to be truthful to the inhabitants in the selectivity of materials. As an organizational participant, however, memory is more fruitfully viewed from the current needs and assumptions of the organization. If only a small amount of time has elapsed between the event and the present, there is little difference between the two. But, if a sufficient time has elapsed, it will be difficult to reconstruct the meaning of the event in the terms of the event's participants, and organizational members will be more likely to view it from their own vantage point and interests. Organizational memory, then, belongs to the current organizational members, and the effort to interpret it must be paid by the current organizational members.[3]

The third historiographical issue is one of context, and is closely related to frame of reference. The implicit understanding of the stored knowledge is based on a

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[2]I use "persistence" in the computer science denotation where it refers to maintenance of data, often objects, between sessions or uses. In this context, "persistence" implies that the knowledge does not go away, but remains somewhere, waiting to be used again. This meaning is not the same as in information science, which uses a meaning similar to that in the dictionary. This latter meaning is synonymous with perserverance, that is, existing despite active opposition. No agency or active effort is necessarily implied in the computer science meaning of "persistence".

[3]As Graham[17] among many others point out, there is a reconstruction and reinterpretation of the past for the elucidation of the present by both historians and organizational members. As a digression, this suggests that organizational members serve as "lay" historians to borrow Callon's [10] term. The difference would be in the additional training a historian has in a specific form of observation, just as the difference between Callon's engineer and a sociologist lies in additional training and sensitivity to sociological phenomena.

similarity between the current context and the context of the organizational inhabitants at the time of storage. This understanding varies from immediately shared to reconstructed or foreign. However, the organizational memory exists within an entity with limited resources. As such, an organization is likely to be little interested in achieving total recall of its experiences; a "good enough" recollection will be sufficient. Therefore, recall that satisfies an immediate problem is all that will probably be required. The effort that is required to construct an archival context will be larger, and therefore less likely, than the effort to retrieve an immediately understood context for the organizational knowledge.

It is not that organizational knowledge and experiences from the archival past, from different organizational contexts, or with different meanings cannot be retrieved and interpreted. Obviously, they can and in some situations, will be. Nonetheless, the cost of doing so is substantially higher than for recent events and outcomes within the current organizational context and for organizational purposes.

In summary, one might expect that organizational memory mechanisms most often are employed for these recent events and outcomes within the current organizational context and for organizational purposes. Furthermore, an OMS that furthers this immediate memory may be more valuable, useful, and readily adopted.

OMS, then, are subject to the issue of incentives. Grudin [18] has pointed out the complexities of upstream versus downstream costs in adopting and using group and organizational systems. To the extent that OMS require upstream costs, such as those in indexing, and to the extent that the downstream payoffs are unclear, they will likely fail. The use of organizational memory adds to the cost. Not only is there a cost of storage and indexing, there may be additional costs in retrieval and interpretation of the information.

In the organizationally constrained view, these costs are considered in the design of the system. To the extent that they serve organizational goals with relatively minor costs, organizational memory applications may prove to be valuable, useful, and readily adopted.

3.4. Organizational memory as technically constrained

The second set of constraints is technical, although they also invoke organizational issues. The limitations of current computer technologies are well known, and so I provide only a few examples.

One example is that an organizational memory system (OMS) is dependent on particular types of data. Since system boundaries follow what could be perceived as artificial boundaries in data collection and storage, the goal of a unified organizational memory may prove to be impossible. These boundaries in data collection and storage reflect the technical realities in system development, and they require the fragmentation of the idealized organizational memory into separate, perhaps overlapping databases of information with all of the concomitant problems.

Similar issues surround indexing and retrieval, as well as scaling. One of the most difficult problems for any OMS will be classifying and indexing the information. While indexing is expensive, there are numerous problems in full-text retrieval. (See [7] for an excellent treatment of this dilemma.) This is true even for groups [6], although the problem is particularly acute for organizations. It may be virtually impossible to construct one data or knowledge ontology for a large organization given the various language worlds that exist.

As much as there is a gap between the idealized view of organizational memory and the organizationally constrained possibilities, there is an even larger gap between the idealized view and the realities of information systems.

3.5. Organizational memory as definitionally constrained

Many types of OMS exist, partially as a result of past development efforts and partially reflecting the technical constraints of system development. While one might perceive organizational memory as a monolithic whole (forgetting problems of abstracting individual and group memories to an organizational level of analysis), OMS clearly are not.

There are many contenders for what constitutes an organizational memory system. In fact, one could argue that many information technologies, including paper-based ones, currently augment organizational memory. Many information systems include the storage and retrieval of important organizational knowledge in their support of organizational processes. Clearly, the corporate database is an important repository for organizational memory. The appendix to this paper lists some of the OMS currently used or prototyped. It is important to note that some OMS have existed for many years, while others are newer enhancements to organizational memory.

Yet, many of these existing systems have been ignored in the literature of organizational memory. Furthermore, these existing systems were ignored by participants in the Answer Garden sites. For example, when discussing their efforts, participants did not define the relational

databases of a company as organizational memory systems. When relational databases were discussed, it was to juxtapose them against organizational memory systems.

Much of this definitional constriction may result from the technical staff's need to be innovative and to participate in innovative projects. Said one technical participant:

> Why am I doing this? It's the next hot thing. And I want to be in on it. Information's hot.

Technical staff, as part of their career development, need to constantly find new skills and new career pegs. It may be difficult to vocationally justify examining standard, pre-existing technologies, even under a new rubric (and especially under an old one). Technical staff's interest would, therefore, be naturally attracted to new systems and technologies. (One might note that academics are not completely immune to this tendency.) The result, however, is a narrowing of what might be considered as technologies to augment organizational memory.

There are, of course, many innovative and interesting organizational memory systems. Many employ new technologies. Nonetheless, examination of only the innovative restricts one's view until present technologies, many of which already work well, disappear from sight.

3.6. The tension between idealized and constrained views

I have starkly set the opposition between the idealized and the constrained views, perhaps too starkly. Nonetheless, the gap between what one would like to do and what can be done was always lurking in these organizations' development efforts. Said one participant:

> This is a terrific idea conceptually. The problem is how to get the ball rolling. Things look great in theory, then when you get to the specifics, it looks like more effort than it's worth or more effort than you expected. You really don't have the time.

Several tensions exist between the idealized view and constrained reality. Some of the tensions are reminiscent of Zuboff's [33] observation that the managers at her Piney Wood site idealized the workers' roles after automation. As she wrote, managers tended to glow positively about the workers' new capabilities to problem-solve. However, the manager's statements "...are rarely accompanied by any sign that consideration has been given to just what kind of 'problem solving' operators will

do..." (p. 247). The introduction of a new system may be accompanied by an idealization of that system. If that is so, important organizational considerations will be ignored, as Zuboff pointed out.

One of the Answer Garden sites demonstrated this tension well. In the idealized form, the systems administration staff would be freed from their mundane questions to solve more challenging problems with fewer crises. This sentiment was echoed by both managers and technical staff. Nonetheless, staff members were concerned over their individual and collective futures. In the following, a support staff member articulates concern about his peers on a help-desk. This conversation was memorable because of the person's tone, which was half-statement and half-plea for confirmation:

> Oh yeah, I'll always have work. I'll just work on harder problems, more interesting [problems]. But what about the first-line [people]? They just change toner and answer easy questions.

One might argue that this avoidance of the workers' future roles and jobs followed from attempts to minimize political conflicts in the organization. However, the tension between ideal and constrained went beyond the future role of the workers. Memory components were critical for allowing staff reductions without service losses. Memory components were also important for learning-organization and expertise-sharing efforts, as two participants noted:

> We have a lot of expertise. Now we'll be able to get it down.

> It's interesting if you can just throw the information in there and get it out in many useful ways.

As mentioned, organizational members promoting these new organizational goals tended to ignore the technical and organizational constraints. It may be that initial development efforts are more easily begun with idealized images of system possibilities.

4. Context management

Another major organizational issue is one of context. Context turned out to be a significant issue in the authoring of new Answer Garden databases and information. It was often necessary to drop contextual information in the authoring process in order to generalize the information. However, the generalized use of the information and the reduced social context brought issues

surrounding the social "face" of the information to the foreground.

4.1. Removing context in authoring organizational memory

All of the case study sites authored or planned to author their own databases. The initial authoring effort involved including electronic mail archives, usually of questions and answers. All of the database authors found that a major effort involved in assembling an Answer Garden repository was re-authoring the available information. Although the premise of Answer Garden is that one can include informally constructed and incomplete questions and answers, authors of the database often remarked that they needed to rewrite the questions and answers.

This was true for a number of reasons. The most commonly cited reason was to make the questions and answers more generalized. The lack of generalizability resulted from several causes. In their questions, users might include many details, only some of which were relevant, because they did not understand the problem at hand. This was particularly true for novices in a subject domain. The answerer, on the other hand, might have used implicit knowledge in his response. For example, the answerer might have known that the asker had only a Sun workstation in his office or that asker knew how to run "chkdsk" on his hard disk.

Additionally, the database author might know that the answer could be made more general in order to answer more questions. This might involve abstracting both the question and the answer. Occasionally, the database author would feel it necessary to correct incorrect, incomplete, or incoherent answers.

The removal of contextual information, including the writer's implicit knowledge of the reader, is required to make the information understandable across organizational boundaries. As King and Star [20] noted, group members share memory, tacit knowledge, and social cohesion. Members of different groups, even within the same organization, often inhabit different social and language worlds.

The requirement to lose some or most of the contextual information is clearly different between group and organizational memory, although this difference is influenced by the time between storage and retrieval. Groups generally need not strip out contextual information from their memory repositories since group members will usually share the same social and language world. They will understand one another's implicit knowledge and assumptions. Organizational members, however, will not, and organizational memories will most likely need to be more formal. However, if the group is required to store the information for a long period because the process takes a long time (as with medical conditions) or because of legal requirements (as with doctors), the memory will be much more formalized. Conversely, organizational memories for restricted use may be much more informal. Examples include memories for small companies, for companies with a strong culture, or for short inter-group projects.

4.2. The lack of social context for information authors

The requirement to lose contextual information across organizational boundaries had an important secondary effect in the authoring process. The loss of social context clearly influenced the authoring style and process in several cases.

Participants in the sites were much more willing to provide informal information if that information was not to be shared beyond the work group. The shorter the distance the information might travel or the less likely it was that the information could be viewed by strangers, the more informal the information content was likely to be. The repeated reason was that the content served as a "face" for the writer within the site [15]. If others, who did not know and already like the writer, could see the face, the writer would be judged solely on the basis of that content; thus, driving up the formality of the content.

This was also true for a group as a whole. Groups also have a face. One system administrator said:

> No, it's not ready yet. ...The chemists [the high-status group and decision-makers in the organization] will see this, and it'll be our group. We have to be careful - we want to look good.

Face was very important when the content was likely to be viewed by decision-makers or management. Much of this resulted from the material being stored. Participants in several sites recalled times when management had perused stored electronic memory; the admonishment for each story was that writers must be careful in what they say. As one interviewee joked, "What you say may come back to haunt you."

In addition, there may have been a push towards formalization of the material when the information was seen to be the "official" response of the organization. Policy decisions, and information that could be construed as policy, were noticeably crafted in the sites that had documents and systems administration policy in their Answer Gardens.

Participants in the sites were very aware of the political nature of the system in use, and they did not view the information separate from its political possibilities. (This is in stark contrast with any idealization of the memory aspects of the system.) One of the reasons mentioned for building an OMS at three of the six sites was to explicitly make the designing group "look good" or "more visible."

Again, the requirement for preserving the social face results from inter-group use of the information. Within a group, there is enough social context for authors to be able to remain informal and open. Organizational memories with their lack of social context may be more formal than will group memories with their social context. However, group memories that are viewed by management or are considered to be "official" may be similarly formalized. It may be possible, nonetheless, that organizational norms will develop around information sharing and anonymity.

4.3. Managing reduced context for information users

One of the significant challenges in constructing organizational memories, then, will be managing the correct level of context. Too much contextual information results in a sea of extraneous detail and hinders generalization of the information. Too little context results in the users' being unable to understand the information and the authors' formalization of their material.

An example of this challenge was in ensuring accurate information in Answer Garden. In Answer Garden especially, there is a considerable tension between the informality of the information (and hence the iterativeness of the construction) and the need for authoritative answers. Users typically know the authoritativeness of an answer through contextual information. The most common method is by knowing the author of that answer [4]. However, information authors may not wish to be known to asker or the organization as a whole, fearing that they might be overwhelmed by questions. The reader can also use other contextual clues, such as the author's organizational position or the author's use of expert vocabulary, to determine the authoritativeness of the information. However, these clues are substantially weaker for many types of information.

Furthermore, authoritative information often becomes inaccurate or obsolete over time. Users know that organizations assign responsible staff members to maintain paper-based memory systems such as corporate manuals. Context is provided for the memory system as a whole through the use of revision dates, incoming manual revisions, and even new binders. Users need similar mechanisms for computer-based OMS.

Answer Garden attempted to replace some context through two technical mechanisms. The issue of decaying accuracy over time led to providing an expiration date to all information in Answer Garden. On this expiration date, the system sends reminders to the information's owners that the information needs to be examined. Second, Answer Garden allows the information provider to be known by name, by organizational position, by organization, or anonymously. The intention was to provide a flexible range of identification to allow the owner to provide some context for the reader while removing issues surrounding workload and social face.

Nonetheless, while these mechanisms reassured all of the sites, additional methods will be required to ameliorate the effects of reduced context in an OMS. One method might be to let users know that the information in the OMS is more authoritative than they could gain elsewhere. Another is to provide training in the goals and the use of the OMS, as well as the type of materials available through it [26]. Still another is to inform them that the effort is on-going and that the information has owners and maintainers. All of these things provide standard clues for accurate, authoritative, and usable memory.

Managing the context may be crucial to allowing users to evaluate and interpret the information. This is likely to be an area of additional research.

5. Summary

This paper has examined two major issues in organizational memory systems:

1. The gap between what is wanted and what is possible with memory systems. The difference between the idealized view and the constrained realities of organizational memory is large. This difference hampers an understanding of organizational memory both conceptually and within development efforts.

2. The need to manage context for the readers and authors in those systems. Some loss of context is inevitable in OMS, but this loss has repercussions for both authors and readers. Managing the reduced context will be crucial for OMS efforts.

There are many more issues, and these two issues also exist in other types of information systems. Nonetheless, these two issues are particularly interesting because they

are more conspicuous and crucial in OMS by the nature of organizational memory and organizational settings.

This discussion has suggested some avenues for managing these issues as well as for further technical and organizational research.

6. Appendix: organizational memory systems - a compendium

As mentioned, there are many information systems that augment organizational memory. Some of those systems may be considered OMS. Systems to augment memory include:

1. Electronic filing cabinets or document archive systems. At the most basic, substitutes for the paper-based filing cabinets form one repository for organizational memory.

2. Many OMS include the ability to share or publish information. These systems include extensions of paper-based technologies; an example is the Virtual Notebook System [16].

3. The portions of current production systems that allow users to store and retrieve data for later use. This could even include the relational databases of a company.

4. Organizational or group memory components within new systems to augment organizational processes. As the role of memory becomes more critical and obvious, we might expect to see memory components within new types of information systems. An example includes group memory support for group meeting systems [25].

5. New types of organizational or group memories. These can be clustered into several groups:

    a. One group of these memories moves present-day, document-based memory that is cumbersome or informal into computer systems. Capturing design rationale on paper tends to be cumbersome; systems to augment this memory include [13] and [21]. Efforts to capture informal communications include bulletin board archives and Answer Garden [3].

    b. Another group attempts to augment organizational memory by facilitating access to organizational members (expertise-sharing applications). Examples include Answer Garden [3] and various Lotus Notes applications.

    c. An additional group of systems attempts to construct knowledge structures atop the organizational information [5], [19].

6. Organizational memory platforms. Some systems, such as Lotus Notes [23] and the Answer Garden Substrate [1], allow the construction of many or all of the varieties of OMS described above.

7. Acknowledgments

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