Supporting and Frustrating Organizational Learning: Exploring the Role of Information Systems in Processes of Organizational Learning

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Abstract
In this paper we aim to gain insight in the effects information systems have on organizational learning. A theoretical framework is proposed that may serve to explore the role of information systems in processes of organizational learning. Based on the sociology of knowledge [5], learning is conceived as the process of constructing and reconstructing organizational knowledge, which can be further broken down into four knowledge intensive processes: externalization, objectivation, internalization, and knowledge-acquisition. Each type of information intensive process may be supported or frustrated by certain types of information systems. This explorative excursion shows that information systems can both support and hinder organizational learning.

1. Introduction

While the interest in OL started half a century ago, it is mainly during the past few years that the concept receives widespread attention. A bibliographic [15] shows for example that as many academic papers on OL were published in 1993 as in the whole decade of the 1980's. This rise in popularity has also taken place within the IS discipline. Recently, a growing number of articles have been published dealing with the relationship between IS’s and OL (see for example the special issue of Accountancy, Management, and Information Technology on IS and OL).

Although multiple perspectives exist at the same time, most contributors to the field agree that OL is an information intensive phenomena. Without information exchanges, there can be no learning at the level of the organization. And if one agrees that information exchange is essential to learning, it would be interesting to understand how systems of information support these processes. This is all the more interesting when we take the view, as we do in this paper, that OL is essentially the process of organizational evolution. From this point of view, exploring the role of IS and OL means understanding whether IS’s support or frustrate desired outcomes of the process.

Despite the growth within the IS discipline in studying OL, most seem to struggle with the meaning of the concept. In general it seems to be difficult to construct a theoretical framework of OL in which the link with IS can be analyzed or interpreted. With Pentland [55], we believe this difficulty in integration can be attributed to a lack of attention to the fundamentals of the concept of organizational learning. As long as the phenomena is not theoretically underpinned and as long as there exists ambiguity concerning its nature and the way it unfolds, linking the phenomena with IS’s remains at least questionable.

The purpose of this paper is to conceptually unravel the process of organizational learning (OL) in order secondly to explore how information systems (IS’s) may or may not contribute to support these processes. This will be done by introducing a theoretical framework of OL which serves to analyze what basic information needs are present during OL and if and how IS’s support these information needs.

In this paper, we treat OL as the process of organizational knowledge (re)construction. Emphasizing the construction of collective knowledge is in line with other recent contributions to the field [12][49][55] and is inspired by the social constructivist approach to knowledge [5][25][62]. Central is the way through which individual or local knowledge is ‘incorporated’ into collective knowledge or organizational knowledge. We refer to organizational knowledge as practices, procedures, stories, technologies, collective opinions, paradigms, frames of references etc., through which organizations are constructed and through which they operate. What is important is that organizational knowledge is independent from the indi-
individual actor. This is similar to the position of Attewell [4] who argues that "the organization learns only insofar as individual skills and insights become embodied in organizational routines, practices, and beliefs that outlast the presence of the originated individual".

In the discussion that follows, we first introduce the reader to a theoretical perspective on OL. In section three we will explore in a descriptive manner how IS’s can support or hinder the various processes that make up OL. In the concluding remarks we will try to tie up the various issues raised.

2. A Theoretical Perspective on Organizational Learning Processes

Most of the literature on OL perceives improvement, intelligence, wisdom, etc. as the main result of learning [2][3][23][24][32][53][63]. Learning then is not so much defined in terms of a process producing results but more in terms of its outcomes. Because OL is often approached as an achievement verb [60], it conceals rather than reveals these and other dynamics of the process of learning [75]. When OL is treated from a process perspective, more attention is given to the dynamics of learning leaving the issue if learning results in positively valued outcomes for further investigation. In that case, OL is not seen as:

"following a path of greater and greater elaboration, beauty, civility or fit with the environment. The essential element is not that development leads to higher and higher states but that it inexorably leads somewhere." [38]

A process perspective also assumes that we are able to identify in general terms the basic underlying principles of the process while its outcome depends on how this process is organized. In other words, whereas the process of OL is assumed to be the same, its organization - the way the process is organized - can differ per organization resulting in different outcomes. Consequently, both failure and success as outcomes of learning should be analyzed in the same terms [9]. There are various reasons why learning does not always result in improvement. Organizational behavior is often far from being efficient and effective. Besides that the outcome of learning heavily depends on the content of learning which may turn out to be inappropriate, unexpected events, myopic forces, and the confusion of history may complicate learning processes [36][43].

In this paper, OL is approached as the process of institutionalizing knowledge that has been gained by adapting to internal as well as external environments. Learning then is conceived as consisting of two mutually dependent sub-processes: ‘institutionalization’ and ‘adaptation’. Institutionalization is the process through which individual knowledge influences organizational knowledge and vice versa. Adaptation refers to adapting to environmental knowledge and takes place through reacting to feedback information and to adapting to knowledge of other organizations [37]. Without institutionalizing knowledge, knowledge acquired by individual members, remains individual knowledge. In other words, without institutionalization, the learning within organizations remains individual learning. Likewise, without adaptation, the learning that takes place is not influenced by the environment. In other words, without adaptation the organization acts as a closed system.

As we will discuss in section 2.2, the way these processes take shape within organizations often results in conservatism or in a lack of significant changes in the organizational knowledge. In order to promote the occurrence of change and innovation as outcomes of learning processes, the process can be organized in such a way as to allow for more diversity of knowledge from which organizations learn.

2.1. Institutionalization

Learning occurs through the action of individual actors while these actions at the same time are influenced by institutional - organizational as well as societal - forces. As a result of this dual character between the one hand actions of individuals and on the other hand deterministic influences of existing organizational structures, OL can be approached as a process of institutionalization [5]. This process of institutionalization centers on the (re)construction of knowledge and how this (re)constructed knowledge influences and is influenced by subsequent (re)constructions.

Berger and Luckman [5] refer to three phases or "moments" that can be distinguished in the process of institutionalization: "externalization, objectivation, and internalization". Externalization is the process in which personal knowledge is communicated to others. Through externalization, "society becomes a human product" "Objectivation in turn, is the process in which things are taken for granted; during which "society becomes an objective reality". During the moment of internalization, "the objectified social world is retrojected into consciousness in the course of socialization" of the individual.
"Through internalization man becomes a product of society".

In terms of organizational learning, externalizing occurs when individual knowledge is communicated and shared among individuals. The process through which this externalization results in organizational knowledge - which is often influenced by power structures as well as by history - is the process of objectifying knowledge. Internalizing occurs when individual actors integrate this organizational knowledge into their personal beliefs [30]. Figure 1 portrays in a simplified form this process of institutionalizing in relation to OL.

In paragraph 3.1 we will elaborate further on these three moments of OL in order to analyze how IS's do or do not support learning as a process of institutionalization.

![Figure 1](image1.png)

Figure 1. The process of institutionalization.

2.2 Adaptation to Environments

Until so far, we referred to the process during which individual knowledge becomes integrated in organizational knowledge and in turn to the process during which this knowledge may influence individual learning processes. In other words, until so far, learning is portrayed as a closed circle. In practice this circle is never closed; organizations and their members are always affected by environmental influences.

Adaptation to the environment occurs by reacting to feedback information as well as by imitating other organizations [37]. These sub-processes of learning are in itself processes of individual learning, since individuals select and interpret the information from the environment. Whenever, through institutionalization, this individual knowledge becomes organizational knowledge, we refer to organizational learning. Thus, learning as adapting to the environment should be considered in combination with learning as institutionalizing.

![Figure 2](image2.png)

Figure 2. The process of adapting to environments.

Learning as adaptation to feedback information was especially at the time academic attention towards OL took off, the most popular way of conceiving OL [2][13][16][21][41]. Feedback information can be derived from for example customers responding to product quality and price, students responding to curricula, and citizens responding to social experiments. Hence, this ‘feedback learning’ [30] requires communication with the environment and can occur through feedback instruments such as consumer-research, opportunities for public comment, policy-evaluation, or through less formalized forms of communication.

Besides ‘feedback learning’, organizations acquire information from the environment through the process of ‘learning from others’ [30]. Learning from external experiences can be seen as a process of imitating [37]. Organizational members gain knowledge from other organizations, which, through institutionalization, becomes integrated with the organization. The knowledge of the organization in turn influences which external knowledge will be recognized and which will be ignored [14][48].

The diffusion of external knowledge takes place for example by appointing gatekeepers and boundary spanners [1][35][73] through bench marking, through hiring new personnel [30], through inter-organizational cooperation [58][20][54] or through hiring consultants [37].

2.3 The organization of organizational learning

The adaptive character of learning may assure that learning results in incremental changes within the existing knowledge and consequently in a continuation of existing practices and cognitions rather than in discontinuous change. There are various tendencies that hinder the oc-
occurrence of discontinuous change resulting from learning. For example, because organizational members in general make use of defensive routines, the detection and correction of difference which could change organizational  knowledge, often remains unspoken [2]. Furthermore, selective exposure induced by specialization may result in the persistence of sub-goals and the selection and interpretation of environmental (re)actions in terms of these subgoals [44]. Next, organizational members frequently treat actions within the environment as being reaction to their own actions [41]. Often, this ego-centrism results in 'dynamic conservatism' [61]; the organization learns, but the result of this learning processes is merely a change within the existing “theories-in-use” [2]. Learning may further be complicated by the fact that the acquisition of environmental knowledge is heavily influenced by the existing organizational knowledge. Or, in the words of Cohen and Levinthal [14], “the ability to recognize the value of new external information is largely a function of the organization's level of prior related knowledge”. This absorptive capacity may prevent discontinuous change.

In sum, because of various tendencies, adaptation often results in changes within the organizational theories-in-use, rather than in discontinuous changes. In the literature on OL, this dichotomy has been referred at as ‘single loop learning’ versus ‘double loop learning’ [2] or exploitation versus ‘exploration’ [39]. The first type of learning results in changes within theories-in-use, that is in incremental changes of the existing organizational knowledge. The second type refers to changing the existing theories-in-use, that is to discontinuous change from the existing knowledge.

Different from this literature, we do not want to introduce yet another dichotomy, Instead, we maintain that more or less radical renewal of existing knowledge may occur when the learning processes as discussed in section 2.1 and 2.2, are organized in such a way that it allows for a generation of new knowledge.

For example, according to [12] the generation of new knowledge often takes place during the learning that occurs within organizations. During their day to day activities, organizational members get new ideas, create new ways of working, provide new meanings to the world and discuss existing routines. Allowing for this form of creativity calls in the first place for the recognition of these - often 'hidden' - creative learning practices. Ethnographic research for example showed that repair-men often tell stories to each others in order to fill the gap between formal (canonical) practices outlined in manuals and the informal (non-canonical) practices that occurred in their daily work activities. Through the telling of stories, new knowledge was generated that supplemented the existing knowledge [52].

Innovation and change may also result from learning when feedback information is interpreted in a different way than is usually done. For example, organizational members can exchange different interpretations of the same feedback information, feedback information can be simulated [43], or explorative data-analysis techniques, such as data-warehousing, can be used as to generate 'broader knowledge regarding the environment.

Innovation and change can also result from “learning from others” whenever organizational members are tolerant towards information that seems to be irrelevant at first sight. According to Koestler, this is the most general form of creativity:

“The most important feature of original experimental thinking is the discovery of overlap and agreement where formerly only isolation and difference was recognized” [33]

Inviting guests who’s knowledge differs significantly from the existing organizational knowledge, may often result in innovative insights. As will be discussed in section 3.3, the use of the Internet and the world wide web in specific, can also result in innovation and change due to creative ways of adapting to environmental knowledge.

It should be noted however that combining learning with creativity does not always result in improvement. As a result of positive feedback loops [66], creative ways of learning may create chaotic uncontrollable situations [38]. Furthermore, the results of creative individual learning processes are frequently not combined with processes of institutionalization. Management for example, are often not well informed about alternative ways of organizing that take place within the organization [12]. Moreover, organizations do not always have time, money, patience and tolerance to wait and see if the creative learning processes will be successful in the end. Given the fact the organizations are mostly short-term oriented and that most new ideas are bad ones, creative individuals are frequently confronted with impatience from the side of management [36].

3. Information Systems and Organizational Learning

In this section, we will use the various sub-processes that make up OL in order to explore in what ways IS's may support or frustrate these information intensive proc-
esses. It should be noted that this endeavor is of an explorative nature. Although most of our arguments are based on research done by others, the following discussion should be approached as ideas and expectations that are deduced from analyzing OL from an IS-perspective. Consequently, we hope the discussion will stimulate more empirical research in the field of the supportive role of IS during OL.

Through the use of IS's, the process of learning can be supported. For example, while using management information systems (MIS's), organizations acquire information about the environment which in turn, through the process of institutionalization may become part of the organizational knowledge. At the same time as these IS's support learning, they also organize the process. For example, MIS's are structured ways of perceiving the organizational activities and how they should be measured. Therefore, attention of it's users is drawn to predetermined knowledge fields, ignoring other possible interesting fields. As mentioned above, the way learning processes are organized is decisive to the outcomes of learning.

In this section we will first analyze what effects IS has on OL seen as a process of institutionalization. We will then examine in what way IS’s effect learning as adapting to environmental knowledge. This will be done by analyzing the way IS’s effect the process of acquiring information. We will argue that most IS’s support the process of OL, but that the outcomes of these IS’s supported learning processes may be problematic. In response to these observations, we will then explore how problems of IS’s might be reduced by focusing the attention on IS’s that support discontinuous change and innovation as outcomes of learning.

3.1. IS And The Process Of Institutionalization

3.1.1. Externalization. During the process of externalization, personal knowledge is communicated to others. Externalization takes place in a variety of ways; informally for example through conversations at coffee-corners, and formally for example during meetings. Next to face to face information exchange, externalization can be supported by communication technologies such as the telephone, e-mail, bulletin-boards, and other groupware systems. In particular Intranets facilitate communication between groups who have a shared knowledge interest. They allow for an interconnectedness through which knowledge of individuals and separate communities are able to spread. They also offer possibilities to create new communities of people who previously acted as mere loosely connected group.

The recent interest in groupware systems like Intranets has a rather optimistic flavor. This technological optimism and determinism that seems to characterize the first stages of the introduction of new technologies in general, may be a result of the lack of experiences with the use of these systems. To be sure, a sound review of the effect of IS on OL can only take place if more long term experiences are gained with the use of the systems. Nevertheless, some critical comments can be made based on the present functionality of groupware systems that may support externalization.

Externalization of individual knowledge is facilitated when the knowledge can be made explicit. Knowledge expressible in language however reveals only the top of the iceberg [57]. According to Polanyi, there are two categories of knowledge: explicit knowledge and tacit knowledge which is very personal, unformalized and difficult to communicate. Most if not all computer supported IS’s are unable to support the externalization of tacit knowledge. This problem can be reduced with multimedia IS's that supports images such as videoconferencing. Another reason which may problematizes the use of Intranets to support externalization, is that not everyone is willing to share his or her knowledge with each other. As a result, the knowledge that is externalized may be filtered.

A specific internet application designed to enable the free communication between accountants, which one of the authors is presently studying, seems for example not to change the existing "communication-culture". The profession of accountancy is typically hierarchical and is characterized by restricted information exchange. The introduction of an intranet with the purpose to increase communication among accountants on a national level, does not seem to change this culture of communication. Despite the opportunities the intranet offers, most accountants continue to work solitary, perceiving no need to externalize their own experiences.

3.1.2 Objectivation. When individual knowledge has become externalized it can be objectified [5]. Duncan and Weiss [21] argue that organizational knowledge must be communicable and understood by others; it must also be ‘consensual’ or accepted by others for its validity and utility. These ‘others’ are usually members of dominant coalitions, such as senior management or a critical mass of organizational members [30]. The (re)constructed ob-
jectified knowledge resulted from this process, can be seen as the organizational memory. Although the literature that addresses organizational memory IS (OMIS) is growing (see for a review Stein [68]), it is still in its infancies. In general, existing literature on OMIS tend to neglect more social aspects of the phenomena. For example, OMIS’s are prone to power issues [71]. The notion of dominant coalitions who influence what knowledge should be accepted as organizational knowledge and as such should be ‘stored’ in the OMIS, is one of importance but has not been addressed fully. The same is true for the subjectivity of organizational memories. OMIS provide interpretations of history rather than an ‘objective’ collection of information from the past [37]. In addition, organizational memories are always reconstructed the moment the knowledge is used in practice. This is certainly true for non-IT based OMIS. The memory of organizations is for a large part captured in fuzzy systems such as for example stories. Because of this fuzziness, the content of the memory develops and changes over time; stories are told and retold in organizations [64].

3.1.3. Internalization. Objectified knowledge will in turn be internalized by organizational members whenever the knowledge is taken for granted. Through internalization, individuals become and stay member of the organization. As such, internalization can be seen as the process through which individuals become ‘insiders’. Internalization takes place through the learning of history and imitating colleagues. Learning from history often happens through story-telling, gossiping and idle talk [42]. History can also be captured by explicit IS’s, for example in the form of manuals, or work flow systems, or through the use of MIS and DESS which have incorporated past organizational experiences.

Learning through imitation can be supported by cooperation and apprenticeship [34].

Interpreting the output of IS’s may influence the process of internalization and consequently the process of OL as a whole.

"The output of an information system is an unfamiliar text to be read, interpreted and made meaningful by those who use it in ways that will always surpass any clear representation its system's creators had in mind" [10].

Such a hermeneutic perspective on IS’s provides insight into the problems of information interpretation. Information interpretation is never an objective activity. Individuals create interpretations, for example, according to the (cultural) norms that are prevalent within their organization or group. Dominant coalitions for instance, can be influential in shaping the interpretations of others [65]. Self-referential forces too influence not only what is considered as important but also how one should make sense of the information [8].

(Computerized) IS’s also play an important role in the internalization of ‘enculturated’ knowledge and as such effect the organizational learning process. Enculturated knowledge refers to the shared understandings, is mostly of a tacit nature, and concerns language, symbols, rituals, norms, values, etc. [6]. Cultural aspects can always be found in IS, since IS’s are ultimately a representation of reality and therefore also of the culture [70]. IS’s provide means of representing reality through a set of concepts and symbols, and in so doing, IS’s can be considered as a medium for the construction of social reality [51].

An illustration of this process of internalization through IS is offered by Walsham while referring to an implicit function of accounting systems. Accounting systems are predominantly used to set targets, to monitor performances and to identify and correct failures. However, these accounting systems are only one way of looking at the world which enacts organizational boundaries and emphasizes certain numerical data. As such they can be seen as institutionalizing the dominance of financial information [74].

3.2. IS And Environmental Adaptation

During environmental adaptation, organizations acquire information by gathering feedback information and information from other organizations. MIS’s are pre-eminently suited to acquire feedback information. Inter-organizational such as EDI systems IS’s and Executive IS’s (EIS) may support both the process of ‘feedback learning’ as the process of ‘learning from others’. IS’s that mainly support organizational imitation are systems that have the latent function of 'disease carriers' [40]. Management journals and books, conferences, Business school courses, personal networks, large standard applications, are examples of IS’s that enable the diffusion of external knowledge. For example, large standard applications such as SAP, are optimized over the years because of being applied in many organizations. Hence, introducing SAP into the organization also implies introducing experiences gained by other organizations. Environmental adaptation is often influenced by a ‘focused’ selection of information [30]. Hedberg and Johnson [27] observe that IS’s incline to thwart organizational
scrutiny and filter away relevant uncertainty, diversity, and change indicators. IS's contain an implicit model of the world which may become outdated. Consequently, IS's do more to stabilize organizations than to destabilize them. Miller refers to ‘focused IS’s’ that "institutionalize and routinize gaps in organizational intelligence".

"Management information systems do not track the things managers believe to be unimportant or unchanging, but instead focus attention on what is thought to have mattered in the past. (...) And in many successful businesses, executives develop the self-assurance to home in very precisely on what they believe explains their success. Their information systems then fix upon this and ignore everything else." [46]

Of special importance is the dominance of self-referential forces in influencing the selection of environmental information. IS's can be viewed as autopoietic systems in which 'narcistic' use of information becomes conspicuous [29]. The selection of information shapes the identity or self-image of the organization and as such influences the ego-centric, conservative learning processes of organizations. EIS for example are designed to reproduce the organizational identity by directing attention towards pre-determined elements in the environment. Elements that do not contribute to a (re)production of this identity will be filtered out before it reaches consciousness, or will be reinterpreted or 'rationalized' so as to remove discrepancies.

Walsham provides an example from the Vietnam War taken from Halberstam to illustrate this self-referential functioning of IS's. Halberstam describes how the internal organization of the American intelligence gathering operation in Vietnam was inadequately structured to cope with an understanding of the evolving conflict in Vietnam.

"Senior decision makers in the American military and political hierarchy concentrated on the 'information' coming from the field rather than questioning, until it was too late, the adequacy of the information systems structure which was supplying their own self-referential view of the world". [26]

An implication for the development of IS's is the need for a constant reflection on the adequacy of the structure of those systems [74]. Such self-reflection cannot be built into software; self-reflection should come from its users and designers. Another option to avoid focused selection of information as a result of IS's use is to engage in more creative ways of learning. We will return to this issue of IS's supporting idea generation in the next section.

### 3.3. IS To Promote Discontinuous Change As A Result Of Learning

So far, we argued that although IS's support OL, this learning takes place within the organizational theories-in-use. As such the learning resembles 'single loop learning' [2] or 'exploitation' [39]. In this section, we will explore how and which IS's are able to support and organize OL in such a way that it results in discontinuous changes and innovation.

In the following we will first critically examine IS's that are usually considered to promote change and innovation as outcomes of learning. This will be followed by proposing the use of alternative IS's.

Simulation techniques such as scenario planning have often been considered as important (management) tools to stimulate so called "generative learning" [18][31][63][67][73]. Simulation techniques are directed at learning about multiple enacted futures by trying to tease out the future events which they realize through posing 'what if' questions. One could argue however that this exploration is based on an already formed perspective and predetermined parameters. Hence, during simulation techniques such as scenario planning, one defines ex ante from what to learn. In other words, it could be argued that these systems stimulate exploration within predefined solutions.

A more unrestricted form of idea generation is open brainstorming and exchange of ideas. This can be supported by Group Decision Support Systems (GDSS) which facilitates the solution of non-quantitative, unstructured problems, and facilitates electronic brainstorming [19][47][50]. Through electronic brainstorming, ideas are exchanged in order for new ideas to emerge. By building on each other's ideas, individuals get creative insights they did not have before. Boland and his colleagues [11][69] for example, propose the design of IT to support distributed cognition. Applications of IT then assist individuals in making interpretations of their situations, reflecting on them, and engaging in dialogue about them with others.

It can be argued that GDSS do have some limitations in supporting discontinuous change as an outcome of learning processes. For example, behind a GDSS lies a rather harmonious perception of social phenomena, since it takes the view that people have enough empathy to consider and appreciate each others standpoints. Secondly, although a GDSS is often believed to have built-in mechanisms that discourage the development of destructive conflict, miscommunication, or 'groupthink' [19], it remains to be
seen to what extent IT can seriously diminish the occurrence of negative group behavior. Miscommunication is often a result of social psychological forces that are deeply ingrained in the thinking and acting patterns of organizational members. Already during the process of socialization, people tend to adopt the beliefs of their personal reference group [45]. The introduction of IS's such as GDSS's will probably only slightly filter away these influences.

Although GDSS are capable of deriving alternative solutions without any constraints such as is the case with simulation techniques, they are not well suited to explore alternative problems. Exploring alternative problems may require different IS's than the systems discussed so far.

Whereas the rationale behind decision support systems discussed so far is to increase certainty, the essence of IS systems that support creative ways of learning is to increase diversity without any striving for certainty. In the context of OL, it can be said that decision support systems are focused on the result of learning by defining ex-ante what to learn. Systems that support discontinuous change do not bother about the outcome. Rather, they are more focused on the process of learning in such a way as to extend the scope of information that might possibly be relevant in an organization's future and to stimulate coincidental "findings" or serendipity. Hence these alternative IS's consist of information that has not been thought of until it is gained, implying that one cannot specify the information requirements ex ante. IS's that support these requirements have been called Alien IS's (AIS) [29].

Although these ideas may sound as contradicting to mainstream assumptions within the IS literature, they are not totally absurd. In fact, libraries, as one of the oldest and most universal IS's are based on these very information requirements [28]. Libraries consist of information sources whose relevance cannot be determined beforehand. In fact, the greater part of a library's inventory will never even be used at all. Librarians, in contrast to information managers, do not determine in detail the information requirements of potential users before they conclude whether an information source has relevance and thus should be incorporated or not. Therefore, libraries serve the purpose of providing a large reservoir of new knowledge most of which is irrelevant at the present but could be of relevance in the future [22].

Another important characteristic of libraries is that its use often leads to unexpected or serendipitous findings [23]. Although a lot depends on the way the books are arranged as well as the pleasure the individual derives from visiting a library, browsing among the shelves and using cross-references provides knowledge one never had thought of or which has been forgotten.

"Those who confine their interpretation of information to its narrowest sense of factual data seem to forget that browsing among the shelves of a good library provides a conspectus of any field of knowledge far wider than the compass of one individual mind, and offers a choice of approach and treatment which can lead to what W.I.B. Beveridge calls a 'eureka situation'" [22].

The image of a library as an IS provides us with two central features of AIS's that promote idea generation. First, IS's that stimulate idea generation should contain a large inventory of knowledge without the constraining issue of relevance. Secondly, these IS's should provide the opportunity to encounter unexpected and serendipitous findings. This means that the supply of information should not be arranged too much so that it might result in focused IS's.

Internet facilities and in specific the World Wide Web (WWW) provide excellent possibilities for the support of idea generation and consequently for creative forms of OL. The WWW is open by its very nature and has no predetermined goal. By surfing on the web, the user can learn from often unexpected knowledge. In fact, the characteristics of the WWW seem to mirror the general information requirements of AIS as described above. The use of the WWW in a learning environment is almost opposite to the use of 'traditional' decision support systems. With reference to the information requirements of 'traditional' information systems [17], the information contained by AIS, such as the WWW and the library [7]:

- does not have to be correct. If the content is valid it is of less importance than if the content is perceived as reliable;
- need not be unambiguous. The existence of various interpretations is not perceived as problematic;
- does not have to be delivered to the right person and the right time. The relevance of the information is not important;
- need not reduce uncertainty. The system is not based on pre-defined information-needs. In a way we could say that it reduces certainty in that it may allow for creative new insights that disrupt the existing beliefs and theories in use.
- need not be linear. In order to support creativity, information should be presented in a more unstructured way.

4. Concluding Remarks
By perceiving OL as being an information-intensive process, it is tempting to argue that IS’s are highly important tools to support the process of learning. In this paper we have tried to give this argument a more theoretical underpinning by conceptually unraveling the various sub-processes that make up OL. We have argued that IS’s indeed are able to support the process. However, because of their very nature and because of the way they are used in practice, we should be careful in being too optimistic about the effects they have on the results of learning. For several reasons, IS’s can frustrate OL processes as well.

For example, some IS’s such as groupware systems can support the externalization of individual knowledge. However, given the fact that they cannot support the externalization of all individual knowledge, we should be careful being too optimistic about its possibilities. A similar warning applies for organizational memory information systems in their ability to support the process of objectification. Furthermore, IS’s are well suited to support the process of internalizing organizational knowledge, although this function is seldom made explicit. Organizations are often not aware that there IS’s are meaning constructors, maintaining a certain representation of reality. In addition, we should be aware that users of IS will interpret the acquired information in various ways that may well be different from the interpretation the designers had in mind.

Surely, IS’s are also suited to acquire information from the environment. Again, exploring its possibilities calls for some critical comments. Decision Support Systems tend to support ‘focused’ acquisition of information. That is, because the acquisition of information is based on pre-defined parameters, the learning of organizations supported by DSS will be more conservative rather than innovative.

When exploring the information requirements within a more creative learning environment, it was argued that IS’s that could support these requirements, are in various respects different from the traditional decision support systems such as MIS’s. Instead of being directed at the outcome of the learning process, they support the process of learning by providing a large reservoir of knowledge of which is relevance is unknown and which promotes the occurrence of serendipitous findings.

With this paper, we hope to have contributed to the ongoing discussion about the effects of IS’s on OL. From this present endeavor, we may conclude that although there seems to be an intuitive link between IS and OL [55], we should be careful in assuming that IS’s are able to enhance OL processes and as such are means to improve the intelligence of the organization. Although many IS’s are indeed able to support processes of learning, their support often seems to result in a continuation of existing organizational knowledge rather than in discontinuous change of this knowledge.

Given that this paper only provided an exploration into the possible supportive roles of IS’s during OL processes, much more empirical research is needed to enhance a better understanding of the use of IS’s within a learning environment. This is especially true for creative learning environments that cannot rely solely on traditional IS’s and on the possibilities of AIS’s to support OL processes.

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