

**Connecting People Not Computers:  
Information Technology and  
Culture Change  
in  
Environmental Management**

by

**Louis J. Sweeny**

**Submitted to the Department of Chemical Engineering in Partial Fulfillment of the  
Requirement for the Degree of**

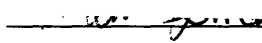
**MASTER OF SCIENCE  
in Technology and Policy at the**

**Massachusetts Institute of Technology**

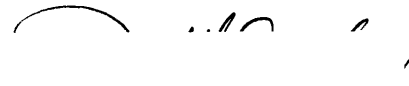
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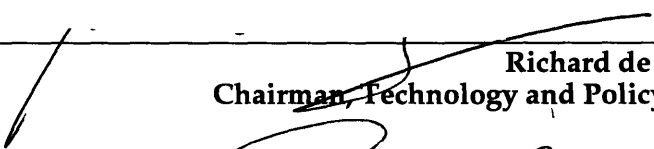
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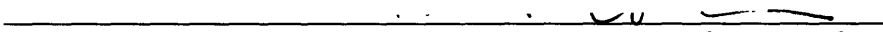
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**Abstract**

This thesis examines the role of Environmental Information Management Systems in corporate culture change. Current trends in environmental management which seek to move beyond compliance towards sustainability must be based on new corporate norms. This thesis examines the role of information technology in the creation and operation of these norms and discusses its implications for private and public environmental policy.

Using Giddens' structuration theory as a framework, I recast environmental management as a problem of organizational sense-making and argue that a key capability IT offers to organizations in this capacity is that of creating a "communications infrastructure," especially through the use of groupware. These systems are different but complementary to more traditional forms of IT support for environmental management which have emphasized massive data collection, processing and retrieval capabilities. Case studies of three firms using groupware to support environmental management systems are presented. One firm used a proprietary system for e-mail and file sharing, while the other two used Lotus Notes® applications. IT was implicated in environmental culture through the following: online question asking and answering; offering of new modes of organizational affiliation; creation of internal "green" networks; enhancement of environmental group identity through creation of electronic forums; enhanced organizational "buy-in" through solicitation of comments on environmental manuals and procedure documents and the routinization of environmental management occasioned by EMIS.

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## Acknowledgments

I wish to acknowledge:

Diana my life-partner, who was able to pull-off the delicate dance of being both editor and supportive partner - this thesis would not have happened without her.

My thesis advisor, John Ehrenfeld, who tempted me into critical theory, supplied me enough rope to get myself in trouble - but then, with a gentle tug, guided and supported me in pulling the thesis together.

The case study companies who gave so generously of their time and insights. I wish I could acknowledge each of you by name - your work is what translates these abstractions into real improvements in environmental management. Your stories were an important part of my education in this thesis experience.

My fellow students in TBE and TPP who provided a wonderful academic community which was as much a part of my education at MIT as my classes.

Coopers & Lybrand for their generous support of the Technology, Business, and Environment program at MIT.

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# **Chapter 1**

## **Introduction**

This thesis examines the confluence of two powerful trends which are shaping and reshaping business. The two trends are the increasing integration of environmental concerns into business operations and the pervasive, and I shall argue, transformative diffusion of information technology (IT) into this same workplace and into society at large.

### **Where the Two Trends Meet: Environmental Management Information Systems (EMIS)<sup>1</sup>**

While there is great emphasis in the environmental management literature on the use of IT to collect, manipulate, and report "environmental information", very little has been written about the organizational implications of how IT may interact with organizational culture - especially for an area as significant as environmental management (EM). Reflected in the nearly exponential growth of the use of e-mail and the Internet itself, it is clear that person-to-person communication, mediated by computers, is becoming pervasive in the conduct of business. This trend, especially as it now begins to include products such as groupware, is openly acknowledged in the business trade press as having strong cultural and organizational effects. It is this Computer Mediated Communication (CMC) between people, as opposed the parallel growth in raw processing power, through which information technology (IT) is seen as having the greatest influence on organizations. This thesis seeks to examine the implications of the current and future growth in CMC on environmental culture change in firms.

### **Motivation for the Topic**

One conception, very common in the practitioner literature, is that EM is essentially environmental information management. This view holds that accurate information on a firm's environmental practice, objectively generated on the basis of carefully defined

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<sup>1</sup> The acronym EMIS has been contrasted with another acronym EIMS by writer and consultant Chris Fitzgerald. See Fitzgerald, 1994. Traditionally EIMS was interpreted as a system for managing large volumes of environmental information (or data). This is contrasted by the term EMIS which implies an environmental management system supported by information.



metrics, and available in a clear and structured ways to key decision makers, will be the trick to successful EM [Fitzgerald, 1993]. This thesis takes a different view. In it I attempt to review and add to the body of research which suggests that the role of information in EM is deeply embedded in each firm's web of relationships and culture. These factors, more than the technical metrics of accuracy or completeness, will determine IT's broader role in influencing corporate environmental practice and culture. Thus it may be more important to a firm's environmental practices that the process engineer or designer sees environmental issues as within his or her own professional identity and so seeks to "make sense" of the information available on an EMIS, than the fact that the system purporting to measure environmental performance is updated hourly and tied to a high-speed computer. This is not to argue that sophisticated "data" based EMIS's should be eliminated, but rather that they must be complemented with a communications infrastructure which supports collaboration. This infrastructure must acknowledge that the link from data to action flows through meaning - and where joint action is necessary, as in EM, this link must flow through shared meaning. This thesis seeks to develop, through both theory and a review of current practices, ways to leverage the potential of new developments in IT, especially groupware, to support the construction of shared meaning around the environment as a means of promoting and maintaining improvement in corporate greening.

### **From Environmental Information to Meaning:**

This research attempts to inform a very theoretical proposition through a review of the literature and new empirical research. The central proposition is that discourse between environmental and other professionals within firms and between environmental professionals and their counterparts in other firms may be an important force and avenue for change in corporate environmental practice. More importantly, I also propose that this discourse is itself an integral part of the corporate culture change necessary to support long term and self perpetuating change in environmental practice. The final part of my argument is that, to a growing extent, this discourse among professionals will be mediated (not substituted) by computers.

The thesis draws on a rather diverse range of sources: from the cognitive aspects of language, to developments in IT and case materials from several firms. With such a wide span to cross, there are bound to be a few thin spots: I point these out now so the reader is careful not to fall into them in an expectation that they would be covered. While the thesis deals primarily with environmental management and information technology, it

is concerned with the interaction of the two rather than the details of implementation of either. Neither the operation nor the theory behind IT, in terms of hardware, software, or the industry, are covered. This thesis is not a review of environmental management practice, history or regulation - although each of these factors is noted.

### **Why Meaning Matters**

The next chapter of this thesis reviews the evolution of environmental management in the US with an emphasis on the emerging broader notion of the corporation's environmental responsibilities. This trend is evidenced by the rise in both voluntary industry initiatives and other activities outside of the traditional regulatory framework. This thesis argues that if firms are to succeed in their struggles to incorporate environmental concerns into their operations - they must *learn* how to do so. An initial, but continuous part of this learning process will be the construction of shared meanings about the environment and how the firm's operations effect it. This thesis examines the current and potential future role of groupware to facilitate this learning process.

### **Overview and Organization**

This introduction has outlined the motivation and background for the research. Chapter 2 provides a brief review of some key issues in environmental management, with an emphasis on its historical evolution from a focus on regulatory compliance to broader concepts of responsibility and sustainability. Chapter 2 also introduces research by Cebon and others on the embeddedness of environmental management in organizational culture and the implications of this embeddedness for the kinds of relationships and communication that support change. For Cebon, this was implementing Pollution Prevention projects.

Chapter 3 introduces the theory of structuration as a theoretical framework linking organizational communication to action and, ultimately to culture. Structuration also provides a useful context in which to review the additional perspectives of "organizational learning" and "sense-making" as they are applied to EM. This section develops the overall background for interpretation of the results from three case studies presented in chapters 5 and 6.

Chapter 4 discusses the motivation and methodology for the case study research.

Chapter 5 provides background information and some general observations on the three case study firms - this chapter provides the context for the individual findings developed in Chapter 6.

Chapter 6 develops findings from the case studies using the framework outlined in Chapter 3.

Chapter 7 presents some final conclusions and explores some of the broader private and public policy implications of these findings. The chapter ends with a discussion of the opportunities for future research in this area.

## Chapter 2

# The Evolution Of Environmental Management

This chapter presents an argument that environmental management is evolving in a way that will make the organizational aspects of greening even more important.

Furthermore, this evolution will be shaped by firms' abilities to communicate environmental issues internally. To support this argument, I review Fischer's "phases" of environmental management. The research of Mylonadis and Hoffman supplement Fischer's perspective with their work on the concept of institutional field and the limited applicability of "purely rational actor" or "strategic choice" perspectives in explaining the internal environmental management processes of firms. I then propose that Cebon's research illustrates a similar dynamic at work in the pollution prevention projects that are his subject. Cebon demonstrates the role of the organization's ability to manage the flow of three distinct kinds information in successful pollution prevention projects.

### From Resistant Adaptation to Institutionalization and Beyond

Firms face pressures to respond to environmental concerns from many directions. Regulations establish a framework of sanctions and incentives while financial considerations in terms of liabilities and market opportunities also exists. Larger social norms on environment confront the firm directly through customers and indirectly through the views employees bring with them to work. The details of each firm's response to the increasing environmental pressures in its course of business will be a unique product of its history (which is a part of what this thesis is about). Fischer traces the evolution of the environmental responses of firms through three general stages: [Fischer, 1993]

#### **1970-1985 Resistant adaptation to increased regulation**

Many had policy statements of the form "we will comply with laws and regulations", and began to build functionally organized Environment, Health and Safety (EHS) staffs.

#### **1985 - 1992: Embrace without Innovation**

Most firms had some form of environmental policies, some of which went beyond commitments to compliance, indicating further general and specific commitments, for example "to reduce emissions of toxics by 50%" by a given date.

### **1992 and beyond:**

For this stage Fischer notes, "There is clear institutionalization of environmental concerns within firms".

Fischer also identifies a longer term and more comprehensive vision of environmental management. He notes that a:

minority of firms are moving beyond a compliance-oriented approach. This strategy does not start with a single demonstration to produce a specific environmentally friendly product because of public or regulatory pressure. On the contrary, it aims first of all at increasing the firm's capability to develop environmental sound product/market combinations. . . . Second, it involves source reduction as a practice of continuous improvement, with a final goal of zero emissions. Third is transparency. They monitor emissions and waste streams, and disclose information, [and] they will allow external auditors to assess performance and publish results [Fischer, 1993, pg. 12 ].

Hoffman's research on the evolution of corporate environmental strategy in the chemical and petroleum industry illustrates similar phases: self-reliance of firms on themselves for environmental practices, confrontation with increasing regulations, cooperation, and finally proactive stance. [Hoffman, 1995]

This proactive stance towards environmental issues is often characterized as "beyond compliance". In their assessment of Polaroid's Environmental Management Information System (EMIS) Nash et al found a clear expression of this perspective:

James Ahearn, senior manager of environmental programs in Polaroid's Research Division, has made this point even more emphatically. The goals of source reduction efforts, he explained, "was to be in a position to never have to worry about regulation again." [Nash, et al, 1993 ]

Thus, rather than looking for an approach which would simply assure compliance, Polaroid expressed a desire to change the game. To understand this evolution we must look beyond the notion that firm's environmental behavior can be explained solely as rational actions towards compliance at minimum cost - we must consider the organizational processes which underlie this behavior.

### **Environmental Management As An Organizational Process**

Do simple, economically-based rational actor models explain this evolution? This thesis is based on the premise that they cannot. Using the work of three researchers who address this question, this section explores three levels at which it may be asked: Hoffman's analysis of the petrochemical industry demonstrates the co-evolution of an

entire industrial sector's environmental perspective, Mylonadis explores the role of "boundary spanners" between the firm and an "eco-world" with which ideas are exchanged and finally Cebon looks entirely within firms and their implementation of PP projects.

Hoffman and Mylonadis have used the construct of a "field", in which the firm is embedded, to explain the complex trajectories firms have taken along the evolutionary paths outlined above. Hoffman's work in the petrochemical industry explored the operation of an institutional field which itself evolved along with the industry actors it included. Thus the account is fundamentally social and organizational:

...such rational actor models treat the organization and its external environment as separate and distinct. Inter-firm interaction is argued to be driven primarily by competition where the individual firm's actions are strictly focused on increasing efficiency. Deviating from this explanation, this institutional account calls attention to the casual impact of state, societal and cultural pressure as opposed to market forces and resource scarcity as driving [environmental] corporate action. [Hoffman, 1995 pg. 319]

This thesis, however is concerned with what goes on *inside* the firm that shapes its responses to these pressures. When Hoffman and Mylonadis looked inside their firms, they observed a rich organizational process which could not be explained purely from either a regulatory compliance nor an economic rationalist perspective. Both observed the highly constructed nature of the "organization currency" (costs, projected benefits and liabilities) on which these theories depend to explain environmental management decisions. For example, Hoffman notes:

While companies are affected by cost, this dissertation argues that they are not the primary driver. It is more important to consider who is applying those costs. [Hoffman, 1995 pg. 329]

Mylonadis' research explored one firm's interaction with an "eco-world" similar to Hoffman's "field" from which the organization imported new themes which were then diffused through communication. Both researchers demonstrated that the central organizational process which shaped their environmental evolution were as much concerned with negotiation and communication around concepts like cost or safety as they were an exercise in optimization or cost minimization as a purely economic model would suggest. For example, Hoffman's account of the co-evolution of industry and industrial field tracked articles published in trade journals which themselves represent an important form of communication. The importance of communication in the

organizational process of environmental management is even more clear (and relevant for this thesis) once we look entirely within the firm.

### **Cebon's Research on the Role of Communication in Pollution Prevention Projects within firms**

Pollution Prevention (PP) is simply the idea that instead of working exclusively towards a better means of controlling pollution at the "end of the pipe", it would be better to "prevent" the pollution to begin with. In most cases, PP translates into changes in materials and processes for given products. A shift from chlorinated solvents in coating processes to aqueous suspension is a very common example of a materials and process change. Cebon's detailed exploration of the organizational interactions around pollution prevention projects provide a rich but straightforward frame.

These pollution prevention projects are a useful "middle ground" form of greening. As Cebon notes, PP involves an intimate relationship with processes and procedure, and therefore requires an organizational perspective. Integrating a pollution prevention philosophy in a firm is a richer and more complex transition for firms than simply thinking about marginal changes in specifically environmentally-related practices. For example, a shift in waste disposal techniques like switching to an accredited disposer would involve only traditional EHS staff. Few others in the firm need to be aware, let alone change, when this transition takes place. On the other hand, the evolution of EM towards a broader notion of product stewardship and sustainability involves changes in the very design of processes across the firm, and therefore requires firm-wide organizational and cultural change. Not only do staff other than EHS professionals need to be aware of changes in practice related to environmental improvements, they need to instigate and apply them. This evolution towards PP presents possibly much greater challenges, and consists of or requires much deeper change in firm culture and practice.

### **Environmental Management: Three kinds of information that need to be brought together**

In his study of pollution prevention in the chemical industry, Cebon notes the importance "of three organizational factors: culture, ability to process information and politics" [Cebon, 1993] in successful PP projects. Regarding "information," Cebon identifies two essential characteristics of organizational processes in implementing a specific pollution prevention project. He distinguishes the *classes and sources* of relevant information from the *means* by which this information is transformed to action.

Cebon identifies "Three distinct classes of solution-specific information have to be brought together." I have adapted Cebon's discussion of these classes into Table 2.1 below.

**Table 2.1: Cebon's Classes of Information Necessary for Successful PP**

<b>Three Classes of Information</b>	<b>Description</b>	<b>Information Resides:</b>
<b>(Generic) Technical</b>	Defines the characteristics of the technology.  Examples: specifications, performance and prices	Generally outside the organization. (i.e with a manufacturer or supplier of the technology)
<b>Contextual</b>	Describes the location (both physically and organizationally) of the technology  Includes the technical interface, all of its idiosyncrasies and the people who would be directly effected	Embedded the workplace. Local to the site of the potential project.
<b>Connected</b>	Describes the relevance of the technology to other functions.  Examples include effects on: worker safety, satisfaction or skills	Within the organization but functionally or geographically removed from the site of the technology

As Cebon also notes, each of these classes of information must be integrated into a particular solution. The capability of the firm in motivating and managing this process is its capacity for greening. In later sections I examine the role IT might play in enhancing this capability.

Cebon also identifies two different approaches firms had used, he labels these "Compliance" and "Savings".

For compliance oriented waste reductions, the approach is very formulaic. Engineers develop a quantitative scheme for ranking the waste streams. For example, they might give volume a weight of five and toxicity a weight of seven. Then they collect data and rank the streams.

For savings-oriented waste reduction however, the approach is quite different. Instead of collecting data first and then working out how to act, the employees develop an idea for attacking the problem and then collected data to substantiate their approach.



That is, while compliance-oriented waste reduction is essentially a deductive process, savings-oriented waste reduction is a much more creative and inductive process. [Cebon, 1993 pg. 177]

A key point of Cebon's findings was the context dependent way a given program will "situate itself in the corporate information-processing system". While a traditional "data intensive" EMIS might satisfy the needs of the "compliance" oriented approach above - what kind of capability would an EMIS need to provide to support the "savings-oriented" organization? The answer is: communication, to support the "creative and inductive process" Cebon identifies. Following Cebon, this thesis focuses on the organizational process of communication, and seeks to examine the implications of the increasing role of computers in supporting this communication. My main vehicle for this inquiry is a series of brief case studies examining the application of IT within firms with the explicit goal of enabling communication in EM.

These cases are described in Chapter 5, but before we turn to them, we need to establish a theoretical base which links communication, action and learning within organizations at a more fundamental level. This is the task of the next chapter.

## Chapter 3

# Theories of Communication in Organizations and the Role of Information Technology

Chapter 5 of this thesis presents the results of three case studies of firms who implemented IT in order to enhance their environmental management. To effectively analyze these stories, we must first develop a framework for the broader question of the role of communication in organizational change. This chapter introduces the theory of "Structuration" developed by British sociologist Anthony Giddens. I use Giddens' theory to describe greening as an organizational structuring process and to explore the role of communication in this process. Using Giddens as a framework, I discuss other theories which link communication to organizational change and its applicability to environmental management, including the notions of "sense making" discussed by Weick and organizational learning as popularized by Senge. I conclude by examining the treatment of IT within the organizational literature with an emphasis on how IT supports communication and, in turn, sense-making.

### Why a Theory Of Communication in Organizational Change?

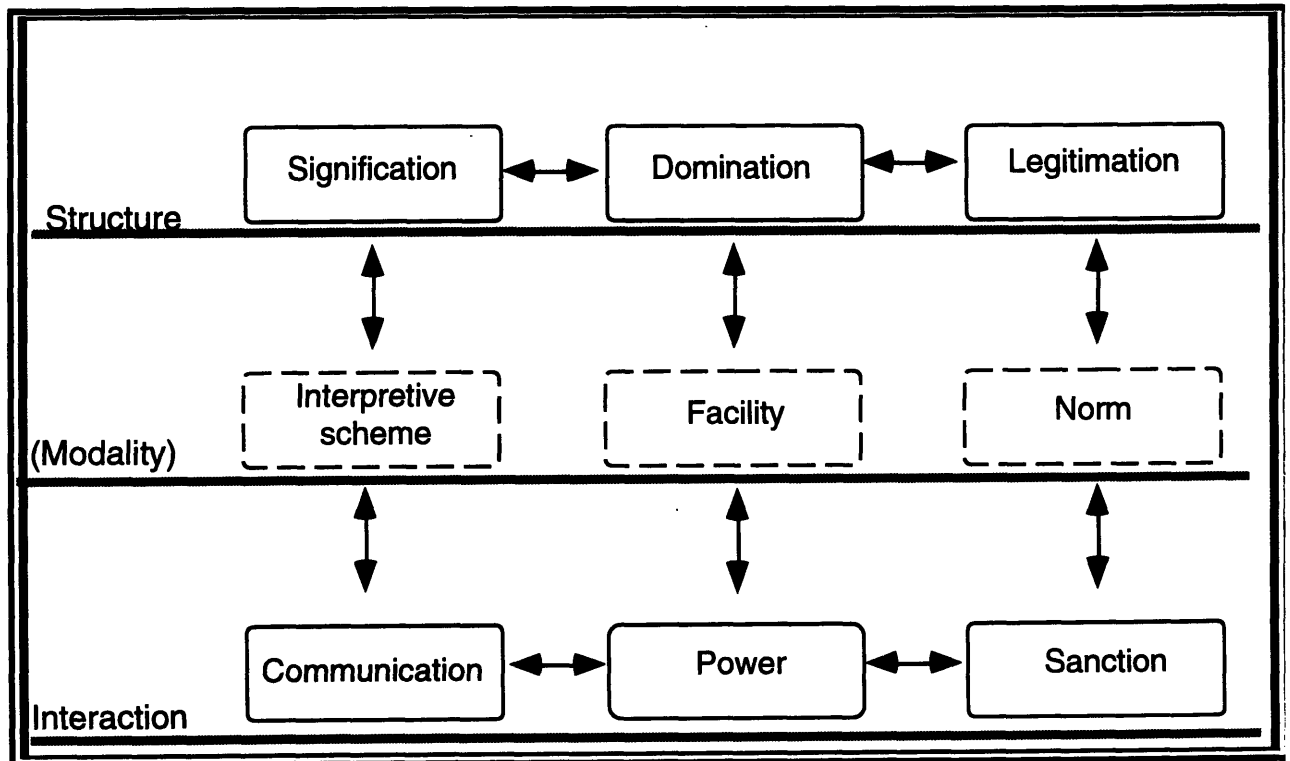
This thesis uses a small number of case studies to support the proposition that environmental management information systems (EMIS), especially as they include more communication-based features, may become an important element of the greening process. Giddens' theory provides a helpful framework for this analysis. First, the theory is used to discuss the structuring of both large institutional fields (Hoffman) and the small "eco-worlds" (Mylonadis) both of which I have relied on heavily. Second, Giddens' theory has been useful in the examination of IT within organizations, especially in the work of Orlikowski, discussed below. Thus the Giddens approach provides links at both the theoretical and applied levels to both central topics of greening and IT. A final motivation for developing this theoretical framework is that after reviewing the case material, I will use the theory to support an extension of current practices. These are covered in chapter 7, "The Technology and Policy of IT Support for Environmental Management."

Two caveats are in order before we begin. First, the following interpretation and application of Giddens work is necessarily sparse and superficial. Second, his theory is

used here primarily as a means of organizing the larger literature on communication and providing a structure through which the case material can be interpreted. Its use therefore is more organizational, than propositional.

**Giddens Theory of Structuration**

Giddens represents an organization's social system as a composition of three fundamental structural forms (Signification, Domination and Legitimation) [Giddens, 1984 ]. These forms are interlinked with actions (communication, power and sanction) through three modalities (interpretive scheme, facility and norms). While originally developed from a sociological perspective, Giddens' theory has found widespread application in the organizational literature. For this thesis, the "box" below describes the firm boundary.



**Figure 3.1: Giddens Theory of Structuration**

While at this point such a diagram is little more than a collection of highly abstract concepts, it is important to note from the start that this model links communication to norms and ultimately to Legitimation.

A central theme in Giddens' theory is that the interactions of the structures indicated above (for example between the "meaning making" of signification and the exercise of power through domination which enacts that meaning) are themselves constitutive of organization. Thus, this network of structures does not describe what organizations do or how they do it, but is itself what organizations are - they are these interrelated structures. This theme is echoed in Giddens "re-solution" of the traditional agency/structure debate of organizational studies:

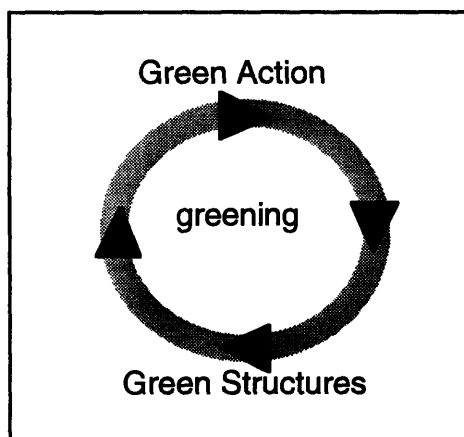
The constitution of agents and structures are not two independently given sets of phenomena, a dualism, but represent a duality . . . structural properties of the system are both medium and outcome of the practices they recursively organize. [Giddens, 1984, pg. 25 ]

These two concepts of "medium and outcome" and "recursive organization" have found widespread application in many areas. They are discussed below with respect to both EM and IT. These concepts are interpreted by Orlikowski in her application of Giddens' theory to IT within organizations:

Giddens proposes what he calls the duality of structure . . . the notion that the structure or institutional properties of social systems are created by human action, and then serve to shape future human action. [Orlikowski, 1991]

Consider "greening" as a form of recursive organization. Giddens directs us not to look solely at agency, the leadership of a CEO or the structure, policies and procedure; but

rather at the duality these establish as they recursively organize the firm. This idea is displayed in Figure 3.2.



**Figure 3.2: Greening as a form of recursive organization**

Before walking through Giddens' diagram for our greening example, it may be useful to consider a metaphor which combines these concepts. Consider a river, running its way through rugged terrain. The water together with its channel of rock and earth constitute "river". This constitution is recursive: the water as it flows is guided by the channel, yet this channel is in turn slowly eroded and deepened by the flow of water. It is both "medium and outcome". To extend this

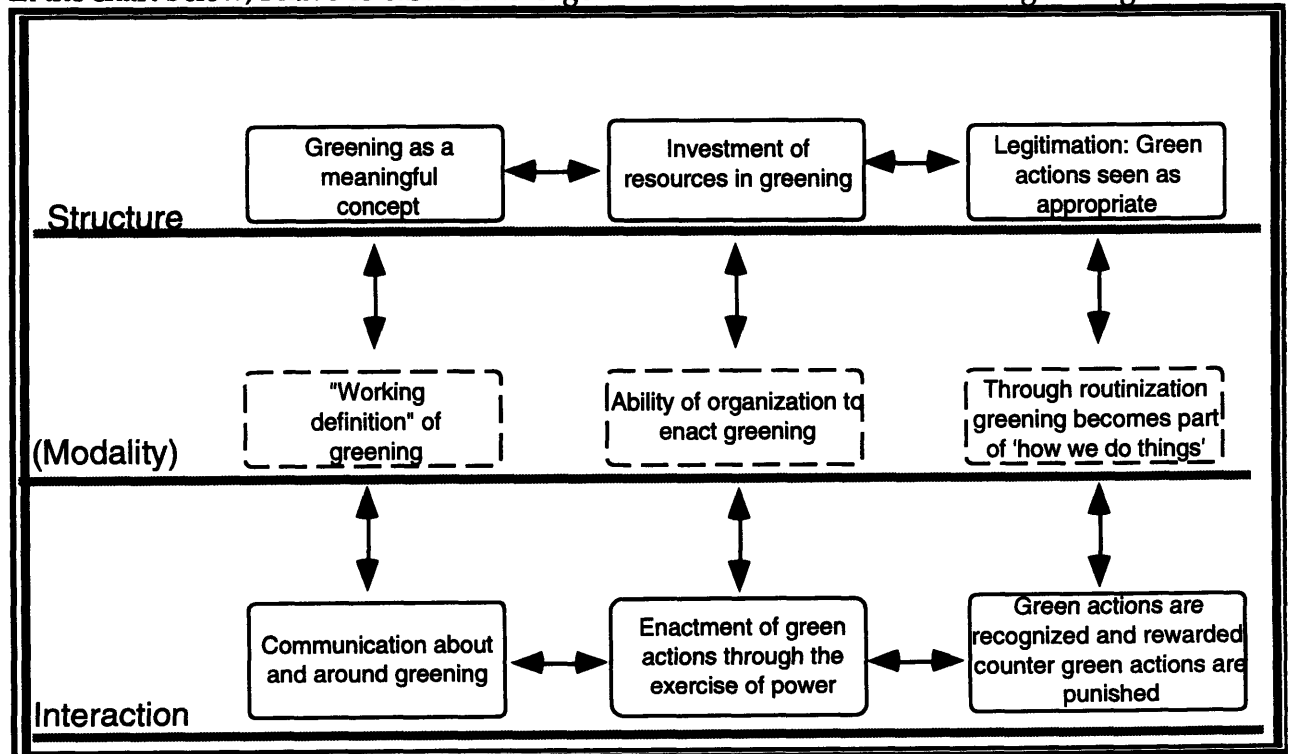
metaphor, these channels of organizational routine and culture are normally stable (while incrementally evolving) until a large perturbation (a flood or dam) upsets the current flow, and presents an opportunity for a new stream bed (organizational structure) to be established.

This metaphor is useful because it links to a final aspect of Giddens theory: his focus on "routinization" as an essential component of organizations. Like water slowly wearing its channel, Giddens emphasizes that it is through their repeated enactment (through the exercise of power) that norms and ultimately legitimacy are attained. How we do things day-to-day creates and recreates patterns of interrelationships between Giddens' three structures. This flow constitutes the organization.

In the next section, I review Giddens three structures in greater detail. For each, I apply his model to the concept of greening and attempt to demonstrate how this framework can accommodate many of the other theories of communication within organizations.

**Giddens as a Framework for Greening**

In the chart below, I have re-cast Giddens' generic framework with a focus on greening:



**Figure 3.3: Application of Giddens' framework to Greening**

For the remainder of my discussion of Giddens, I have substituted the idea of "control over resources" for Giddens' term "domination" as suggested by Orlikowski.

Signification of Greening: Signification is Giddens' term for organizational meaning making. For a theme like greening to have a collective meaning, members must have roughly agreed upon the meaning of Greening. I believe that this step is especially important for an area as expansive and ambiguous as the "environment." I encountered this ambiguity first hand when many of my potential research interviewees asked me "What do you mean by environmental management?" To be green, an organization's members must have a sense of what each other means when they talk about the "environment". The difficulty of developing a common "metric" for determining what is significant has spawned an entire literature and industry in the field of environmental performance measurement. It has also been acknowledged as one of the most difficult and important aspects of the ISO 14000 EMS negotiation by the negotiators.

Controlling Resources Around Greening: For an organization to be green, it must enact green actions - and enacting always requires a degree of power. In a green organization, power is exercised within the organization on behalf of green concerns. Thus a new product is introduced or a budget increased. Something is compelled to change in order to accommodate green concerns.

Legitimation of Greening: It is important to recognize in Giddens account that these are the "enacted" norms of an organization parallel to Argyris' "theory in use" as opposed to "espoused theory" [Argyris, 1985]. Through routinization, these actions become norms - and are re-enforced through the exercise of rewards or sanctions like the "green awards" noted by Cebon or the "audits non-compliance" report noted by my case study firms. For example, a number of interviewees said that they were most compelled by seeing environmental concerns as a natural extension of the concept of "responsible business practice"; clearly a highly normative concept. Legitimation implies that common green concerns are endorsed or "legitimized" by the organization.

Piecing these three structures together we can therefore construct a working definition of greening. A green organization has members who share some common understanding of what green means when their co-workers or CEO talk about environment, power is exercised within the organization consistent with this shared meaning and that through enactment these practices become norms - supported by

organizational endorsement and sanctioned when they are violated. It becomes "That's how we do things around here now."

With this sketch of greening as a "structuring" process we can now examine how other theories which link organizational communication to action fit within this framework.

## **Structuration as a Framework for Other Theories**

### **Organizational Learning and the Meaning-Making**

Senge's image of organizational learning as a process of sharing "mental models" fits well within Giddens' schematic of: communication -> interpretation -> signification. But Senge goes one level deeper by showing the cognitive aspect of the word "mental" in "mental model":

The central message of the Fifth Discipline is more than "radical organization redesign" - namely that our organizations work the way they work, ultimately, because of how we think and how we interact. [Senge, 1990, p. xiv]

Since communication is often the dominant aspect of "how we interact" at work, I posit that this observation applies as much (if not more) to EM as it does to other areas. Focusing on providing data to environmental decision-makers understates the need for communication by over-emphasizing "decision making" as the primary organizational activity.

Returning to the example developed by Cebon in Chapter 2, success at implementation of pollution prevention depended not only on the technical structure of the proposed process modifications but also on the quality of the "connection" - i.e. how the change would fit within its organizational context. In fact, Cebon titles his article "The Myth of Best Practices" - in order to highlight the fallacy of there being "one" best decision process for pollution prevention. Winograd and Flores quote Keen et al to make a similar point:

A serious weakness of the whole study of management has been ignorance of and lack of interest in how decisions are really made." . . . Managers are often irritated by the tendency of management scientists to focus on the inherent structure of a decision . . . ignoring the context that makes that irrelevant. [Winograd, 1987 p. 146]

The importance of context over the "inherent structure" of decisions may be especially important in environmental management because meaning-making regarding environment management is even more important given the concept's newness and ambiguity. Thus the organization member's question: "What do my colleagues mean when they talk about 'dealing with the environmental issues'?" may be especially critical. This context may often be more important (if less visible) than the structured aspects of the decisions (e.g. the cost-benefit of a proposed modification or the regulatory liability associated with a proposed course of action) which they face.

Both Winograd & Flores and Weick have noted that an obsession with decision-making over the building of common "interpretive schema" may be a limitation especially when it comes to the design of MIS to support organizations. As Weick notes:

The omission is a pervasive Western bias that reflects our preoccupation with decisions and answers, rather than with interpretations and questions. [Weick, 230]

This distinction seems especially appropriate to the EM area. While we need systems to support the decisions and answers (i.e. cost/ benefits or ROI), organizations should not ignore the infrastructure necessary for "interpretations and questions." As will be discussed in the case studies, "discussion areas" may an ideal environment for this kind of communication.

In their work on group support systems, (a rapidly growing branch of groupware I have not discussed here) Weick et al extend this perspective with the extremely useful concept of "sense-making":

Sensemaking is about negotiation and construction of a mutually shared agreement of what causal linkages and outcome preferences constitute a confusing event. To simply call these activities of negotiation and construction "problem identification" is to miss the important point that to label a small portion of the stream of experiences as "a problem" is only one of many options. [Weick, 234]

This image of sense-making seems especially applicable to the environment, since it is so difficult to categorize according to traditional schemes. The environment is not only a factor in market demand, a safety issue, or an issue of price. Perhaps it is not a coincidence that a recent EPA initiative from the Clinton administration is termed the "Common Sense Initiative" to suggest a return to more "sensible" environmental regulations. This name was surprisingly evocative to the companies studied.



Helping firms make sense of the environmental concerns they are faced with is a prerequisite for effective action on their part. From an organizational learning perspective, this approach recasts the challenge to corporations to one of "negotiating and constructing mutually shared agreement" about "greening". Labeling the environment a "problem" is only one option, although one that has characterized much of industry experience. At its heart, a problem-oriented perspective has seen an environmental management approach focused on solving the problem of compliance. Inherent in the construct of "problem" is the idea that it is solved once, in one act. It is not consistent with the notion of continuous improvement and learning. Under this "environment as problem" model, the multiple facets of environmental problems are resolved into multiple compliance problems each to be solved in isolation.

### Images of Learning

Improving a firm's environmental capability beyond compliance is thus more reliant on its ability to successfully carry out this process of "interpretation and negotiation" around environment than on the collection and calculation of "environmental data" in a structured decision process. This distinction can also be thought of as two different visions of organizational learning: one discursive, based on communication and the other, accumulative: based on data and structured decisions. Winograd and Flores contrast these two image of learning:

Learning is not a process of accumulation of representation of the environment; it is a continuous process of the transformation of behavior through continuous change in the capacity of the nervous system to synthesize it. [Winograd, 1987 p. 45]

An richly detailed example of this type of change is presented by Mylonadis in his research on the evolution of one firm's environmental culture and practice:

This study demonstrated that, in the process of learning how to deal with environmental issues, ECoT transformed its organizational structure and strategy. This finding is analogous to Maturana's observation that as the frog begins to recognize a stimulus, the firing path of the respective neuron cells changes, as well as the neuron cells that are involved –in effect both the strategy for seeing and the structure of the sight organ. [Mylonadis, 1993, p. 319]

In the findings section of this thesis I present a story of how the building and using of internal communications networks can be interpreted as part of the "transformation of organizational structure" process of firms in responding to environmental concern.

## IT and Structures of Meaning

The final piece of theoretical background we need to develop before moving onto the case material frames the question: "What role does IT play in enabling these communication structures within organizations?" To address this question, I will briefly review the literature on IT in organizational settings with an emphasis on how this technology is involved in organizational learning via structuration.

### Three Perspectives on IT in Organizations

Markus and Robey identify three broad perspectives on the generic question "what happens in organizations when IT becomes present." These perspective are shown in Table 3.1 [adapted from Markus, 1988]. I have extended their discussion to include how these perspectives might apply to the study of Environmental Management Information Systems.

**Table 3.1 Perspectives on IT in organizations applied to the study of EMIS**

<b>Perspective on IT in Organizations</b>	<b>Description from Markus</b>	<b>Applied to Study of EMISs</b>
Technology Imperative	"The essence of the technological imperative is conveyed by the word "impact." This perspective views technology as an exogenous force which determines or strongly constrains the behavior of individuals and organizations".	Technical capabilities of an EMIS (e.g. data capacity or speed) will determine its use and organizational impact.
Organizational Imperative	"...assumes almost unlimited choice over technological options and almost unlimited control over the consequences"	Organizational factors such as who buys the EMIS or who is allowed to access it will be far more important than any technical capabilities.
Emergent Perspectives	"...use and consequences of information technology emerge unpredictably from complex social interactions"	Use and consequences of a communication-based EMIS will emerge unpredictably from complex social interactions

This thesis approaches the creation and use of communication based EMISs as emergent processes. Rather than focusing on a technical factor such as the communications

system's ability to handle a wide variety of messages, or an organizational factor which encourages communication in general, I will examine the interplay of these factors in the "emergence" of new patterns of use. For example, the systems in the case study firms discussed in Chapter 5 often developed in an opportunistic and ad hoc fashion. As one MIS manager put it "Notes just happened."

The need to view MIS systems in general as having an inherently social nature has become a growing theme in the business. This perspective is acknowledged as a shift away from the "technological imperative" viewpoint which had typically focused on the computational prowess of systems rather than their social integration:

Indeed, if you carefully listen to most data-processing managers or CIOs talk, what you'll most likely hear is how well their high-tech networks handle data. It's a bit like listening to talented architects brag about their houses; they're so enthusiastic about the designs, they forget that families will have to live in them. [Schrage, 1990 ]

For this thesis, Schrage's analogy is useful because it suggests that as families have to live in houses, organizations need to make meaning using computer systems. Sproull and Kiesler's observation follows:

The more profound impact of computer-based communication may ... come from changing patterns of organizational interaction [Sproull and Kiesler, 1991 p. 35]

Along with an increasing attention to the social aspects of the use of IT in organizations, some observers have noted a need to move beyond the concept of "information as a discrete commodity." Again, Schrage notes:

Information is a derivative of the relationship, not the other way around....Instead of asking, "What is the information that matters and how do we most effectively manage it?" Companies must start asking, "What are the relationships that matter and how can the technology most effectively support them?" [Schrage, 1990 ]

This perspective of an EMIS as supporting the essential relationships that a firm must develop in order to effectively manage its environmental impact proves very useful. It suggests that instead of massive computational or bandwidth features, the system must support the flow of meaning across very different organizational boundaries.

The approach of focusing on key relationships has applicability across the firm, and is a key component of the TQM approach of always asking "who is my customer?" Moreover, this focus may be especially important in EM, first because the concepts

themselves are relational, ultimately of the firm to the ecosystem and second because EM is an area around which much organizational "sense-making" must occur. While traditional information systems may effectively support the relationship between production and distribution, the relation between the EM unit and the organization will likely need a system with an inherently greater emphasis on communication.

Thus far, our discussion of IT as a support for organizational sense-making has focused largely on the idea that simply by enabling communication or interaction, organizational sense-making will be increased. Yet if we return to the concept of IT as an "emergent" phenomena then we can see ways in which the *use* of the technology itself conveys meaning. Take the example of an "environmental information exchange" within a firm. What one reads one day shapes what one contributes the next day, thereby shaping one's co-worker's experience tomorrow and, recursively, one is affected by the co-worker's contribution. Thus the overall pattern of use emerges over time. These related concepts, emergence and recursion, have been a central theme in the application of Giddens' theory to IT<sup>2</sup>:

Human social activities, like some self reproducing items in nature, are recursive....That is to say, they are not brought into being by social actions but continually recreated by them via the activities of agents which reproduce the conditions that make these activities possible. [Giddens, 1984]

"And so it is with the relationships between communication structure and uses of organizational media - each shapes the other in an emergent pattern of mediated and non-mediated social interaction. [Contractor, 1990 ]

...Giddens' "dialectic of control" - the social technology shapes the user, but the user likewise shapes the technology, exerting some degree of control over its use and meaning in social action. [DeSanctis, 1990 ]

...information technology is the social product of subjective human action within specific structural and cultural contexts - and its *constitutive* role- information technology is simultaneously an objective set of rules and resources involved in mediating (facilitating and constraining) human action and hence contributing to the creation, recreation, and transformation of these context. Information technology is both an antecedent and a consequence of organizational action. [Orlikowski, 1991]

These observations are especially relevant for our consideration of EMIS because instead of considering the "impact" of the one set of technical capabilities represented in a static EMIS "database" system, we are instead studying the "emergence" of new patterns of

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<sup>2</sup> For a good review of the literature on the application of Giddens to IT see the paper by Walsham and Han [Walsham, 1991]

communication whose rules, meaning and organization are themselves the subject of continuous negotiation.

This intimate interconnection between IT and the social context of its use has been extended by Johnson et. al to society at large. They develop the notions that "Groupware is computer-mediated culture" and "Groupware as context" which they suggest is "based on the social theory that human systems are self-organizing and arise out of the unrestricted interaction of autonomous individuals" [Johnson-Lenz, 1991]. Johnson extends the concept of "learning" we have used here as it applied to the firm and its environmental practice to culture writ large. Thus, the burgeoning use of wide-area networks (e.g. Internet) and the new patterns of communication they enable are seen:

As the virtual reflection of developing society, purpose-centered groupware is an essential part of the necessary transition to a vital, sustainable culture. [Johnson-Lenz, 1991]

### **Re-interpretation of a classic: Barley as Structuration Occasioned by IT**

This chapter introduced structuration theory with the objective of developing a theoretical framework with which to interpret the cases presented in Chapter 6. It may be useful to end with a consideration of what is perhaps *the* classic use of structuration theory to case-based material.

Barley's account of the introduction of new medical technology (CT scanners) into two suburban hospitals [Barley, 1986 ]. This research has been cited frequently in the literature as a powerful example of structuration in action:

...as in Barley's analysis, the scanners occasioned change not because of their inherent characteristics (as the technological imperative would hold), but "because they become social objects whose meanings were define by the context of their use" The technology presented an "occasion' for structural change but did not determine which of a large variety of alternatives actually emerged from the process of structuring.[Markus, 1988]

Technology [in Barley] is not regarded as causing or even constraining structure. Rather, technology is an "occasion" for structuring because its presence provokes human interactions that may subsequently effect revise social structures. [Orlikowski, 1991 pg. 12]

Through painstaking observation of doctor-technician interactions surrounding the introduction and use of the scanners, Barley demonstrated structuration in action. Two

especially relevant findings of this work were: a) the significant differences in the structuration trajectory of identical technologies in similar settings (two suburban hospitals) and b) the essentially social constitution of this trajectory. While nearly all of the authors cited in this section have discussed Barley's work in the context of the structuration around a generic technology, I believe it is especially useful to view the CT scanners *as information technologies* in that what the CT scanners provided was, in essence, information. It was the complexity and ambiguity of the information provided by the technology (a series of images and numerical readouts) that established the context for much of the structuration Barley observed. Many of Barley's most fascinating findings came from the structure of the discussion which would ensue as the doctors and technicians sought meaning in the output of the device. This joint "sense-making" becomes especially interesting as it transgressed or re-enforced pre-existing (or evolving) power relationships and technical understandings.

For example, in one hospital doctors developed a collaborative relationship with the technicians and would ask their advice on the operation of the scanner and the interpretation of the images. [Barley, 1986 ]. Here there was joint construction of "interpretive schema" which were shaped by existing power structure and norms. In the other hospital, relations went in nearly the opposite direction. Doctors took it upon themselves to decide an 'interpretive schema" and actively excluded the technicians from this work - even when technicians possessed superior understanding of certain key features of the instrument - understanding the doctors presumably could have benefited from.

As will be discussed a greater length in Chapter 6, Barley's research suggests that given the intimate relationship between firm culture and the trajectory of a technology like an EMIS, one could imagine the same diversity of responses. While some EH&S groups might find the transition of their roles to facilitators of discussion, trainers or consultants liberating, others might see the widespread distribution of EH&S information in the form of an EMIS as a threat - especially in cultures where sole-source knowledge is power and diffusion of knowledge is diffusion of power. The case study firm FoodCo experienced precisely this phenomena as the senior "expert" EHS staff actively resisted implementation of the EMIS evidently because it represented a reduction in the firm's reliance on them as "sole sources" of this information. Thus the EMIS became an "occasion" for structuration, as the firm began to implement a central tenant of organizational learning: the sharing of information.

Having developed this framework, we are now ready to meet the case study firms, and learn from their experiences in implementing these systems. As a final prelude, Chapter 4 reviews the methodology used to develop this thesis topic and identify the firms for study.

# Chapter 4

## Methodology

### Research as an iterative process

Like the emergent process this thesis seeks to study, my selection of this particular topic, EMC/Groupware and environmental management, was an iterative process. To provide the context for the study, I will briefly retrace the path that led me to this topic.

My interest as a researcher were initially drawn to the general area of IT and EM by the realization that anything approaching "greening," especially as embodied in Life Cycle Analysis or Design for Environment, would require the integration and manipulation of massive amounts of information. It appeared likely that firms were using IT to manage data of this magnitude. I wondered if any commercially available products offered any interesting structures in support of environmental planning. I examined the currently available integrated software packages such as ECMS®<sup>3</sup> and EnCompass®.<sup>4</sup> However, both the relatively limited penetration of these products and their extremely heavy emphasis on compliance and industrial hygiene led me to look elsewhere.

At the same time, I became increasingly aware of the critical social and organizational aspects of the environmental management process I was interested in. Coupled with an increased exposure to the Internet, I began to wonder about the use of large scale networks in the functioning of EM. The two theories of "institutional field" and "Structuration" applied to environmental management by Mylonadis and Hoffman suggested that there were powerful social forces both outside and within the firm shaping environmental management. I surmised that IT could have a powerful influence in organizational communication, in some sense the heartbeat of these social processes. I chose to focus on the forces inside the firm. This led me to examine large scale "discussion groups" and "forums" related to the environment, to see what impact they were having, or could have, on environmental management.

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<sup>3</sup> ECMS stands for Environmental Compliance Management System, an integrated compliance management system sold by Versar, Inc., Springfield, Virginia.

<sup>4</sup>EnCompass is sold by Navix Corp. (Greenup, KY)



I reviewed the Internet and then commercial networks (America Online®, and CompuServe®). Unfortunately, my initial survey indicated that although there are beginning signs of use of these systems by environmental professionals the wide access and very high "noise level" of these forums did not provide an appropriate setting for substantive discussion.

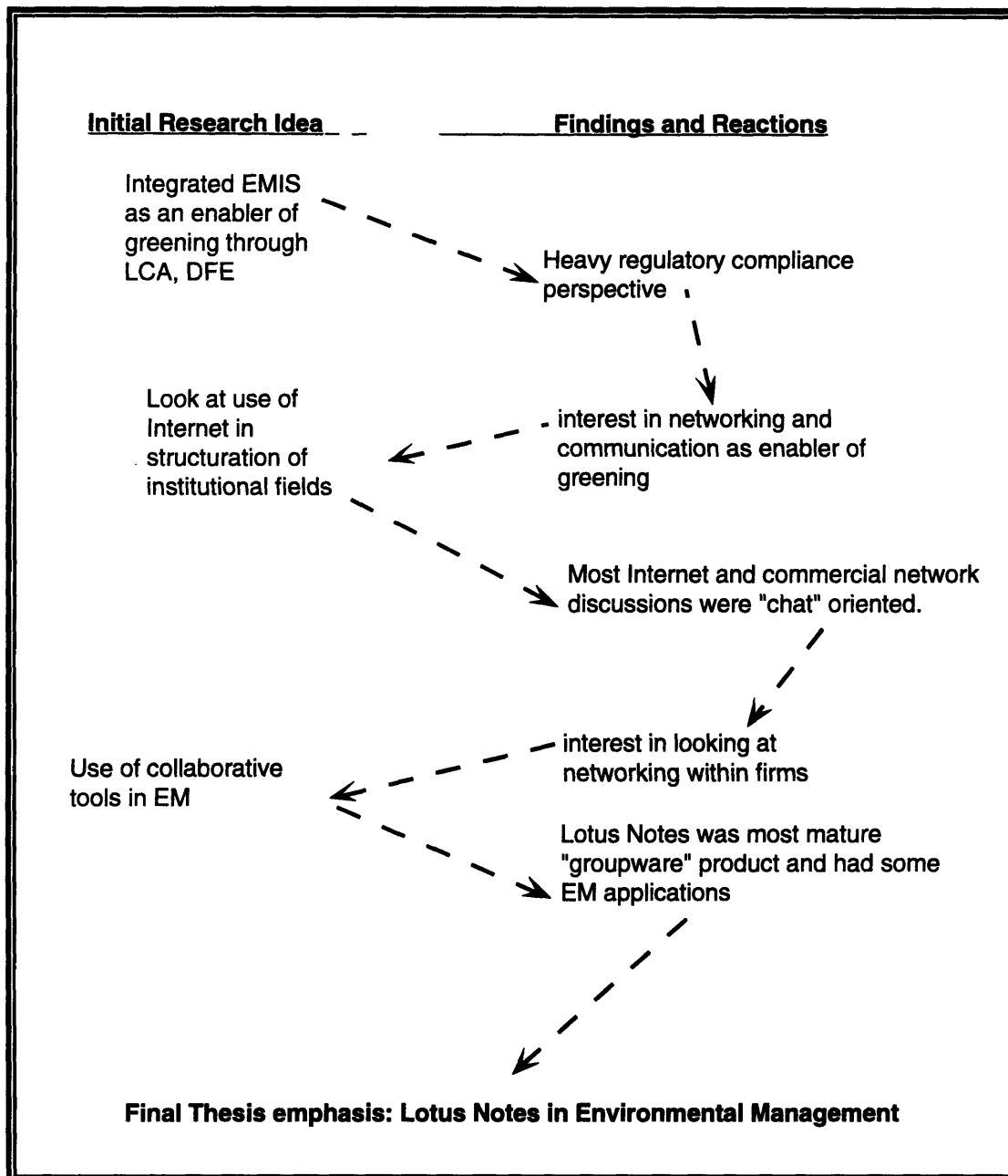
The results of a limited study of the USNET newsgroups and CompuServe forums will be reported separately.

### **Groupware as a Medium for Analysis**

Given the proposition that electronic communication between environmental professionals and the rest of the firm needed a more context rich environment than the traditional data collection, archive and retrieve functions of IT , I then returned to the idea of studying individual firms and EM within them. I first considered analyzing simple daily e-mail use for EM but found it difficult to distinguish e-mail for EM from e-mail for other day to day activities. In addition, preliminary conversations with firms suggested that access to "personal" e-mail messages, even where they involved routine communications, would be a sensitive issue. I then turned to the newly evolving area of "groupware" which supported communication in varying degrees of "public-ness." I became especially interested in those features of groupware that provided firm wide "sharing spaces".

Through exposure to Lotus Notes in a course taught by Tom Malone at the Sloan Center for Coordination Science, it became clear that Notes was the most mature product that firms might have imported with the explicit idea of fostering collaboration and inter-group communication. This hypothesis was confirmed by my preliminary literature search. In addition, I discovered the research by Orlikowski at the MIT Sloan School, which assessed the social character of IT within organizations. I was especially interested her use of structuration theory interpreting fieldwork with systems including Notes.

Although other products existed, and other in-house systems had been developed with this capability in mind, Notes seemed the most mature. (In fact, one firm (OfficeCo) finally selected for study did in fact have a proprietary system with much of Notes' functionality).



**Figure 4.1: Research Topic Development**

**Identifying Firms for Analysis**

Once I had settled on the area of Notes or equivalent products in EM, I began look for firms to study. I inquired into companies participating in the MIT Technology, Business and Environment Working Group, with which I was affiliated. I also used several online databases to search for firms which were acknowledged to be large Notes users and who were also likely to have significant environmental operations. Interestingly,

the literature search revealed no any published citations on the use of Notes specifically to support environmental management, nor was Lotus Development Corporation (the creator of Notes) aware of any firms that were using Notes in this capacity.

Perhaps the most novel, fortuitous and interesting avenue I pursued in search of firms was a "post" to two USENET news groups describing the research and requesting interested firms to respond. This post produced many responses from firms as well as from some consultants who were interested in using the results of my study in their work. Among the most significant contacts made through this post was with the consulting firm RPM Systems Inc. of New Haven, Connecticut. RPM had recently begun using Notes to construct EM applications for clients. They provided invaluable assistance with both general background in the newly emerging field in addition to contacts with other firms.

I made preliminary phone calls to all firms who responded to assess their interest in participating. This initial screening produced a list of six firms. Due to scheduling and other constraints, I ended up visiting five companies. Of the five I visited, three had systems developed enough to produce results for analysis. These three are presented in Chapter 5. The two companies I did not discuss here had systems which were simply too new. They had not been in use long enough to provide useful data for the analysis.

To ease my entry into the firms, I elected to keep the identity of the firms confidential. In addition, I also offered firms both a copy of the thesis itself, and, along the lines of a modified Schein "clinician" model of interaction, offered them a brief memo, with my own observations and recommendations. It was my hope this would be of interest to firms in terms of identifying things I found in other firms which they might be interested in learning from - in effect as an informal way of benchmarking their systems anonymously. Of course I admitted to them that I could make no guarantee as to how useful these results might be. My secondary motivation for this approach was to encourage an honest and critical discussion of the systems capabilities and problems. Although I did not ask, I did get the impression that most people were not inclined to spend the time with me unless they thought they would get something out of it.

Prior to my site visits, I gathered background information on the firms regarding their experience and background with environmental issues and information technology. Most of the background information came from searches of Nexus and FirstSearch databases.

## **Content of Interviews**

During my interviews I sought to balance the need to ask similar questions of all firms with the importance of allowing all interviewees to "tell their story," especially around critical incidents involving the IT systems. I developed an interview guide, but permitted the discussion to stray from it when appropriate.

The structure suggested by Orlikowski also proved extremely helpful in organizing both my questions and interpreting the responses [Orlikowski, 1991 pg. 21]. This structure organizes the "issues" surrounding IT (in this case the EM communications system) within organizations into the following areas:

- 1) The development of IT within the firm
- 2) Deployment story of the system
- 3) Its intended and unintended consequences
- 4) The conditions through which agency changes the function of IT
- 5) The conditions within which IT sustains or undermines the status quo.

This framework formed the underlying structure of my interview guides and data analysis.

## **Conducting the Interviews**

After much debate, I elected not to tape record interviews. Firms were hesitant about exposing commercially sensitive information that sometimes arose, although I tried to stay away from it when it was not directly relevant to the questions. There may have been some sensitivity about compliance issues as well. Instead, I took notes directly into a laptop computer and in most cases "cleaned-up" soon after to ensure clarity of my sometimes rushed typing.

An extremely useful aspect of the site visits involved the chance to "demo" and browse through postings on the computer systems with the interviewees. I was surprised and pleased by the access I was granted to their systems. In some cases, I navigated alongside the interviewee, reading and asking questions about posts as they appeared on the screen. In others, I was left alone to work the terminal myself and discuss the posts I saw later with the interviewee. This provided me an opportunity to assess the meaning "in context" of the readers.

In most of the firms I interviewed the MIS and EHS manager involved with the system and one or more users, although in many cases these distinctions were not at all clear.

For example, at ExploraCo, the senior EHS manager was informally involved in the design and implementation of a discussion base, but was also a major user.

### **Review**

Once interview results were written up, they were sent to case study firms for review. In most cases, firms offered very limited comments.

## Chapter 5

### Results of the Firm Case Studies

My search yielded three firms which were appropriate for study. In this chapter, I outline the results of the site visits for each firm. Table 5.1 describes the firms.

**Table 5.1: Three Case Study Firms**

<b>Firm Pseudonym</b>	<b>Sector</b>	<b>System Studied</b>
<b>ExploraCo</b>	Petroleum Exploration and Production	Small Lotus Notes Discussion Area for EHS staff
<b>FoodCo</b>	Food and food related products. Broad range of production facilities	Large suite of Lotus Notes Applications designed by corporate EM office for use by subsidiaries
<b>OfficeCo</b>	High Technology Office Equipment	Integrated e-mail distribution list and file sharing system.

#### Case Study Firm 1: ExploraCo

ExploraCo is the exploration and production (the "upstream" in oil parlance) division of a large US-based oil company. It contains approximately 100 employees with direct EHS responsibilities. ExploraCo's environmental responsibilities primarily revolve around their exploration, drilling, production, gas processing and delivery via pipeline. Typical issues they were concerned with were disposal of drilling muds and brines, air emissions, spills and leaks from pipelines. Environmental management responsibilities were tied into a corporate "core value" phrased in terms of "protecting workers and neighbors, in the course of conducting our business." The EHS manager emphasized that despite the size of his group, EHS issues were "lost in the rounding" in terms of the total budget of ExploraCo.

Notes was introduced into ExploraCo when the Corporate MIS department secured a volume discount on Notes and established a practice of distributing copies on an as requested basis. Thus groups who thought they might have a use for Notes would request it, and then work to develop their own applications. In some sense, this is a "let

a thousand flowers bloom" approach in which people had to ask for the "seeds". As the Senior MIS manager noted, "Notes just happened". The senior ExploraCo MIS manager explained that Notes use grew slowly for the first year but has grown rapidly since then. Notes is now being adopted as the standard for collaborative work. By the time of the research, the parent company had thousands of Notes "seats".

ExploraCo also experienced the familiar "explosion" of discussion groups, some with names as simple as "coffee shop." Aside from their sheer volume, some of these databases raised concern for their content of free flowing commentary and "off-color" jokes. In retrospect, this was seen an evolutionary phase. The MIS manager noted that while there may have been a number of policy memos on the subjects of appropriate use, the controversial databases "eventually went away, but it was not a big deal".

#### **Implementation of the ExploraCo Environmental Health & Safety Discussion Area (EHSDA)**

Approximately 9 months prior to the interview, a Division EHS Manager proposed the idea of a discussion group for environmental issues to the Senior EHS manger. The initiation of the discussion base required no formal approval or involvement of the MIS department. "We still have some bureaucracy at ExploraCo but not that flavor". This easy start-up was seen as a natural extension of their work, and very much in line with ExploraCo's "work together" attitude. For the EHS department, the EHS manger estimated that 20% to 25% of the 100 staff were connected.

Consistent with the informal approach taken towards the implementation of the EHS Discussion Area (EHSDA) was the decision to keep the structure very simple. There is only one posting area and all messages are visible from there. As users at other firms noted, this is consistent with the theme that you don't always know what you are looking for until you see it, and an overly structured environment forces you to pre-screen areas you may be interested in.

The manager also noted that he used the EHSDA more as another source of general information about "what's going on" rather than as a source for any pre-defined information. As an example, he noted that he learned about a regulatory requirement that ExploraCo use alternate fueled vehicles from a co-worker who posted the regulation along with a commentary. He was not looking for this particular piece of information.

ExploraCo staff allowed me to read the 200 postings that had been made during the 9 months of the discussion area's operation. Most of the messages posted did not have responses - although a few had as many as nine. The overall rate was disappointingly low to the ExploraCo Manager- particularly the low rate of responses to postings. He expected use of the system to grow as more EHS staff were set up with Notes.

I identified four general types of messages on the system:

- information posts (e.g. regulatory updates)
- requests for help/information (i.e. on a particular kind of pipeline)
- general discussion comments meant to solicit comment (often concerning regulatory matters)
- proposals coupled with "straw polls", i.e. "I propose we do x, what do others think?"

Despite the fact that the technology itself added a new communication capability to the EHS staff nationwide, ExploraCo manager stressed that openness and emphasis on horizontal communication was already part of the culture of ExploraCo. ExploraCo had undergone significant down-sizing and "de-layering" so, while Notes would have been a "big deal" 10 years ago, it would not be right to say that the use of Notes was tearing down organizational barriers, because those barriers are no longer there. He could recall a time at ExploraCo where this kind of communication may not have fit the culture.

This thinking was also reflected in the fact that the EHSDA was accessible to anybody in ExploraCo, including the other non-exploration divisions of the company. Managers decided that confidential information could always be handled through e-mail.

This EHS senior manager was located in the corporate office, but had "dotted line" authority (this is the same term used at other case study firms) over EHS staff at the production centers. Thus while the EHS staff reported to the local division manager, the senior manager I interviewed was involved in personnel reviews. With this "dotted line" reporting structure, the EHS manager noted he paid attention to staff participation on the EHSDA. "Since we are not located in same city, I do not have daily contact but through the system I can see they are active - and this is lots faster than the normal channels"

The manager noted that while he was increasingly requesting that correspondence be carried out through Notes, he did not anticipate ever making participation in the databases a formal component of the performance incentive system.



A next step for the system will be to place issue papers on-line. These papers review environmental issues relevant to ExploraCo. They compile the regulatory, trade association, ExploraCo and others views into a common document. These documents had previously had limited distribution on paper. My interview question as to whether or not ExploraCo would be looking for comments on these papers prompted an especially interesting conversation. They are now considering how or if to look for comments on these papers. That question would have never even been asked before Notes gave them an opportunity to manage the process. This process of comment management was noted as primary strength of Notes.

### **Case Study Firm 2: FoodCo**

FoodCo is a large producer of food products with a range of subsidiaries in related industries. FoodCo facilities cover a wide range of both size and manufacturing processes. Like OfficeCo (described below) it has had a tradition of corporate emphasis on environmental issues, especially as they are related to the quality and purity of its ingredients and their agricultural sources. Also like OfficeCo, there has been a strong connection between the Total Quality Management philosophy and the environment. This perspective is evident in the approach and the language used in many of the environmental applications discussed here.

As a manufacturer, FoodCo's concerns vary from facility to facility. Most are concerned with waste, water and air emission from its food processing lines. The packaging plants have additional concerns consistent with those of traditional light manufacturing, including some limited use of hazardous materials. FoodCo has an aggressive and successful program to encourage the recycling of its packaging, both for consumers and for its own industrial suppliers. With well over 100 facilities where environmental management is an active concern, FoodCo facilities have a wide range of EM information systems. Until recently, most of these systems were only semi-automated, consisting of site specific spreadsheets, databases and manuals.

The system I studied was a suite of relatively new Lotus Notes® applications developed by the corporate environmental offices but intended for use by the facilities. The central motivating theme of these applications is a standardized "Environmental Management System" which could be tailored to fit each facility's needs but would enable the corporate office to track, guide and support the environmental programs at the facilities. Central to this effort is an Environmental Management Workbook - an electronic

document that provides a customized and customizable database describing the management system and supported by a system of audits and measures.

The applications suite also includes a capital budgeting system, used to ensure that environmental considerations (i.e. opportunities for efficiency and PP) are considered early in capital investments, and a simple information exchange or discussion area, similar to the one studied at ExploraCo.

FoodCo's experience highlights the challenges of attempting to coordinate the environmental practices of a decentralized and diversified corporation. How can a corporate office improve environmental practice without creating the very hierarchical systems that prompted decentralization in the first place?

This is a special challenge given the diversity of facilities themselves and the differences in staff experience with environmental issues. Some facilities at FoodCo have established EHS staffs, while for others, environmental responsibilities are covered only part time by staff with other primary responsibilities. FoodCo corporate EHS staff noted that the more experience they have, the less they tend to like the "Workbook", at least initially, because it covers areas they feel they have well in hand. On the other hand, for those without established systems, the "Workbook is a God-send".

### **History of Notes Development and Implementation**

The corporate requirements now cover areas beyond compliance. FoodCo is positioning itself for the future. " It takes a long time to get all of this up. If you don't start now, 10 years from now, other companies will not have it, we will have competitive advantage" In order to prepare for the future, we cannot just say 'Here are the regulatory requirements, go do them. [We have to] anticipate. The upcoming ISO 14000 EMS was definitely seen as a factor in this planning, especially given FoodCo's international operations. Staff stressed however, that these have just as great an impact on domestic facilities as well.

Notes was introduced into FoodCo 's Environmental Management group after it was identified as a superior alternative to an in-house database being used to track audits and audit exceptions. As the FoodCo employee recalled, "we were looking around for idea and somebody stumbled on Notes and said this looks good". In addition, FoodCo had commissioned a consultant to help them benchmark their still developing audit plans with those of other companies.

The immediate and significant draw of Notes was its capability to quickly provide a "pseudo-network" with the many sites with which the corporate EHS office worked. FoodCo EHS staff knew it would take a long time, if it ever happened at all, for all facilities to be tied into a traditional "leased line" network for continuous communication. And yet, they needed to work with these facilities daily. This ability to support modem connections to these facilities immediately was an especially attractive feature of Notes.

The implementation of Notes at FoodCo encountered less of a clash of culture than anticipated. "We were actually surprised at the rapid acceptance. Now we are in the midst of trying to catch up with the demand created. There are many requests into the MIS group for databases specific to various departments. We are also trying to give guidance on security and consistency and scalability." It's very easy for people to "get a hold of Notes and go crazy." This is precisely the experience ExploraCo had in its Notes introduction as well.

### **Making green arguments inside FoodCo**

Staff at FoodCo agreed that you do not typically see investments made only because they are environmentally beneficial, but rather because they offer an opportunity for some balance of reducing future non-compliance, reducing cost or improving the image of the firm.

Initially there was something of a backlash against wider promotion of environmental concerns. People did not want to be associated with an area that had been nothing but "a pain". The perception of environment issues was: "If there is one thing of consequence in environment, you can slip up, get caught out of compliance and get in big trouble from your boss." But now with the successes in energy recovery and recycling (for example) people are more willing to try.

The corporate EHS at FoodCo also noted that they must often convince those skilled EHS staff at the local facilities around the country that investment in the system is worthwhile. They must argue that this is "larger than just you, this is for FoodCo Inc." The system turns out to be highly valued by the managers of those EHS staff who know they have liabilities and deliverables in the environmental area but don't know it as well as they know the production processes. Most of these managers were promoted up through the ranks on production lines. Thus this system, with its emphasis on structure, gives them a way to manage environmental concerns as a core business process - like

they do others. Just as they would not think of having a production line whose operation was a mystery and known only to one person, they like the idea of institutionalizing environmental management. The Notes applications are a vehicle for this. Conversely, some highly skilled EHS staff may interpret the Workbook as a threat to the facilities dependence on their expertise.

### **Organizational changes brought on by Notes**

The audit process, however, can act as a way of transferring practices since the auditor may say "you need to improve here, why don't you look in the Louisiana facility's Workbook at how they handles this". Each facility's Workbook, describing their unique practices, are accessible across all facilities. Of course the staff may just call and talk to their counterpart as well.

FoodCo staff thought that the increased communication with and among the facility EHS staff was the among the most important capabilities Notes brought. This communication, either through the EQM, or the asking or answering of questions via the system may help built the professional image of the facility environmental staff. This improved communication is especially valued by staff with less experience who had previously felt isolated. There was much they did not know, and were afraid to ask.

FoodCo Interviewees noted that the system had already changed the way they work just by enabling the sharing of information. Their corporate EM jobs have changed markedly. Notes is responsible for much of this, since it provides the corporate staff with the opportunity to have a much wider impact with the same manpower. This is especially helpful because these staff people have to wear two hats - auditor and helper. Notes provides a resource for both roles. FoodCo thought that they had not yet exploited the Notes' potential for horizontal sharing of information ---yet they hope that this capability and use will grow.

FoodCo hosted their first conference of EHS staff from the facilities in 1991, and it was very obvious that getting together to share ideas benefited everyone. If one subsidiary had solved a problem, others could learn from them. The audits themselves were used in this way. This conference demonstrated the potential of horizontal transfer of practices. The Workbook database should help with horizontal sharing. FoodCo is also considering a personnel directory which would contain information staff's areas of expertise. They noted that staff now notice the names of authors of posted documents

and this builds a sense of professionalism and expertise. Prior to this kind of sharing the staff at facilities were basically on their own and each had to invent their own solutions.

Among the most significant changes brought on by having the Workbook system on Notes was an increased sense of ownership that facility EHS staff felt once they realized and acted on the notion that the Workbook was their document. They could make changes to it as they learned new practices. They are working to see that the EQM is not a static, "dead" document. "We are actively engaged in working with overseas facilities on their Workbooks. This would not be possible without Notes capabilities." The moment paper documents were completed, they would be out of date.

In addition, the increased communication and sharing of data has raised the "naturally competitive nature of some engineers". Since the Workbooks are accessible to all, each facilities general performance and management system can be compared. This was seen as a mostly positive development.

FoodCo experienced the way Notes changes business expectations. The staff from the legal division asked why the new system they were developing could not automatically import data directly from the facility Workbooks rather than the legal staff having to collect it manually. They would have never even thought of asking for this kind of capability before Notes.

FoodCo operates a sophisticated waste water recovery system and analytic laboratory. This system produces a salable product using the waste water left over from one of the process lines. Prior to the introduction of a Lotus Notes based pilot application, the three facilities had very little communication. This would result in a lack of coordination between the outflow of the plant and the receiving plant's ability to accept it. When a miscommunication occurred, the flow would have to be diverted to the POTW rather than the recovery facility. Thus the treatment facility was both physically and organizationally at the "end of the pipe". Using a Notes application, communication between the two facilities was improved and they began to coordinate more effectively. This suggests that an information system can play a role in the organizational and the material integration of pollution control. Participants in the pilot estimated a significant savings in time by reducing the amount of data collection (typically by phone calls or faxes) or data re-entry they had to do.

FoodCo staff noted that environmental professionals were traditionally seen largely in the context of dealing with problems, or making sure that environmental issues didn't

interfere with production. If an expansion was planned, completed plans would be drawn, then given to the EHS staff with the mandate to "handle it".

The new Notes application suite contains a "Capital planning" module which offers an opportunity for an environmental review of all significant capital investments to ensure that environmental concerns such as opportunities for efficiency improvements or pollution prevention can be identified early. The goal is to proactively take advantage of access to information in the planning stages rather than reacting to investments once they are made. As an example, this process identified a significant savings opportunity in a planned chilling line.

### **The importance of "Views" in Lotus Notes as a support for browsing**

In addition to its capability to communicate information, FoodCo staff also noted the importance of the "view" function in organizing that information. "In traditional database systems you get only what you look for. We are now finding that with the chemical master list, things we did not look for are showing up because of the context Notes provides." One FoodCo interviewee put it "you don't know what interests you until you see it." In a traditional, report-driven database "you find only what you are looking for . . . the bizarre ones are screened out." One interviewee also noted that most views used in the Notes application provided information in a list form where it was surrounded by other information. One then selected the item of interest and 'zoomed' in. There is a synergy gained by allowing people to browse, to follow their curiosity. FoodCo estimated that about 1/3 of the EM staff connected with Notes do some "browsing".

The ability to easily attach documents (e.g. spreadsheets or word processing documents) and share them with co-workers especially at other sites has been especially valued by facility staff. In some cases this capability has been the one thing that "sells" them on Notes.

### **Case Study Firm 3: OfficeCo**

OfficeCo is a major manufacturer of high technology office equipment. For over a decade, OfficeCo has placed a very heavy emphasis on "TQM" approaches. This quality emphasis is also evident in OfficeCo's aggressive environmental programs for which it has received widespread recognition. OfficeCo is an acknowledged leader in the area of corporate environmental practices. With its emphasis the "office", OfficeCo has had a

long history of information technology projects and products. OfficeCo established an advanced in-house e-mail and file sharing system relatively early, and continued to use this proprietary system up to the present. At the time of this research, OfficeCo was in the midst of a transition from this platform to a well-known application suite.

My research at OfficeCo focused on the use of internal e-mail based "distribution lists" for communications and information sharing supporting OfficeCo's corporate level environmental initiatives. Similar lists, numbering in the hundreds, exist for smaller, often facility specific groups throughout the company. I also did not assess the use of facility-level systems used to track traditional compliance issues such as permits and discharges.

The OfficeCo Green Distribution List (OCG) was the primary subject of my OfficeCo interviews. The OCG was created after the consolidation of other Distribution Lists (DLs) dealing with environmental issues. The list was intended to support OfficeCo's Environmental Initiatives. The manager of these programs (and the OCG "owner") noted: "as we started our environmental initiatives we knew we had to tap the resource represented in the skills and interests of individual employees through the firm - thus the early emphasis on building internal connectivity through the DL's like OCG". Unlike "open" lists, OCG is "closed." OfficeCo employees must request to be added to the list through its "owner". This arrangement is intended to keep the traffic on the list directly relevant to OfficeCo environmental issues. The list is not intended as a discussion area for general environmental issues.

The owner of this list also uses the list itself, and any new requests to be added to the list, as an internal networking tool by compiling a directory of member's work areas and current projects. Thus the list is used not only as a communications medium but also as an tool for promoting "cross-fertilization". This manger described his job as evolving from conductor to cheerleader for OfficeCo environmental initiatives.

### **Evolution of Greening and Green Arguments at Office Co**

OfficeCo interviewees noted that one could really see an evolution of ideas within the company concerning greening. Most arguments for environmentally beneficial investment often still contained strong cost components, though the environmental benefits are increasingly acknowledged as important. For example, there was a debate regarding a significant redesign investment necessary to enable a certain part to be recycled. There was a strong long-term cost savings argument made, but it finally came

down to a small number of committee members who were environmentally inclined to give the project a go ahead. The project has since been very successful.

The "Conserve" DL is used as a forum for discussions on issues such as water conservation and transportation to work (a significant issue for a large employer in an area with air quality concerns). This interviewee noted that both the team meetings and the DL discussions reflected the diversity of motivations and attitudes towards environmental issues of OfficeCo employees.

"Some people come in with different concerns. Some want Conserve to only do things that will save OfficeCo money by any means that deal with conservation - less energy or less paper - this is what they [at the meetings] for. Others, like me, think it's fine to be saving OfficeCo money but also stress OfficeCo's responsibilities to be a good corporate citizen. We are inclined to propose things that are a little riskier, like the installation of drought tolerant landscaping for our water conservation project. We see these efforts as especially important given OfficeCo's acknowledged leadership in the corporate environmental area. We hope that by setting a good example, others might follow."

DL's exist to support the work of the many environmental committees in OfficeCo. In addition to being used for the normal distribution of agendas and minutes to committee members, OfficeCo has defined a category of "committee participant" who, while not formally part of the committee, is on the DL. This allows an employee to stay informed on a committee's or team's work. Where committee or team interests overlap (as is often the case for environmental issues) groups will often elect to add or subscribe their entire DL to other DL's. Email, both person-to-person and DL traffic, is now a major route (and in some cases the sole route ) for official communications. Membership and monitoring of DL is often a formal job responsibility for some people.

When asked if he thought people actually read the posted meeting agendas and minutes, he replied he thought they did and gave an example of where electronic distribution of this information had an impact. The Conserve team, (also the name of the DL) was meeting to discuss its various projects. The interviewee, who was present at the meeting, raised the idea of swapping the incandescent bulbs in the lab with compact fluorescent bulbs, as an energy conservation measure. After this meeting the minutes were distributed on the Conserve DL. The facilities manager (who had not been present at any of these meetings) read the minutes (having received them directly from Conserve or via his membership on another DL which subscribes to Conserve), liked the



idea and decided to pursue it further. He subsequently attended the next Conserve Team meeting and has since begun to phase in the new bulbs beyond the original lab.

The OfficeCo interviewee initially raised the idea out of a personal interest in energy conservation. He noted that he now regularly monitors the Conserve list to track progress on the compact fluorescent installation, and added a comment about his personal satisfaction in seeing an idea come to reality.

Since environmental responsibilities are often dispersed within OfficeCo, the DL's (as well as personal e-mail) provide a source to which employees can turn when they are not sure where to take an issue. For example, one message to an internal DL requested information about the recycling of computer diskettes- which the company produces in large number. These disks were normally sealed and therefore not re-usable to the customer. An employee had received numerous complaints about this from customers, and did not know where to take the issue - so he or she posted it to a DL.

One OfficeCo interviewee noted that in addition to being a source of information, DL's provided both useful contacts and a means of breaking down the isolation which sometimes accompanies work on environmental projects, by connecting one to others within OfficeCo who are working on the same issues.

### **Earth Day Announcements And Stirring Things Up On The DL**

When asked if/how DL traffic reflected the described diversity of environmental perspectives at OfficeCo, the interviewee told the story of a post on meat consumption. As part of its Earthday activities, this employee sent a series of announcements about events and some brief "green messages" to the "All OfficeCo" DL. These messages were intended as part of an overall "education" effort about environmental issues. One of the messages concerned "the environmental impact of meat consumption". This message produced a surprisingly large and wide-ranging response. These responses ranged from strongly supportive to strongly negative - both in terms of the proposition itself, and of its posting to the list. The responses included concerns about fellow employees' health, and concerns that aspects of the message could offend those of a particular religious affiliation.

## Chapter 6

### Case Study Findings

The three cases described in the previous chapter illustrate a number of common themes in the implementation and use of CMC for environmental management. This chapter reviews these themes within the framework developed in Chapter 3. In some ways each theme is a different answer to the three core questions motivated by Giddens theory:

- Does information technology help build a common meaning of "green"?
- How does this signification influence the flow of resources?
- How is this meaning routinized through action and endorsed by the organization?

This section reviews some common findings from the cases presented in Chapter 5. After developing each finding separately, I conclude by returning to these questions and using them to motivate some broader conclusions.

#### About the cases

Before reviewing these themes, I want to re-emphasize a number of qualifications about these cases. Although I sought out applications which were as mature as possible, in most cases these firms had only just begun to use these systems. This was especially true of those using Lotus Notes. The exception was OfficeCo where the "OfficeCo Green" list has been used for nearly five years. Use of this system has tailed off, possibly in anticipation of the switch to a new system - which will likely be similar to those in the other firms studied.

These studies are not intended as comparisons within similar industries, but rather as a diverse group to show breadth of different approaches firms have taken towards implementing information technology in support of environmental management. My hope is that these firms might learn something from each other, because the central capability each system seeks to build is purposeful communication between environmental and other professionals. The dynamics I observed are sufficiently generic that they should be applicable anywhere.

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## Finding: Questions Influence Meaning Making

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Among the most common "traffic" in the discussion areas at OfficeCo and ExploraCo are questions. Often questions are replied to with yet other questions. These questions may be playing an important role in supporting the meaning-making process described above. Other research of corporate e-mail system has also noted that question-asking is among the most common forms of electronic discourse. [Sproull and Kiesler, 1991]

I observed three kinds of inquires:

- 1) "Does anybody know?" or "What about Y?": These questions were in their simplest forms requests for specific information- i.e. "Does anybody know how we recycle large quantities of fiber-board?"
- 2) "Did you mean to ask X": These follow-up questions seek clarification or to add additional context to a previously posted question.
- 3) "I have that question too.": These typically request either the original requester, or the group at large to respond with a copy of any answers.

We can interpret these questions as forms of both information seeking and "sense making". The third form of question is particularly interesting because it demonstrates the power of making questions as well as answers available to all. Since many people in an organization will have the same question as their co-workers, the most effective, context rich way they can have that question answered is by seeing it answered for someone else. In effect, reading someone else's question makes another person realize that this is something they are interested in as well. It is analogous to the conversational phenomena of the realization "I was wondering the same thing myself." This demonstrates an additional value of discursive vs. one-way information structures. As in a conversation, one can be as interested in the questions your fellow participants ask as in the answers they produce. One interviewee made this point by noting "you don't know that you are interested in something (a regulation for example) until someone else asks about it.

This common mode of "I have that question too" inquiry has led to the development of one the strongest institutions on the Internet: the "Frequently Asked Questions" (FAQ) lists, seen in many areas. A general question forum has been the subject of research and application in, for example, the "Answer Garden: A Tool for Growing Organizational Memory. [Ackerman, 1994] I gained first hand experience with this third type of question when I posted a request for firms interested in participation in my case studies

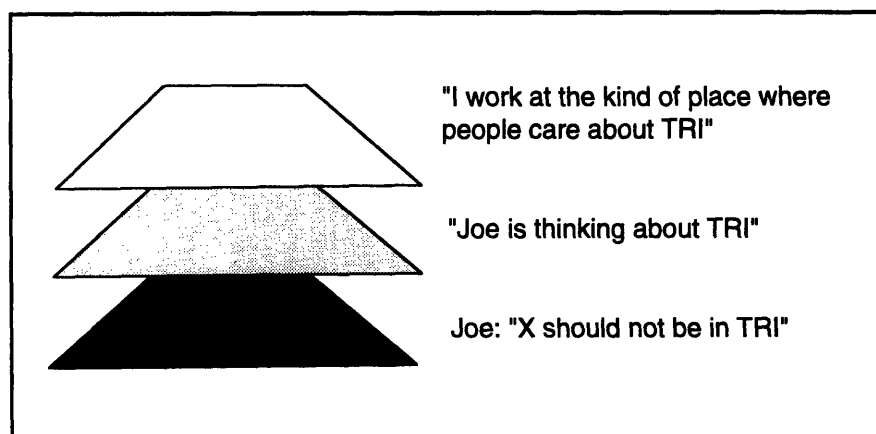
- and received 6 requests from others (3 consultants and 3 companies) for copies of any information I collected.

### Modality of Structuration: the questions people ask

It is useful to think about the questions people ask in terms of the many levels which may be operating. At the first level they simply need an answer to a question they have.

The second level of such a posted question might lead to one to think "that person is interested in waste minimization, should I be?" This could produce an action in another person independently of the answer the original post produces. Finally, at the highest level, these questions foster the perception "I work at a kind of place where people think about recycling". Sproull and Kiesler make a similar observation of the level of meaning of e-mail messages regarding presents for an ill co-worker. They carry both the detail level information ("give a dollar to Joe to buy flowers") and the mental message "I work with caring people". This observation could easily be extended to the discussion groups examined here - and interpreted as having the mental message - "I work at a company that cares about the environment".

For example, there were a series of questions and answers at ExploraCo regarding a particular TRI listing. Figure 6 outlines the influences it had on several different levels.



**Figure 6.1: Levels of Meaning Associated with Questions**

The public policy implications of this and similar discussions about environmental regulations are discussed further in Chapter 7.

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## Finding: CMC as a New Modality of Organizational Affiliation

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CMC has led to the development of a different level and kind of organizational affiliation with environmental issues than had previously been possible in paper-based systems. The following letter sent by an OfficeCo EHS manager shows the possible growth and development of new kinds of affiliation.

Happy New Year!

As you are probably aware, we have started the Environmental Leadership Program at OfficeCo (Management Communiqué on Environment was sent by John Smith to OfficeCo Managers on Dec 3, and a Today At OfficeCo was issued on December 17).

One of the most important aspects of the Environmental Leadership Program is employee involvement and participation. Because of your interest in Ecology and EarthMatters, I think you are a prime catalyst in our move towards a sustainable future. Your ideas, support and feedback on environmental leadership programs will be greatly appreciated.

You may perhaps know that we have formed a OfficeCo wide "OfficeCo Green:all areas" dl (controlled by me) for communicating information on environmental leadership programs. The OfficeCo green dl has almost two hundred members, worldwide. These are people who have been working on one or more of the environmental leadership programs. Some of the information that has been communicated on this dl in the past is:

[list removed]

Documents are typically communicated via the OfficeCo Green file drawer, accessible by OfficeCo Green members. All of the above documents are in the OfficeCo Green file drawer. Please note that this dl is not for general global discussion of ecology, environment or social issues but information that has specific bearing to OfficeCo or one of our environmental leadership projects would be welcome. As member of OfficeCo Green dl, you will also get access to the Environmental Leadership file drawer for archival of project related documents. If you want to be kept informed about environmental leadership programs and want to be on the OfficeCo Green dl, I can add you to the list and send you the file drawer icon with access. Please let me know by answering this message with your name, address, telephone number, title and areas of environmental interest/expertise for our data base listing. A brief note on any environmental projects you are currently involved with or would like to be involved with may also be added. Thanks and best regards.

John Smith

### Figure 6.2 Letter Seeking Members for the OfficeCo Green Distribution List

Through this letter OfficeCo sought to engage staff who had previously demonstrated an interest in environmental issues by having joined one of the earlier related DL's during the "proliferation" stage. Thus, this group made a natural starting point for a possibly more formal affiliation signaled by membership in the OfficeCo Green DL.

From a Structuration perspective, creating, moderating and sharing information on environmental issues through a distribution list is an instance of recursive action: what you read on the greening list affects the way John Smith moderates the list and how he moderates the list affects what you read on the list. Together, they form a part of thinking about greening at OfficeCo.

The Green DL represents an affiliation in the context of an IT-based forum. Much more common in all of the case study firms was the use of Notes in support of and alongside more traditional environmental teams and committees. Quite often managers noted that the ability to distribute agendas and minutes to a wider range than simply those attending was a major use of the systems. OfficeCo had actually formalized a "participant" status on DLs associated with specific teams or committees which allowed interested parties to keep track and participate in though not attend meetings.

Thus the technology itself offers organizations a new modality of affiliation, one which was started in conjunction with and derives its viability through its connection to a recognized "legitimate" entity. This kind of opportunity could be critical in assisting organizational learning because it allows a less-threatening mode of access to members across the organization to environmental issues and data - in a manner that is likely to be most useful to them. The OfficeCo example where affiliation to the "Conserve" DL contributed to the installation of energy efficient lighting is just one such example.

While membership on an e-mail list may, on the surface appear to be a relatively weak form of affiliation, it may not that different from the relatively weak affiliation of "being on the green committee" which often consist merely of "showing up at meetings" i.e. participating in the exchange of information. While an electronic message system cannot take the place of face-to-face meetings with one's coworkers - it could fulfill the information sharing function of this interaction.

The evolution of these new kinds of affiliations is important, because it reduces the barriers to entry in involvement with the issue, building professionals' sense of ownership or commitment to it without asking them to completely "convert" to a green attitude. Senge stresses the importance of seeking effective methods of appealing to people's genuine interest in building a common vision worthy of their *commitment* [Senge, 1990]. If, instead of building this vision, the organization imposed a mandate - the best it can hope for is *compliance*.

Compliance may also be the dominant (but less desired) response as environmental issues make their way into non-traditional areas of the firm especially if they are implementing in terms of metrics or standards. It is possible that by initiating this contact through an informal CMC system - the design engineer could be enrolled into the effort to bring environment into design rather than simply required to comply with a mandate whose legitimacy (in terms of its non-design base) is questioned.

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## Finding: Internal Networks Facilitate Meaning Making

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As both a purpose and an emerging result of the systems in use by all three firms was the creation of an organizational network which mirrored the IT connections that were established. For OfficeCo, this network was linked via the DLs, whose creation and maintenance was itself an organization building effort. As gatekeeper for the list, the moderator could perform "entrance" interviews of the members thereby enriching his own knowledge, and in turn the firm's network of knowledge. There was a sense that these networks of people as well as of information were important resources.

In all three case study firms, these networks provided some basic functionality: a place to gain new information or to ask questions which operates under different (and still evolving) rules of social interaction. The "proliferation" story told by each firm was an example of this evolution.

These internal networks varied in the degree to which they crossed organizational boundaries and in the kinds of boundaries they crossed. OfficeCo's network reached throughout the organization. OfficeCo's "OfficeCo Green" DL is the most significant cross-cutting system I examined. While use of the list was limited (and declining), its reach demonstrates that technology can enable discussion of some of the underlying organization issues.

ExploraCo's discussion area was the most narrowly focused, on the EHS professionals from the ExploraCo portion of the parent company. Early on, however, the user/designers of the system decide to keep the system accessible to all employees (as was the norm both at ExploraCo and through the parent company).

FoodCo's network, while initially focused on EHS staff, integrated EHS personnel from a very wide variety of facilities. FoodCo's networks are still spreading into the

organization. Even in this early stage of implementation, they cross significant boundaries both in terms of subsidiaries and the kinds of facilities they operate.

### **Networks and their role in the organization**

The establishment of these internal networks and their wider organizational implications have been noted by other researchers. Cebon notes that the junior engineers participating in PP contests reported using e-mail to communicate with colleagues "on the other side of the world" [Cebon, 1993 pg. 181] regarding technical aspects of the project. Clearly their ability to do so represents both a resource to the firm and a re-enforcement of PP as a thing "engineers talk about". It builds critically important professional links and is part of the evolution of an organizational culture in which the engineers see environmental concerns as part of their profession.

Meima, in his research on British IT industry EM notes a similar trend:

The establishment of internal networks of factory environmental coordinators, eco-auditors, environmental design experts, and other expert groups is a central aspect of . . . companies' organizational strategies. The initiation of these networks has thus also emerged as one of the major priorities of the corporate environmental manager. In the absence of large central staffs or an environmental line organization, and especially in the case of Gamma's loose international federation structure, this has been necessary in order to assemble the expertise and manpower to implement the environmental policy and respond to ad hoc requirements. The communication of many novel ideas out into the organization seems to be a central task of the corporate environmental unit, and these networks also facilitate this. [Meima, 1995 ]

Mylonadis also drew on the concept of network, (in this case one extending outside the firm) and stressed their importance in the evolution of EM:

. . . these networks provided a testing ground for new ideas by allowing members to engage in discourse on new concept and to interact without the need to articulate their thought with much precision. At the same time, participation in these networks was instrumental in the crystallization of the concepts. [Mylonadis, 1993 p. 303]

### **Networks help Build Understanding**

Using Giddens' framework, we can interpret these networks as means by which organizations can build common "Interpretive Schema" and ultimately common "meanings" about EM. These common meanings - established through the more discursive components of the systems is, as suggested by Giddens, a necessary step



towards the enactment of those meanings through the control of resources and ultimately the internal legitimizing of those practices as they become norms.

The information that firms need and have will gain its most essential element: "meaning" not through its absolute accuracy or completeness (as in LCA) or its scientific fractured rigor but through discourse. The discourse rests in a social context that is enabled by IT.

### Learning by comparing mental models

This process of forging common "meaning" around these concepts has a powerful analog in organizational learning. In our case, firms are learning new responses to increasing environmental concerns.

Networks offer the firm an arena where an essential aspect of learning, sharing and comparing of "mental models" can take place [Hoffer, 1993 p. 18]. Developing shared meaning and shared understanding of mental models is especially important given the ambiguity and challenges to sense-making in a field as broad and ambiguous as environment.

Stubbs' research demonstrates a similar finding:

*Environmental information* is defined here as data which concerns the environmental requirements for, performance of, or risk associated with, products and processes which are given meaning by the recipient of that data in order to facilitate action. Based upon the broad principles of phenomenology - i.e. social reality being 'constructed' by the individual rather than being absolute - this definition assumes that data received are internalized as information using an individual's conceptual model of the world - a product of the individual's beliefs, attitude and prior experience (Checkland, 1981; Senge, 1990). The implication is that an interpretation made by one individual upon a set of environmental data may differ significantly from that made by another, and sharing mental models becomes an important part of successful communication. [Stubbs, 1994 ]

ExploraCo's discussion area showed signs of beginning to be used for this purpose. For example, it hosted a discussion on the merits of including a particular chemical on the TRI list. This topic occasioned a discussion which contextualized the issue as part of the larger picture of ExploraCo's regulatory world. ExploraCo used the discussion area to "make sense" of a regulatory requirement.

Participating in an on-line discussion exposes our mental models to learning at each step. In posting a request, one formulates one's own mental model in order to communicate it. A reader compares their own view with that of the posters. The reader

of a discursive exchange (for example a post, and then an objection to a proposed solution) can be exposed to many mental models, models of the people he or she works with. An OfficeCo interviewee noted: "electronic mail forms a key component of how one expands one's ideas by being exposed to new ones."

This idea of "expanding one's ideas" by communicating through a personal and electronic network is an excellent example of Meima's finding that internal networks are avenues for the diffusion of novel ideas about environment. This connection is very reminiscent of the parallels between organizational cognition and the neural connections thought to constitute memory in the brain, discussed by Winograd and Flores. Walsh and Ungson have drawn this parallel explicitly in their study of personal networks:

which includes language, symbols stories, and frameworks and personal networks, can be thought of as retention facilities comprising organizational memory. [quoted in Hoffer, 1993]

In this perspective, an e-mail list itself, like membership on a committee, provides not only a very low transaction cost means of communication, but is an aspect of the organization structure in and of itself. Just as many interviewees in the case studies noted that environmental responsibilities often constituted "dotted-line" reporting responsibilities (in addition to the solid lines of organizational charts) so does the e-mail list represent an organizational structure itself.

Again returning to the definition of "learning" in Winograd and Flores as conditioning of an organization to better respond to future events - we can see that the building of internal networks would give firms this ability. When that firm faces a new environment challenge, it will draw on its memory - and an important element of that memory bank will be the personal networks, perhaps aided by computer, across firm boundaries.

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## Finding: Technology Appropriation Reinforces Shared Meaning

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Interviewees in all three case studies stressed that by far the single most significant contribution these systems had made was the simple improvement in basic communication. The second most important feature was their user tailorability and flexibility. Users are directly engaged in "appropriating" and "designing" the medium of this communication to suit their own needs and organizational identities. MIS managers noted that it was precisely the tailorability of these systems that made them useful but

also made them difficult to manage in a traditional sense. As one put it "It's easy for people to get a hold of Notes and go crazy".

### **The Proliferation of Electronic Discussion Areas as a Sign of Appropriation**

DeSanctis's term "appropriation" is useful because it describes the transition from a "passive" to "active" user of IT. One sign of the readiness for this transition in the case study firms is their common experience of the relatively rapid proliferation of discussion areas (either in the form of Lotus Notes discussion areas or OfficeCo's DL's). Some of these discussion areas ranged from "chocaholics" to "ecological" areas where issues like ownership of cars was discussed.

ExploraCo and OfficeCo offer particularly interesting examples. In ExploraCo, the Division EHS manager proposed the idea of a discussion group for environmental issues to the Senior EHS manger. The initiation of the discussion base required no formal approval or involvement of the MIS department. They recalled, "We still have some bureaucracy at ExploraCo but not that flavor".

I believe that it is useful to consider this as a "technology appropriation" with the secondary message that the identity of a group (in this case ExploraCo EHS as a group) is strengthened. In addition to the communication based affiliation the group itself represents it is also important to see the founding of the group as an claim on the organization's communication resources. This impression was strengthened upon examination of some of the early messages in the system. The managers who came up with the idea of the EHS discussion area sent out an introductory posting describing the motivation of the group as simply an area to share information. This post also included a request for others to respond so everyone would know who was "on". Shortly after this post, responses began to trickle in as EHS staff accessed the area. The informal tone of these messages suggests that members had internalized the idea of this as "their" area. A few of these comments were: "*Hey, I can use this!*", "*I'm on the system hooray!*", "*It's another world of info.*" and *Great stuff.*"

A useful analogy for this signaling function of technology appropriation might be the decision of a group to begin putting out a newsletter. They appropriate the technology of desktop publishing to produce the newsletter. More importantly, however, they are strengthening group identity by saying 'we are distinct enough to justify a newsletter.' It is interesting to note that electronic newsletters on environmental matters were one of the most common features of these systems.

The evolution of OfficeCo's DL's provides another example of the organizational issues behind something as trivial as the creation or removal of a DL. OfficeCo experienced the same proliferation of informal communication forums as other firms in this analysis. At one point, the list of DL's included areas such as "hobbies" or "chocaholics." In the environmental area, a number of "eco" or "earth" related areas existed. These lists acted as forums for very wide ranging and sometimes heated (flaming- in net parlance) exchanges on issues ranging from paper recycling to the morality of automobile ownership. The number and traffic volume of these lists finally provoked corporate attention due to both the computing resources they required and the human resources consumed by those participating in them. A significant elimination and consolidation of these lists then took place, and an approval process for the creation of new "wide-distribution" lists was created. Participants on the more philosophically oriented lists requested that their list be kept, and requested the assistance of the manager in charge of OfficeCo environmental initiatives. He assisted them in writing a justification statement to the system administrator for the group.

Each discussion group has a "Group remark" area which summarizes the "purpose" of that group. In most case this is just a brief phrase indicating which formal committee or team the list supports. In this case, however, the discussion group explanation is more extensive. It is reproduced below.

```
Summary of earth-interest:all areas ...  
Summary of Earth-Interest:All Areas:OfficeCo...  
Group remark: To facilitate communication and resource sharing among  
OfficeCo employees about our responsibilities as Earth citizens in  
support of OfficeCo corporate citizenship value; to promote ecological  
awareness and personal environmental leadership as a supplement to  
OfficeCo corporate environmental initiatives
```

**Figure 6.3: Example of a "Group remark" summarizing the purpose of the group**

A message like this has the opportunity to speak at many levels - both in providing a forum for these issues and in making the proclamation that "we think this issue merits a formal discussion area".

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## Findings: "Comment Management" enables "Living Documents"

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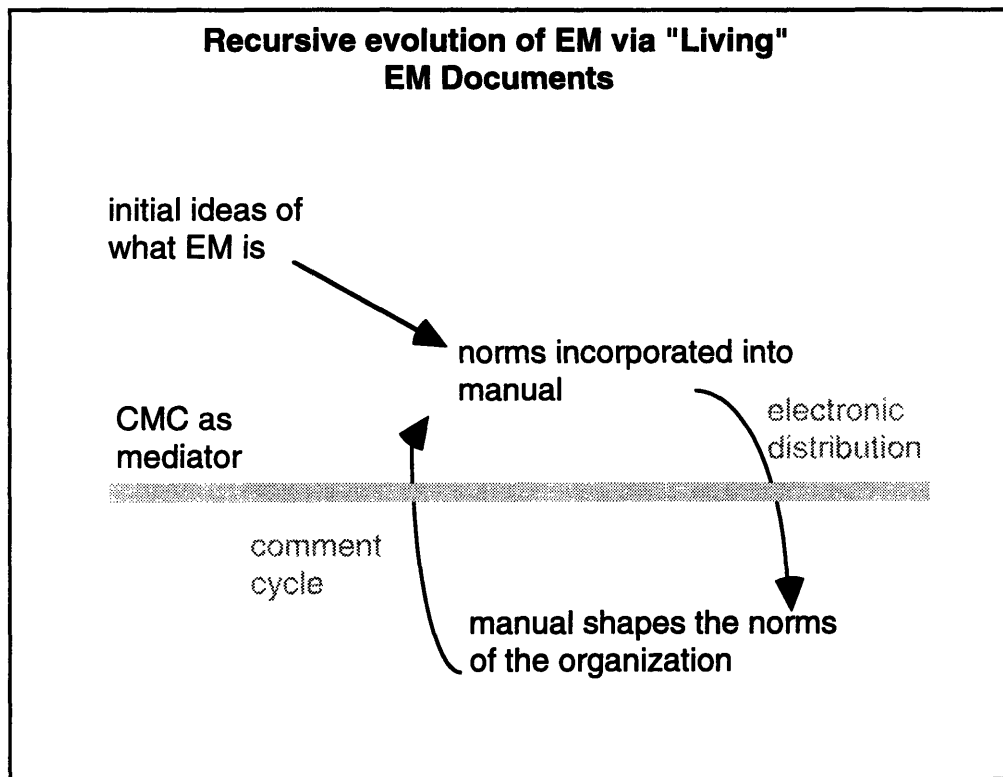
One of the most helpful features of Notes used extensively by both ExploraCo and FoodCo was its ability to support "comment management" of documents distributed on the system. OfficeCo's system accomplished much the same functionality via common "file lockers".

While this technological capability is seemingly minor, it was seen as having significant organizational implications because it opened participation in the design and drafting of the documents to a much wider range of members. These documents ranged from the FoodCo audit workbooks to "issue" papers in ExploraCo.

Again, at first glance, one might consider the key "data processing" needs of an EMIS to be those capable of dealing with the large amounts of numerical data (especially in an age where regulations require the continuous monitoring of some sources). Obviously these data flows are vital to the organization. But this "document" flow is its vital counterpart. The capabilities of Notes to allow a manager to practically solicit and make meaning of comments from 50 co-workers is just as much an innovation as the ability of the system to perform a mass balance on a facility in 10 seconds. In the past the feeling had been, "What am I going to do, print 100 copies of a 100 page document and then have everybody go through it with a pen? And then spend hours tracing through it?" Needless to say, no matter how valued feedback might be, the rigors of soliciting and managing that feedback was, in the past, a practical impossibility.

FoodCo's implementation of this concept was especially thorough in that they wrote, together with the Corporate office, a negotiated workbook which was the framework for environmental management across the facility. These workbooks, of which nearly 50 are now on-line, are accessible to other facilities. Together they represent a valuable embodiment of organization memory and experience, available in a context rich and easily accessible form. This flow of comments could be especially important in the construction of common "interpretive schema" because each gets to see other's interpretations of the same "stimulus" thus building a real sense of common understanding.

From our theoretical framework we could interpret this cycle of comments on environmental practices (as codified in a manual) as a form of structuration. This is depicted below in Figure 6.3



**Figure 6.3: Recursive Evolution of EM via "Living" EM Documents**

As the manual comes to reflect the norms, it also comes to validate those norms in a recursive cycle.

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### Finding: Routinization is Occurring

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In each of the case study firms, the applications I examined were either currently part of, or were on their way towards greater integration with the systems managing core business processes. Lotus Notes itself is rapidly expanding into many business areas, - environmental management represents one of its more minor applications.

This connection between and integration of EM information systems and general day-to-day business information was evident in different ways for each company. At FoodCo, one of the best received features of the system was its ability to produce a standard

calendar and to-do list for that facility's environmentally related procedures. In OfficeCo this integration takes place by virtue of the fact that the environmental DL and file sharing spaces are just a tiny fraction of the mainline business conducted over the system. Thus the latest message from the "Conserve" team appears next to the most recent production schedule.

FoodCo noted this routinization as well. The new system was especially appreciated by managers who supervised areas with environmental responsibility. Most of these managers were promoted up through the ranks on production lines. Thus this system, with its emphasis on structure, gives them a way to manage environmental concerns as a core business process - like they do others. Just as they would not think of having a production line whose operation was a mystery and known only to one person, they like the idea of institutionalizing environmental management.

It is interesting to note that this could be interpreted in two ways. One would be to interpret the construction of these measures or "to-do" lists, as in some sense demeaning an issue as important as environmental management. It could be seen as "reducing" it to simply another business practice, for example making just like equipment maintenance.

If we recall Giddens' emphasis on the "routine" within organizations:

Each action today, sets the stage for doing the same action tomorrow. Much as in habit. [Giddens, 1984 pg. 25]

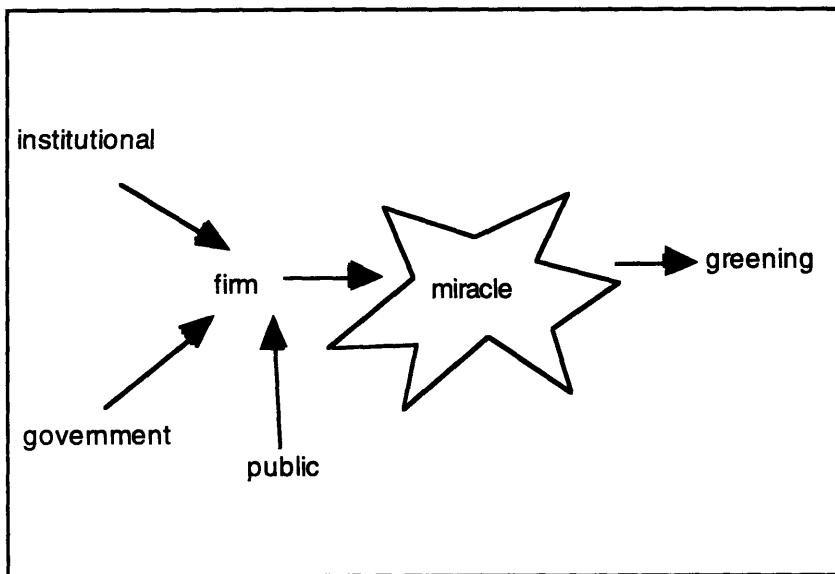
On the other hand, one could interpret this "routinization" of EM as an important (however gradual and incremental) move towards greening. To become part of the culture of an organization, environmental concerns will have to undergo a process of structuration, where the environment becomes part of the institution, and part of people's mental model of their place in it. The FoodCo Capital Planning module - which ensured that opportunities for energy efficiency and pollution prevention were explored for all capital purchases is a further example

As we look hopefully for signs that the environment is becoming more important in firms, it is important not to look for it in the wrong form. A useful analogy might be quality- ultimately the EHS function might meld into the operation of a firm. The TQM approach is that quality should be "everyone's job"; one could imagine arguing that the "quality" division should ultimately be integrated into each business area and no longer exist as a separate unit. A number of interviewees for this study noted that they ultimately expected the EHS units to be dissolved and these duties integrated into

others. This theme has been consistent in the total quality environmental management literature. (See for example, Fitzgerald, 1993.)

Much of the literature on greening has focused on corporate policies. But how does greening make it from corporate policy to practice, which, from Giddens perspective, is the only way it will ever become a "norm"?

This situation is reminiscent of the famous cartoon of the two scientists discussing one scientist's theory. A complex of equations all flow into a central cloud bearing the caption "and then a miracle happens". A single arrow out of the clouds points to the solution. The other scientist remarks to his colleague 'I think you need to be a bit more explicit about this middle step'. As students of greening we may want to take this advice to heart.



It is clearly observable that for some firms, perhaps exemplified by FoodCo, there is a move towards the routinization of attention to environmental issues, however traditionally those issues may be defined. This routinization is demonstrated in the integration of EMIS systems into the larger MIS context. Unlike the past, when environmental responsibilities were borne by few if anyone, and the emphasis was almost entirely regulatory, these systems suggest a movements to setting in which environmental considerations will become part of the day to day work. Now and even more in the future, the production scheduler, the staffing scheduler, and the environmental management scheduler will have on the PC in front of them a discussion about the application of a new energy efficiency devices or possible responses to a new



regulation, on the same system as an order for 10,000 parts, or the request to a college for tips on solving a quality problem.

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### Finding: Internal Negotiation of Norms

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Another interesting example of the still evolving norms in the use of e-mail involves the types of messages that are sent to "all". As many researchers have noted, the negligible cost of sending a given message is nearly zero but the organizational cost of reading all these messages can be considerable [Sproull and Kiesler, 1991]. Thus each organization tends to develop its own norms about which types of messages merit global distribution - in some cases requiring formal authorization for these messages. This suggests that global e-mail has become another forum in which signification can be expressed.

An interviewee at OfficeCo began our interview by noting that "for one thing, people like having me on the team because I'm the kind of person who is willing to send environmental messages to all of OfficeCo R&D." He recounted a meeting of the OfficeCo's Conserve Team where the issue of whether or not to send a global message regarding a conservation project was debated without resolution. He finally decided he was willing to risk whatever negative effects he might incur and just send the message himself - which he did.

This vignette offers a simple example of an internal "boundary spanner", who, as Mylonadis points out, must be willing to risk legitimacy to be the carrier of new ideas. In this case the risked legitimacy was that of being a "junk e-mailer". The team debate was an instance of a group socially constructing the meaning of the Conserve team's work and the simultaneous construction of norms regarding the use of e-mail. Each norm is intermeshed with the other - demonstrating the "recursive" feature of IT in organizations noted by Orlikowski. The decision, to send or not, becomes part of the norms of e-mail, and in turn shapes future discussion about whether Conserve meets that standard.

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### Finding: Relevance and Group Identity are Self-reinforcing

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Many of the communication forums discussed in the cases are constructed around the simple premise that people with common interests or job responsibilities will find

similar information useful. Using our theoretical framework however, this premise turns out to be richer than it first appears.

At each case study firm, interviewees noted that a major benefit of the systems was their ability to learn from each other -especially for areas or topics about which they were previously unaware. This was commonly phrased as “you don’t know what your interested in until you see it” or, “in a regular database you only get what you are looking for.” The ability to “browse” areas in systems, especially with the benefit of customized “views” which allowed information to be viewed in a variety of contexts (e.g. facility, material, date, etc.) was seen as a major benefit of these systems, making contributions of co-workers more accessible. In the previous finding on “Questions”, I noted that the idea of the “relevance” of material contributed by co-workers had two components - a) its information content (i.e. it is something you need to know about for your job) and b) its organizational content (i.e. you should know that Bob is interested in X). If we return to Orlikowski’s notion of IT as both consequence and antecedent we can see the formative role communication via these forums plays.

Giddens argues that a key feature of what makes a group a group is its common codes of signification - that as a group we generally agree on what is important, not necessarily what to do, but what is important. Discussion groups thus have the potential to play a role in the recursive organization of communities of interest and meaning. As we contribute to the group we are both informing it (because the people on that group want to know about greening) but also strengthening the identity of this group *as the people who are interested in greening*. Thus, this discourse carries with it the potential to both inform groups working on greening within the firm and strengthen their self-identity through doing so.

### **Returning to Giddens' Three Questions**

We began this chapter by using the framework developed in Chapter 3 to ask three questions:

- Does IT help build a common meaning of green?
- How does this shared meaning influence the flow of resources?
- How is this meaning routinized through action and endorsed by the organization?

With the findings developed above, we can now begin to suggest some answers.

### **Does IT help build a common meaning of green?**

By providing a new and rich forum for organizational communication, these systems are contributing to the construction of common "interpretive schema" by their users. Among the most important modalities for this "meaning-making" may be questions. Question asking, question answering, and listening in on either of these, provides members the opportunity to learn about environmental issues from each other. Questions are a particular form of discourse, which "stops the action" and gives pause for reflection. Questions can have meaning at many levels - from the most practical, as in "What do these regulations mean to us?" to the more organizationally potent "What do my co-workers think is green?" In addition, these cases suggest that the new modality of affiliation offered by these media (i.e. being on a distribution list) provide an important context and baseline of relevance for this question asking and answering. Members now have a forum in which to ask questions they might not otherwise pose. In addition, the seemingly trivial capability for these systems to support "comment management" on documents presents another opportunity for collective "sense-making" since members are provided the opportunity to both comment and see the comments of other. This capability may be especially important in an era of increasing standardization and reliance on "procedure manuals" as reflected in the ISO 14000 environmental management standard.

### **How does this shared meaning influence the flow of resources?**

While these cases did demonstrate a number of areas where communication via these systems produced real changes in resources, the more powerful implications of this research for organizational investments in greening are likely to be mediated by their capacity to build common meaning of green around which action can be organized.

The examples of *direct* involvement of these systems in resource flows include the occasion at OfficeCo where membership by the facilities manager exposed him to a suggestion that OfficeCo install energy efficient lighting - this piqued the manager's interest and contributed to his decision to formally pursue this investment. FoodCo has implemented a Lotus Notes module which supports the review of all capital investments to ensure that opportunities for pollution prevention and efficiency are fully exploited. Because this system is supported electronically, its information is available to the entire organization. A final explicit influence on resources is represented in the ExploraCo story of the EHS managers deciding themselves to create a discussion area -

this represents an appropriation not of simple budgetary resource but of the technology itself . This technology appropriation sets the stage for developments at ExploraCo similar to those of OfficeCo or FoodCo - thus demonstrating the recursive nature of IT's involvement as both cause and consequence.

**How is this meaning routinized through action and endorsed by the organization?**

These cases suggest that IT is involved in a number of avenues through which attention to environmental concerns is routinized. Perhaps the most important of these is the trend of increasing integration of EMIS into the core business MISs. In the case study firms, this integration was mostly just beginning. But even in the current state of development, both e-mail or Lotus Notes systems have symbolic, if not practical implications, since - now on the same screen and in many cases the very same software - environmental and day-to-day business issues are transacted.

There are also signs that these systems are contributing to stronger affiliation among EHS professionals. Contributions to these systems are now seen as a routine part of their work. This has exposed them a broader community of colleagues, building a sense that, as professionals, they are engaged in a common enterprise. By increasing communication between organizational units, these systems reinforce the notion of environment as a firm-wide common enterprise - for routine, not just exceptional consideration.

From the general manager's perspective, the observation of FoodCo interviewee may be especially important. These managers, who have EHS supervision as one of many responsibilities, look to these systems to support their own management of environment *as another core business process*.

Finally making the "comment management" process practical, thereby allowing greater input into documents like ExploraCo's Issue papers or FoodCo's extensive "workbooks", will likely increase the internal legitimacy of these day-to-day procedures as members see their own meanings reflected in their and the organization's norms.

## Chapter 7

# The Technology and Policy of IT Support for Environmental Management

### Overview

This chapter concludes the thesis by drawing some of the potential implications suggested by these findings for both private and public policy makers. This research is merely suggestive of the potential work that could be done in this very rapidly developing field. First, these observations are based on two projections which I want to render explicit here: 1) Technological support for the communications systems discussed in this thesis will become more and more common as the hardware and software continue their trends towards increased capabilities and reduced prices. If these trends hit any barrier - they are more likely to be organization in nature rather than technical, although, as I have argued in this thesis, this distinction is often a superficial one. 2) Notwithstanding the recent political shifts in the US political system, firms will continue to feel pressured to incorporate environmental concerns into their operations - although this pressure may come more from the "internationalization" of these concerns represented by the ISO 14000<sup>5</sup> standard than from increases in traditional government regulations.

Given these two premises, my research suggests a number of broader considerations for companies and policy makers working to accelerate the greening process.

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<sup>5</sup> The International Organization for Standardization (ISO) is in the process of drafting environmental management standards. These standards, patterned after the ISO 9000 quality standards, will cover a wide range of practices: a) environmental management systems b) environmental auditing c) environmental labeling d) environmental performance evaluation and e) life-cycle assessment. While negotiations and drafting are still very much underway, many observers expect a final draft of these standards to be issued for balloting by national standards organizations in 1995. Once adopted, firms would gain certification through a process of third party audits of their EMS. Judging from the large number of firms seeking ISO 9000 certification and the fact that ISO 9000 has become a de-facto requirement for business in Europe, the ISO 14000 standard (as it will be called) has the potential for widespread impact on environmental management practices.

## **Considerations for Corporate Environmental Policy**

The cases studies suggest three broad findings that should be considered by corporate readers:

- 1) In order to provide the organizational context necessary for greening, firms must move beyond the traditional tracking and monitoring roles for IT in environmental management. Within or alongside these systems, firms should build networks connecting their EHS staff together and with the rest of the organization.
- 2) The key design theme for this network should be to create a palette of forums through which members can more effectively construct the meaning of the ambiguous and dynamic elements of environmental management. The process of developing a corporate culture "beyond compliance" is inherently social. The IT support for it is different (but complementary) from that used for tracking and control functions. Agreement, at least in broad terms, is a prerequisite to gaining members' commitment to effective environmental management as opposed to solely their compliance.
- 3) There is a new role for key members charged with EM responsibilities: that of facilitator of purposeful, effective communications. One forum for this communication may be groupware. The objective of this facilitator is to help ensure that every intellectual resource is brought to bear in resolving environmental problems and in exploiting every environmental opportunity.

### **Design Themes for Implementors of Groupware Support for EM**

The section below describes observations that may be particularly relevant to Implementors of these systems. An important general feature of these systems is their "emergent" qualities. These systems take complex evolutionary trajectories reflecting the highly contextual nature of their operation. To paraphrase Orlikowski and Giddens, the systems influence the way people use them, and people, both by designing new applications and in their usage patterns, influence the systems.

### **Firms Should be Prepared for the Natural Trajectory of Discussion**

Most firms I interviewed had experienced similar "adoption trajectories" where use of the discussion groups initially lagged, then began to grow very quickly. This was

accompanied by a proliferation of groups and very loose organization of the discussion within groups. This proliferation was eventually controlled, directly or indirectly through elimination and consolidation. In OfficeCo's case, many groups were eliminated and a number of environmentally related ones were merged; a similar path was taken by ExploraCo. In both groups there was a strong feeling that it was important not to destroy the informal nature of the groups.

Firms considering implementing such groups should be aware of this cycle and anticipate it - the initial informal use period may be an important definitional stage, but it does carry risks that may "turn people off" the system because it is so cluttered. The ability of groups to "appropriate" the technology results in both this "proliferation" tendency but also provides the organization a powerful ability to adopt the technology to their own needs.

#### **Use of the systems by senior management sends a strong signal**

Online participation on these system by senior managers was seen by many interviewees as a strong organizational signal. This signal sounds at two levels. First it validates the medium itself, legitimating its use and the time employees invest in it - demonstrating an organizational investment in the "message" of environmental management. Second, it draws the manager into the discourse itself, again increasing the base of intellectual resources applied to effective environmental management.

#### **Managing Diverse Subsidiaries**

FoodCo's experience highlights the challenges of attempting to coordinate the environmental practices of a decentralized and diversified corporation. How can a corporate office improve environmental practice without creating the very hierarchical systems that prompted decentralization in the first place? This tension is heightened with the advent of the ISO 14000 standard.

EMIS may play particularly strong role in EM of decentralized firms. The findings suggest that these systems will give firms a means by which to involve subsidiaries in the design of common, yet flexible, environmental management systems. For subsidiaries who might only grudgingly participate in such improvements, the interaction with and support by corporate-wide EHS experts may represent a useful "value added carrot" to gain enrollment. It allows firms to leverage their EHS staff company-wide. A similar situation exists even for smaller firms where corporate EHS

offices must wear both the "helper" and the "auditor" hat. It is also interesting to note that the capability of leveraging this corporate wide "pool" of expertise represents something of a competitive advantage to larger firms without interfering in the independence and self-reliance which is motivating the general decentralization of US businesses. There may even be a synergistic effect between such networks and the ISO 14000 standards. With a communication infrastructure in place, the ISO "language" may facilitate communication by giving members both a common experience (the certification process) and a common language.

## ISO

Operation of the ISO 14000 quality standard, like its predecessor, the ISO 9000 standard, is heavily depended on a continuous flow of document -based information. Procedure manuals, glossaries of terms and definitions, training schedules, audits and audit results, and improvement plans are just a few of the kinds of documentation the system will require firms to manage. For most firms, IT will be necessary to manage this flow - and the kinds of systems discussed in this thesis may be particularly suited to this task. Application developers have already produced Lotus Notes applications for ISO 9000 documentation management.

Observers critical of these systems see this documentation load as a waste of resources. This research suggest that firms may be able to leverage this investment by recasting the task as one of "sense making". The early experience of the case study firms suggest that CMC systems could provide an excellent forum in which the organization could conduct this discourse. The finding in Chapter 6 on the organizational implications of the 'living document' are especially relevant here. The analysis concerning "routinization" in these systems (also covered in Chapter 6) may also be critical for ISO 14000, by enabling a more efficient and widely dispersed flow of environmental information, organized around the standard. The systems themselves could be important mediators of how the practices and ideas embodied in the standard are diffused through the organization. This would be an excellent question for future research discussed below.

## Designing Networks of People for Organizational Learning Around Environment

Findings in this thesis suggest that designers within firms should consider a different but complementary set of objectives to the traditional view of EMIS as primarily concerned with data collection, archival and retrieval. To support collective "meaning making" around this data, designers should adopt the approach of "growing" a



communication infrastructure, which supports organizational learning around the environment. As analogs to the desired qualities of traditional systems of "accuracy", and "completeness", organizations should strive in these new systems to develop the qualities of context, richness and flexibility in the kinds of discourse supported. A useful metaphor for this discourse may be a "virtual environmental quality circle".

This research also suggests that the current emphasis on metrics and measures (which are often intimately bound up with EMISs) may be more valuable to the organization when they serve as *common frames of reference supporting relationships* within the firm, as opposed to absolute performance standards. A given measure's internal legitimacy, may provide as much value to the firm by supporting collective action as it will through its sophistication, comprehensiveness or metrical accuracy. For the firm as an organization its more important that, through a common, if limited notion of greening, everybody is rowing in the same general direction --- instead of a few rowing in *precisely* the right direction while others watch and wonder why.

This discourse may be even more important in the environmental area since both the problem space and the solution must be defined in context - that firm's context. Most firms are likely to be pursuing multiple goals with their environmental resources, including public recognition, safety, savings, and consistency with corporate and personal values. Linking these objectives to organizational action requires more than simple indicators or measures.

## **Considerations for Public Policy**

Given that many of the processes discussed in this thesis as important to improving EM are internal to a firm - the role of public policy is made more difficult:

Pollution control policy makers might best view their task as one of creating heuristic devices both for the individual organization involved in the pollution control debate, and for society in general. [Roy, 1988 ]

Despite their import and, potentially, their broad applicability, these findings may say more about what government should not do, than what it should do. This thesis focuses on the need for people to "make sense" of the regulatory pressures their firms operate under as part of the overall environmental management picture. Unfortunately, many of these regulations, while well-intentioned, resist "sense-making". The most commonly cited examples were requirements whose implementation produced an environmentally

negligible result or results which were vastly expensive relative to their benefits. The dissonance then carried over and affected their perspective about regulations in general. Such frustration was a common theme among the discussion groups I examined. This finding re-affirms the potential benefits of the current EPA "Common Sense" initiative - whose goal it to develop regulations which protect the environment but do so in a "common sense" way.

### **Specific EPA Policies: Audit Privilege Rules & "Leadership" Programs**

Few EPA policies are as likely to influence the internal dynamics of firm communication as directly as the 'legal status' of these communication in the face of administrative or judicial action. While a complete discussion of these implications is beyond the scope of this thesis, a few points are worth raising here. It is in everyone's best interest if the discussion among EHS professionals within firms is as vigorous and unfettered as possible. Many firms noted, however, that concerns over the potential use of information captured in such systems (especially where firms have turned to substantial self-audit programs) in enforcement actions, especially criminal actions, could reduce their effectiveness. EPA recently refined its audit self disclosure policy, [EPA , 1995] - but this issue is one that will require additional attention. It is likely that public policy on this point will be linked to another major development: EPA's recent emphasis on alternative forms of environmental protection, discussed below.

EPA has recently emphasized voluntary "recognition" type programs such as the Environmental Leadership program. These programs rely on incentives for positive publicity. Meima's work, quoted earlier on firms building of internal EM networks, has also noted the potential 'legitimacy conferring' potential of environmental recognition:

I believe that the most important type of competitive advantage which successful EM currently delivers in the IT industry is social legitimacy - ambiguous, intangible, impossible to measure, but important nonetheless. [Meima, 1995]

EPA should ensure that effective use of IT in the ways discussed above are included in the "best practices" that these programs seek to recognize and diffuse.

### **Prospects for Future Research**

This thesis has hypothesized that networking people within firms is the most important element of communication around environmental management. CMC may have the capacity to shape the evolution of greening within the corporation.

Research on corporate EMIS offers a number of compelling features which suggest its potential to make a significant and unique contribution to our understanding of greening:

- It offer a rich if complex data source - the electronic communications themselves. Given the appropriate security safeguards common in other research fields, this data could be accessed by the researcher.
- This data would be highly complementary to the "narrative" interviews which typically available in corporate ethnography.
- Study of these systems and the potential applications of the research to improve their operation would enable researchers to use the "clinical practitioner" model as described by Schein.
- Most of these systems are still quite young, providing an opportunity to observe structuration in action. Especially if such research were initiated soon, it would offer the opportunity to watch early stages of development

This thesis identifies some potential mechanisms for learning and innovation in environmental management through the use of IT. Because this process is inherently evolutionary, the next step in research might be to conduct some longer term longitudinal research with an emphasis on the ethnographic context. Ideally, these studies would be able to track to the evolution of communication on a particular issue and place it into the larger organizational context. For example, examining a corporate decision to join CERES, or to implement or cut back a major program might be used as a focal point. The EMIS could be examined and interpreted in real time with the participants. This would help provide information on what "this means to you now" rather than relying on the "what did x mean to you last year" as was necessary in this research.

### **Study of the wider information systems**

Research on the uses of IT by firms to communicate with their institutional fields should also provide a new perspective on the processes described by Hoffman and Mylonadis. The rapid growth of the Internet and other online services suggests that this phenomena may be ripe for future analysis. Preliminary research on communication among environmental professionals using the Internet USENET Groups and CompuServe did not show a great deal that would be of interest to the typical EHS professional. However, given the rapid growth of both the traffic on these systems and the number of new institutions (e.g. corporations, trade associations, universities, government agencies and consultant) going "on-line" every day, there could be significant potential for this medium.

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