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Computer-Based Information Systems and Knowledge Management: Contrasting the Objectivist and Subjectivist Perspectives

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Abstract

This paper examines the role that computer-based information systems can play in the communication and sharing of knowledge. It considers the actual and potential symbiosis of such systems with the concepts of knowledge management within an organizational environment. It identifies the objectivist philosophy of knowledge, which typically underpins the literature advocating computer-based knowledge management, and questions the foundational assumptions of this perspective in terms of the dichotomy made between tacit and explicit forms of knowledge. Thus it is suggested that there is a lack of critical understanding within the paradigms of research which examine the role of computer usage in managerial knowledge development, and that this is based upon a prevailing objectivist orientation to systems design. A subjectivist philosophy of knowledge is introduced which identifies the tacit and explicit elements of all human knowledge that are embodied in both human minds and bodies and embedded in organizational actions, activities and environments. The paper develops a critique of the possibility of computer-based information systems and their contribution to the process of communication of knowledge. This is based not only systems developers' failure to understand key social and cultural issues but also on a failure to recognise the fundamental character of what human knowledge consists of. Finally, the possibilities for the true extension of the role of computer-based information systems within human knowledge communication and sharing activities are explored.

Keywords: tacit knowledge, explicit knowledge, computer-based information systems

1. Introduction

Much recent literature in the area of knowledge management (KM) suggests that the new data infrastructure will permit radically new business process activities and allow organizational membership to create new value-added, information-based products and services (Nonaka and Takeuchi, 1995; Castells, 1996; Ferneley *et al.*, 2004). A resonant theme in this literature on knowledge management is the central role of computer-based information systems (CBIS). The aim of this technology is to provide a powerful means of gaining new insight into, and control over, business functions and to assist directly in knowledge sharing activities in all organizational areas. The ultimate goal is the integration of information processing in order to create a knowledge environment in which organizational members can regard and understand the organization in new ways. Much of the discourse in this area provides an optimistic approach to describing how the knowledge assets of an organization may be shared, or strongly supported,

through the intensive deployment of computer-based information systems. However, it is argued in this paper that this approach to knowledge management is largely based upon a restrictive objectivist epistemological perspective.

2. Knowledge Management and the Objectivist Perspective

The objectivists perspective identifies the existence of a set of objective and reliable facts, principles and theories which are available codification and sharing in a tangible form, for example scientific theories published in documentation. The assumption is that it is possible to develop a type of knowledge and understanding that is free from individual subjectivity. This normative perspective is characterized as one which focusses upon 'the discovery of technology solutions (rules, explanations, memory systems) to knowledge problems' (Shultze and Leidner, 2002: p.221) However in developments in KM literature authors who support the objectivist recognise that knowledge may be categorized into two categories: those of explicit and those of tacit knowledge (Nonaka and Takeuchi 1995; von Krogh, 2000; Stenmark, 2001). This functional emphasis is characterized by Nonaka and Takeuchi (1995) who state that tacit knowledge may be convertible into explicit knowledge through computer-based systems. While explicit knowledge is identified as that which may be codified, tacit knowledge is identified as that which people possess but which remains inexpressible and incorporates both cognitive activity and physical skills (Nonaka and Takeuchi, 1995). However, the ambiguity of tacit knowledge is considered to open the possibility of contesting just what it is that makes up its 'tacitness' and opens up the possibility for systems' designer led attempts to identify explicit elements which may be available for incorporation into KM systems. Nonaka and Takeuchi (1995) posit that through 'capturing' knowledge in this way, it can be replicated and shared. Through the incorporation of inserting human agency into the technology, these authors identify the possibility to convert tacit knowledge into a more tangible commodity and consequently enable the active sharing of this knowledge. Thus, while tacit knowledge is regarded as subjective, being embedded within the particular cultural values and perspectives of those who interpret it and use it, it is suggested that it always contains within it the possibility of conversion to explicit knowledge, which is unhindered by such restrictions and may be regarded as a pure and objective form. The notion of tacit knowledge now becomes one of it being knowledge-not-yet-articulated, but awaiting for its 'translation' or 'conversion' into explicit knowledge (Tsoukas, 2003). The recent developments in CBIS for knowledge sharing are now being promoted as part of a paradigmatic break with the more traditional forms of management information systems which allows for the conversion of this tacit knowledge to explicit forms (Hayes, 2001; von Krogh *et al*, 2001; Lee and Choi, 2003). However, it is argued here that much of this development, often promoted by academics and vendors as tools for knowledge sharing amongst the organizational membership, may on detailed examination merely reflect the continued extension of the rationalistic objectivist philosophy with its tradition traceable to Weber's (1922/68) concepts of bureaucratization. This is, in part, probably a reflection of the roots of systems design in the automation of 'well understood' business activities. Well-defined processes and a well-defined problem space are at least implicitly assumed by the objectivist perspective. Typically, computer-based applications of KM follow the work of Simon (1960) and presume a heuristic search through a problem or possibility space undertaken by a socially isolated individual. Newell and Simon (1972) further objectify knowledge and qualitative reasoning by claiming that computational manipulation of symbolic representations is

representative of human thought, understanding and choice. This suggests a 'conduit' model of 'knowledge' in the form of expert human judgement and qualitative reasoning that can be transferred from the human 'expert' and implemented onto a computer and transferred to a recipient without distortion. As Shultze and Leidner (2002: p.221) observe, 'the metaphor that emerges from these operationalizations is knowledge as an object that can exist outside an individual, that can be stored and manipulated in the absence of a human knower, and can be transferred to others (human or machine)'. Thus from the 'knowledge management as technology' perspective a strong role for CBIS in supporting the sharing of explicit knowledge is advocated (Nonaka & Takeuchi, 1995). The division between tacit and explicit forms of knowledge within the objectivist epistemology has important consequences for explaining the ways in which tacit and explicit knowledge may be communicated within the organization.

3. Knowledge Management and the Subjectivist Perspective

The objectivist epistemology of knowledge is one which identifies the distinctive separation between tacit knowledge and explicit knowledge forms. This is in contrast with the subjectivist perspective which suggests that tacit and explicit forms of knowledge are indivisible and are mutually constituted (Tsoukas, 2003). Thus the notion of rigidly explicit objectivist knowledge forms within KM may be identified as self-contradictory in that it contains 'tensions and contradictions in the idea per se' (Alvesson and Kärreman 2001: p.996). As Polanyi (1967) notes, without their tacit coefficients, all forms of data [words, formulae, maps, graphs, etc] are strictly meaningless. Without the background understanding of grammar and syntax any text or language will appear as a random presentation of letters, numbers and images. Following from the need for this background knowledge Polanyi (1967) argues that fully explicit knowledge cannot exist as all knowledge is either tacit, or rooted in tacit knowledge.

Two distinct but closely inter-related elements of the subjectivist perspective on knowledge are that knowledge does not exist outside of the knowing subject and, secondly, that knowledge is located within and is identifiable with the activities and practices that people undertake. Thus the indivisibility of tacit and explicit knowledge within the epistemology of the subjectivist perspective means that the unarticulated and uncoded elements of any knowledge will always make it tacit to a certain degree. The subjectivist perspective challenges the objectivist position that knowledge can exist in a fully explicit and codified form independently of human agents (Wilson, 1997; Tsoukas, 2003). The subjectivist perspective suggests that knowledge and understanding emerges from the activities of people acting within the specific circumstances and environments they find themselves. In what Tsoukas (1996) identifies as the 'indeterminacy of practice' the explicit and well defined rules which may guide action will always contain some element of ambiguity or uncertainty, which requires actors to make inferences and judgements. From the subjectivist perspective knowing becomes a function of the integration of both cognitive and physical processes which involves active individuals bringing their embodied/embedded knowledge to act on focal object (Wilson, 1997; Ferneley et al, 2004). That the objectivist perspective recognises the role of human agency in the development and use of knowledge is evidenced in the data-information-knowledge process model. Here it is suggested that knowledge is emergent when data and/or information is acted upon by human intellect/labour added (Wilson, 1997, Tsoukas, 2003). However, the objectivist perspective

assumes that the output of this interaction can be codified into fully explicit knowledge, whereas the subjectivist perspective does not.

Related to the concept of the embodied nature of knowledge is the understanding of the difficulty of separating knowledge from activity. This challenges the idea of what knowing is and consequently and development of what knowledge is. The objectivist perspective conceptualizes knowing to be primarily a cognitive process carried out by the reflective individual in isolation from the physical [mind-body duality] (Barnes, 1977; Damasio, 1994). In contrast, the subjectivist perspective posits that knowing and doing may not be so easily separated. The subjectivist perspective challenges the cognitive model of understanding and views the development of knowledge as resulting from the routine activities of people and, as such, is less of a cognitive process and more of a holistic activity. This sense of knowing is identified by Polanyi (1967) who observed that we know with all our senses, muscles and sinews and well as our brains. From this perspective knowledgeable activity is the result of an intimate fusion of both an actors thought and action whilst engaged in specific activities and tasks. In contrast to the objectivist perspective on knowledge, where it is proposed that codified knowledge can exist in an isolated and reified form, the subjectivist perspective argues that all knowledge is socially constructed and remains highly subjective (Wilson, 1997; Tsoukas 2003). While the objectivist perspective assumes that language contains fixed and objective meanings and that there exists a direct equivalence between words and what they reference, the subjectivist perspective argues that the meaning of language is inherently ambiguous and suggests that language has no such fixed meanings (Wilson, 1997; Tsoukas, 2003). Thus the subjectivity or interpretive flexibility of language undermines objectivist claims upon status of knowledge, whether it is totally tacit and personal or whether it is partially explicit and codified into a text.

4. Knowledge, Computer-Based Information Systems and the Communication of Meaning

The proposition that all knowledge remains subjective has significant implications for the extent to which any knowledge, no matter how explicit, may be shared using CBIS. If all knowledge has tacit components and tacit knowledge is difficult to codify and communicate then this suggests that the sharing of explicit knowledge may not be as easy the objectivist perspective of KM suggests. As observed by McAdam and McCreedy (2000) both the creation of semi-explicit knowledge in the form of a text, together with the reading and interpretation involved in an actual understanding of it, require an active process of both meaning construction and inference. A further difficulty for the promoters of KM is that knowledge can never be totally neutral and unbiased and will remain in varying degrees inseparable from the values of those who produced it (Brown and Duguid, 1998). Further, this process of constructing meaning and inferring from it is typically culturally embedded. The meanings that people attach to language and events tend to be shaped by and, to some extent, reflect the values and assumptions of the sociocultural milieu in which they exist (Cole, 2003). An example of the way in which pre-existing values and assumptions influence these processes of knowledge construction and interpretation is through the filtering of data/information in order to decide its relevancy. Examples of such filtering processes at both the organizational and individual level are those which contributed to the Challenger and Columbia Space Shuttle accidents (Cole, 2003). In the case of the Challenger engineers neglected what turned out to be important information regarding O-ring erosion as, based on the assumptions they had, such a situation presented an extremely small risk. In the

case of the Columbia cladding from the main fuel tank was identified as hitting the port wing of the space shuttle. However reliance on damage prediction software for this scenario resulted in engineers assessing the event as insignificant to safety and failed to insist on any visual inspection of the damage which could have been undertaken by the crew (Cole, 2003).

The importance of the way in which certain types of knowledge become culturally embedded within areas of professional activity is identified by Lave and Wenger (1991). They identify this process as one of the development of 'communities of practice' where working and the sharing of knowledge are social-communal activities which contain many informal aspects (Barnes, 1977; Brown and Duguid, 1998). A particular occupational group [community of practice] typically develops their own ways of working and their own values and assumptions, which shapes activity and influences the ways which knowledge is developed and interpreted (Brown and Duguid, 1998). The example of the Challenger and Columbia shuttle disasters showed how the values and assumptions of such professional communities, all of whom were intensively involved with IT based 'knowledge' systems, shape and distort the way meaning and knowledge is developed in these systems.

The problem of computer supported KM implementations distorting professional knowledge is highlighted in Ferneley et al (2004). In their study of a KM supported call centre, established to facilitate medical nursing consultation, they concluded that the KM systems were an effort to rationalize the network of personal interactions that constitutes the supposedly informal relationships and tacit skill elements of nursing professionals. The case study revealed the problem of distortion of meaning and ultimately action remained within the KM implementation where the nurses continuing professional practices and mores failed to confirm and reinforce the authority of systems based technology. Ferneley et al (2004) observe that the nurse operatives' actions in 'short-circuiting' the KM system and deviating from script-based responses in pursuit what they believed to be the patients best interest was, perhaps, an example of how the system has become a site of a struggle for interpretative supremacy about what nursing (professional knowledge) is and how it should be deployed. The dangers inherent in over-reliance upon computer-based systems by both medically qualified staff or the incorrect use of it by unqualified staff was in this case overridden by the continued deployment of professional skills by nurse operatives. The difficulty remained in the dichotomy between the system designers and its users with regard to the degree with which this knowledge autonomy should be continued to be allowed to override the essential structures of the system design. Such contestation has significant implications for both professional self-representation and resistance to erosion of this through systemic reductionism (Ferneley et al, 2004). Thus from perspective of the subjectivist position 'knowledge' remains identified as being highly contestable in both its nature and meaning. The meaning of any particular piece of partially explicit knowledge rests upon its social construction both by its producer and user together with the degree to which it is professionally and culturally embedded.

5. Knowledge and Human Communicative Practices

The proponents of KM identify the possibility of designing CBIS for allowing people to reflect on the interpretations of events that they have made (Boland and Tenkasi, 1995; Hayes, 2001; Stenmark, 2001). Unlike more traditional management information systems that automated

formal, hierarchical data flows, such network technologies allow for the possibility of horizontal communication between much broader organizational constituencies (Hayes, 2001). From this perspective CBIS may be used to support distributed cognition by enabling individuals to make richer representations of their understanding of situations and events and to reflect upon these, together with engaging in dialogue with others, before using these representations to inform action. Thus under this KM position it is recognised that tacit knowledge exists as an important feature of organizational life but it is posited that through the use of networked computer-based communication etc this will somehow 'solidify' into organizationally useful forms. However the degree to which people may be able to achieve the necessary self-reflexivity, particularly within the organizational setting, remains questionable. For example, there may be values and assumptions that are buried deep in our subconscious that we are not aware of and cannot even begin to articulate. Further, even if people can reflect on their assumptions and values, they may not be able to articulate them fully or clearly. As Dawson (2000: p 321) observes, 'these processes have major deficiencies, partly as people can know far more than they can communicate to others'. The extent to which anyone, however willing, diligent and reflexive they are, is capable of developing an explicit appreciation of the values upon which their actions and opinions are based, is always somewhat partial. The rational methods that are so employed to solve the problems of translating embedded knowledge into that which can be articulated and made explicit are developed in a systems framework which presupposes the bureaucratic-rational models of what is acceptable as knowledge. This is not surprising, since only in these rigid contexts can 'knowledge' be unambiguously defined. Beyond these contexts is an intellectual barrier which cannot be breached without abandoning the notion that true knowledge has at its basis both tacit and the subconscious elements which will forever remain unavailable to formal systems (Winograd and Flores, 1986). Thus, the problem of articulating and sharing knowledge is not just that it is tacit, but that it may be partly subconscious and forever unobtainable.

Another difficulty that many of the proponents of this approach to tacit knowledge sharing is that, for such implementations to work, an idealized model of both human behaviour in organizations and the nature of organizational relations must be presupposed (Schultze and Boland, 2000; Stenmark, 2001). They assume the enhancement of the communicative competence of the organizational participants through the creation of an 'ideal speech situation' (Habermas, 1970), where genuine debate and willingness to share with others their assumptions and values leads to undistorted communication and a move towards a truly rational consensus about the constitution of organizational. However, as Scarbrough (1999) suggests, the ability to achieve open communication and the sharing of knowledge in many organizations may prove elusive. While some organizations have been successful in institutionalizing systems that review and challenge basic norms, policies, and operating procedures in relation to changes occurring in their environment, e.g. by encouraging ongoing debate and innovation, many fail to do so. This failure is especially true of bureaucratic organizations, since their fundamental organizing principles often operate in a way that actually *obstructs* the knowledge generation process. This is compounded by the complexity of the link between an organization and its use of technology. Because of the increasing scope of technological requirements, as well as their extensive influence over organizational activity, the costs of large-scale technologies 'create immense demands that dramatically narrow the room for democratic decision-making' (Strasser, 1984: p.162). This may be particularly so in managerial settings where key participants' assumptions and values may be perceived by management to be unwanted or unacceptable [*c.f.* the space shuttle disasters]. The

promoters of knowledge sharing present a limited analysis of the potentially conflicting nature of organizational relations and largely assume that organizational members are open and forthcoming about their motivations for sharing knowledge and that there is little conflict of interest in doing so. Storey and Barnett (2000) and Hayes and Walsham (2000) illustrate the limitations of such a perspective by observing the extent to which knowledge-sharing processes can be highly political in nature. As Polanyi (1967) observes there is no such thing as fully explicit knowledge and the tacit-explicit dichotomy must be considered to be misguided. Instead, all knowledge must be seen to consist of both tacit and explicit components and any partially explicit knowledge is relatively meaningless without an understanding and awareness of its tacit components (Polanyi, 1967; Tsoukas, 2003). Thus, although it may be argued that it is possible to use CBIS for the transference of semi-explicit knowledge, without the tacit understandings which support it, it will remain difficult to develop a complete understanding of the true meaning of this knowledge. Without a broad appreciation of the tacit assumptions individuals make in the way they use language it will not be possible to develop a full understanding of it. As a consequence, if it is recognised that all knowledge contains within it tacit components, then it leads to the conclusion that the extent to which it may be possible to communicate and share true human knowledge through CBIS will necessarily be limited and constrained. The sharing and transference of knowledge transcends the conduit metaphor and the process becomes one of active human participants involved in the inference and construction of meaning as a result of differing experiences. In support of this the subjectivist perspective proposes that the sharing of knowledge requires individuals to develop an awareness of the tacit assumptions and values upon which all knowledge is based. Bolisani and Scarso (2000) identify this as the 'language game' approach to knowledge sharing and emphasise the importance of dialogue and language to such processes. From this perspective knowledge sharing within organizations requires developing a process of mutual perspective taking where 'distinctive individual knowledge is evaluated, integrated and exchanged with that of others in the organization' (Boland and Tenkasi, 1995: p358). The problem remains that in order to achieve this KM designers have to resist the temptation to try to operationalise tacit knowledge rather than taking the more difficult path of finding 'new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting' (Tsoukas, 2003, p16)

6. The Role of Computer-Based Information Systems in Knowledge Sharing

Whilst the subjectivist and objectivist perspectives on knowledge have differing implications for the role of computer-based information systems in knowledge-sharing processes, making general conclusions remains problematical. This is a result of the wide ranging contexts in which knowledge sharing may take place. Apart from the differing levels of tacit knowledge the knowledge to be shared may contain, other important factors in the communication process need consideration. For example, it may take place in a small organization where the membership know each other well and interact on a social level, or in a large one where many the members have never met face-to-face and share differing social and cultural backgrounds, a feature to increasingly found in globalised corporations. In all these situations the role of CBIS is likely to vary considerably. In the development of some conclusions about the role of CBIS in knowledge management this section examines some of the key factors which affect the process of knowledge sharing and briefly discusses how they may affect the role of CBIS in this activity.

The single most important factor influencing the KM processes is the degree of tacitness perceived to be in the knowledge domain. Studies of various organizational contexts and case-studies have shown that, where knowledge is perceived to be highly tacit, the effective sharing of it requires intensive social interaction (MacKenzie, 1996; Wilson, 1999; Robinson and Wilson, 2003; Ferneley et al, 2004). Thus, CBIS are likely to be most useful in situations where knowledge is perceived to have a significant explicit element. However, as previously discussed, the subjectivist perspective suggests that fully explicit knowledge can never exist. Therefore, even where knowledge is partly explicit, KM will be at its most effective where CBIS knowledge sharing exists along side other communication and sharing mechanisms. Another key factor is the extent to which of referential knowledge exists between the parties involved in the knowledge sharing facilitation.

Considerable research supports the view that the sharing of knowledge between people who have only a restricted set referential knowledge between will be difficult, whether this is done through CBIS or through face-to-face interaction (Brown and Duguid, 1998; Bolisani and Scarso, 2000). CBIS are substantially disadvantaged in this aspect since the medium provides a much reduced 'richness' of communication than would be available through face-to-face interaction (Brown and Duguid, 1998). One of the postulated advantages of the 'communities of practice' model of knowledge sharing is that participants in such a community develop a significant set of referential knowledge (tacit assumptions, shared values, social norms etc.) through working intensively with each other, which makes the practice of knowledge sharing within such a community relatively straightforward (Brown and Duguid, 1998). Thus, CBIS are suggested to have the greatest potential role where there is already in existence a significant amount of common knowledge shared between the parties involved in KM process, such as will exist within a community of practice. The contemporary KM literature indicates that, for KM to be effective, people have to demonstrate a willingness to share their knowledge and that a critical factor in shaping this willingness is the extent to which trust previously exists between relevant parties (Hayes and Walsham, 2000; Storey and Quintas, 2001). This is particularly important in situations where the possibilities for face-to-face interaction are limited, such as in virtual organizations. Thus, unless some degree of trust exists and where further opportunities for social interaction are unrestricted users of such technology may be unwilling to enter in the process of knowledge via CBIS. CBIS supported KM implementations are likely to be at their most successful where a significant amount of common knowledge and trust already exists between the participants sharing knowledge. This trust between individuals and the consequent success of KM implementation is likely to be at its highest when the degree of explicitness of the knowledge shared is relatively high. Not all of these circumstances are essential for effective CBIS supported knowledge sharing to occur, but the more that exists at any particular period the greater the likelihood of success. In such situations new knowledge emerges through social interaction, rather than through any KM design led attempts to turn the tacit into the explicit

7. Conclusion

The centrality of the importance of the role computer-base information systems have in knowledge management may be identified in much of the contemporary literature on the subject. However, wedded as it is to a master discourse of market economics and human capital theory, this perspective is based upon set of restricted assumptions with regard to the fundamental nature

of knowledge, together with the assurance by promoters of KM that knowledge can be transferred through CBIS, whilst alternative forms of knowing and learning are rendered less visible and thus less desirable. Through analysing these assumptions the precepts of KM and the role of CBIS within knowledge-sharing processes become more problematical.

The promotion of the potentially significant role that CBIS can play in the processes of knowledge sharing is based upon what is referred to as an objectivist perspective on knowledge. A central feature of the KM perspective is that there is an identifiable dichotomy between tacit and explicit knowledge. Thus, in KM implementations tacit and explicit knowledge are identified as two separate and distinctive types of knowledge. While the difficulty of sharing tacit knowledge through CBIS is accepted by systems developers, the sharing of explicit knowledge through such systems is regarded as being relatively straightforward. From the 'traditional' KM perspective certain types of knowledge are considered to be able to be expressed fully and explicitly and are consequently able to be codified into a permanent and objective form. Following from this assumption a model of knowledge communication is developed in which it is suggested by KM developers that CBIS can be used for transferring explicit knowledge between people with the full sense and meaning of it remaining intact and unmodified in the transference process.

In contrast, the subjectivist perspective questions the possibility of the simple dichotomy between tacit and explicit knowledge which remains the foundation of objectivist systems design. This perspective views knowledge as possessing fundamentally different characteristics and identifies that it contains both tacit and explicit elements which remain mutually constituted and inseparable. Human knowledge in both its highly tacit and partially explicit form is shown to be embodied in the socially constructed nature of the activities and actions which people undertake and embedded in the cultural contexts and social values of those who use and develop it. The subjectivist perspective problematises the possibility of the successful sharing of any knowledge even partially explicit forms via CBIS. By its very nature tacit knowledge cannot be shared through CBIS. Without the tacit elements which underlie it partially explicit knowledge will remain incomplete and inadequately communicated. Thus, the KM model of knowledge sharing is undermined through the recognition that all knowledge is to some extent subjective and can never be fully unambiguous.

A further difficulty arises in the use of language both as a means of designing and developing a KM system and in the interaction between the system and its users once implementation has been completed. From the subjectivist perspective knowledge communication involves active inference of meaning by both those 'sending' and 'receiving' it within a particular social context through the use of language. This critical role of the context, within which observations are made and within which conversations take place, exposes a potential impediment to computer systems design for knowledge management i.e. the danger of developing a system with an emphasis upon the syntactic, at the expense of the semantic and pragmatic levels of communication. Instead, the subjectivist perspective observes that for effective sharing of knowledge extensive and direct social interactions between people is a prerequisite since it is only through such exchanges that the tacit elements of knowledge may be shared.

In conclusion although the use of computer systems within the managerial knowledge sharing process provides access to complex communication and modelling capabilities a danger has been identified in computer systems development based objectivist validity claims to the constituency of knowledge which cannot be discursively questioned by the user who is not cognizant of the system's logic. Systems which support 'objective' views of organizational reality are useful, and probably even essential, for supporting many managerial efficiency, quality and perhaps training activities. However, in functions devoted to human knowledge formation where the concern is mainly with the interpretation of the organizational situation, an over-use of computer systems may marginalize more hazardous, spontaneous and intuitive forms of sense-making, leading to a more unified 'world view' but at the same time exacerbate the problems associated with routinization. The reinforcement by the computer systems, and acceptance by the users, of a uniform and monolithic 'symbolic universe' perceived as necessary to explain and understand what the organization is all about may disable innovative change and adaptation.

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