Evaluating Waste Minimisation Projects : The Contribution of Organizational Learning and Organizational Knowledge Theories

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(1) Introduction

Win-win approaches to environmental management in businesses have gained ground since the 1990s. Early business responses to environmental concerns involved mainly responding to regulation but compliance was seen as expensive and damaging to competitiveness. However, since the 1990s, the efficiency and productivity gains involved in environmental measures have increasingly been recognized. Eco-efficiency is seen as a 'win-win' scenario, where more efficient use of resources can enhance, rather than damage competitiveness.

However, firms have been criticized for limiting their environmental efforts to eco-efficiency, which implies making more efficient use of resources but not necessarily using less resources. Traditional business agendas continue to emphasize increased sales and production. Many authors have argued for the need for culture change which allows more fundamental questions to be asked concerning the aims of businesses.

In order to make change palatable, policymakers have pursued an incremental approach towards environmental improvement. Waste minimization have been seen as a first step towards promoting the message that environmental improvement is good for competitiveness. This is based on the assumption that radical change needed to achieve sustainable development can be pursued, by first 'getting a foot in the door' and moving on beyond easy changes to more fundamental change. This is akin to Hart's model of change, which distinguishes the three phases of pollution prevention, product stewardship and sustainable development (1995). However, little attempt has been made to understand to what extent companies move towards more fundamental change. Waste minimization projects have often been for a limited time period, and have focused on getting started by taking some easy pollution prevention measures, often of the 'good housekeeping' kind. Since projects have frequently ended having achieved a few waste minimization measures, it is largely unknown to what extent companies have gone further. Evaluation of waste minimization projects has been limited mainly to calculating short term cost savings. Therefore, the question of how effective waste minimization projects are in kicking off a process of on-going improvement and more deep-seated change, remains largely unanswered.

SMEs are widely regarded to be at an even lower level than larger firms in terms of environmental improvement. Their reluctance to engage in waste minimization and other such environmental improvement programmes has been widely documented. It is only recently that understanding of the response of SMEs to the environment has begun to develop, with theory development still at an early stage. Some authors have sought to develop understanding of characteristics of SMEs that might explain their lack of

environmental awareness, such as their informality, lack of planning and multi-tasking nature. Such characteristics may hinder the embedding of waste minimization into company culture, thus making the incremental approach of moving beyond waste minimization even more difficult in SMEs.

Organizational learning concepts have the potential to shed light on these processes by which businesses, and in particular SMEs, achieve significant change. Initial attempts have already been made to understand environmental improvement in business with organizational learning concepts. Building on the work of organizational learning writers, such as Argyris and Schön (1996), a number of authors have considered the extent to which environmental improvement in business is symptomatic of higher level learning, or learning which involves questioning deep-seated values. Some authors have recently done some work to understand the greening of SMEs using organizational learning concepts (Hooper et al. 2000, Petts 2000).

The aim of this research is to provide answers to some of these questions, based on empirical work with SMEs that have participated in a waste minimisation project in the UK. A total of 20 managers from 19 companies were interviewed, representing at least two companies each selected from 5 waste minimization projects. The co-ordinator of each project was also interviewed. This paper considers the concepts in organizational learning, in order to identify their usefulness in terms of evaluating waste minimization projects to understand their potential to move from small changes towards more significant environmental improvement in SMEs. Firstly, the main concepts behind eco-efficiency and the main developments in waste minimization projects in the UK will be presented. Secondly, particular issues relating to SMEs are considered. Organizational learning and organizational knowledge literature will be discussed in an attempt to identify the main useful concepts which will help in evaluating waste minimization projects. Finally, the paper will put forward some preliminary ideas on how to analyse waste minimization projects to understand how they are useful in promoting organizational knowledge development and learning among SMEs, which may facilitate the move from small environmental improvements towards more significant change.

(2) Win-win and Eco-efficiency

During the 1980s and 1990s, the concept of sustainable development gained ground, and has come to dominate mainstream thinking on business and the environment. Whereas early thinking on business and the environment pointed to the need to limit growth, sustainable development allows continuing growth provided that it is ‘sustainable’ (although there has been considerable debate the meaning of ‘sustainable development’). Such concepts have allowed environmental issues to become a mainstream concern for the public and for industry, and change has largely been accommodated within the traditional neo-classical agenda of continuing economic growth and increasing profits. Since the 1980s, with the increased emphasis on reconciling economic growth the environment, there has been a large literature on win-win scenarios, where companies have improved their environmental performance at the same time as producing an improved product or reducing costs. Since the 1990s, resource productivity and eco-efficiency have begun to be recognised as concepts which can help to achieve sustainable

development. The concept of 'decoupling' economic growth from increasing resource use has been widely promoted in academic literature and policy documents.

However, win-win approaches have been accused of using the language of business to make environmental improvements more palatable to businesses and promoting the idea the environmental improvement can be achieved by making a few cheap and easy changes. In 1995, Porter and van der Linde argued that waste is a symptom of inefficiency resulting from incomplete material utilization and poor process controls, which result in unnecessary waste, defects and stored materials. Correcting inefficiency would improve business performance as well as being beneficial to the environment. They argue that more advanced companies have taken on the concept of pollution prevention, and make the case for going further to embrace resource productivity. Von Weizsäcker et al have argued that it was possible to double wealth whilst halving resource use (1998). Eco-efficiency has been promoted by the World Business Council for Sustainable Development (Holliday et al 2002, Seiler-Hausmann et al 2004), who propose measures such as reducing material intensity, reducing energy intensity, reducing dispersion of toxic substances, enhancing recyclability, maximizing use of renewables, extending product durability and increasing service intensity.

However, it is widely acknowledged that eco-efficiency has so far proved inadequate. The two main problems of eco-efficiency highlighted are: (1) insufficient numbers of companies have taken eco-efficiency on board. Many of the case studies widely presented are confined to large, high profile multinational and exceptional smaller companies. The majority of companies, particularly SMEs, do not have the resources to devote to eco-efficiency (or it may be argued that they do not have the capacity to change their way of thinking). (2) Producing goods and services more efficiently may be insufficient to compensate for increased production, or may even result in increased production (Von Weizsäcker et al 1998, Holliday et al 2002).

Walley and Whitehead (1995), are critical of win-win scenarios, as they give a false picture that it is easy to be green. Many authors have argued that environmental change in business has been reduced to eco-efficiency and management systems. Therefore, in recent years, an increasing number of authors argued for greater attention to culture change (eg Welford 1995, 1997, Li 2001), which addresses questions relating to the nature of change in organisations.

(3) Waste Minimisation

Waste minimization has been recognized as a useful vehicle for moving industry towards increased resource productivity. A few showcase waste minimization demonstration projects were instigated from the late 1980s in the Netherlands and the 1990s in the UK to demonstrate the possibilities inherent in waste minimisation. The approach of instigating environmental improvement in companies through the vehicle of waste minimization programmes, has been based on the premise that by first 'getting a foot in the door' or by engaging businesses with the simple message that reducing waste saves money, companies may embark on a broader programme of change. Therefore waste minimization epitomizes the win-win approach towards environmental improvement in

business. This makes it is an excellent case study to provide answers to some of the questions relating to whether, by starting with a simple message which is palatable to businesses and a few small changes, more radical change can ensue or whether, in contrast, by falsely giving the message that a few simple changes are sufficient, such programmes only serve to delay more significant change, whilst achieving only minor environmental benefits.

Waste minimisation techniques have largely been based on the waste hierarchy, which involves several levels of reducing waste: preventing waste by reduction at source, re-use, internal recycling, external recycling or treatment, and dumping only as a last resort. The first projects in the UK were the Aire and Calder Project in West Yorkshire, Project Catalyst in Merseyside and the Leicestershire Waste Minimisation Initiative in the early 1990s. Their aim was to demonstrate the benefits of a systematic approach to waste reduction, in order that the approach would be widely copied. Early projects attracted considerable funding. Following success reported in terms of financial savings, projects were set up around the country. According to the Envirowise website, there have been around 145 clubs in the UK (2004).

As projects have been set up, approaches have evolved, and a variety of approaches have been documented (Clarkson and Phillips 2002, Millard et al 2005). There has been a trend away from well-funded consultant led projects towards a greater reliance on self-help. The number of companies involved, the geographical scale, the time scale of the projects, the types of issues tackled and the networks on which the projects are based have varied widely. Early projects involved small numbers of companies, but some have now expanded their membership, some have been very local, some only covering a business park, whereas others have covered wider regions, some have had a very specific aim, eg reducing water use, whereas others have been broader, some going beyond waste minimization, and, some have limited their membership to sectors, to SMEs, or to their own suppliers, compared with others, which have included all types of companies.

Although promising developments are taking place, which are seeking to increase the impact of the projects, there is a lack of comprehensive data and a lack of evaluation. Evaluation has mainly taken the form of project reports, which are criticised by some academic writers for not necessarily being accurate, complete or consistent (Cheeseman and Phillips 2001). Such authors have taken initial steps in evaluating the financial and environmental impact of the project, but call for further work involving detailed cost benefit analysis (Henningsson et al 2001, Coskeran and Phillips 2005). As yet, attempts to evaluate the extent of learning and change which resulted from waste minimization projects have been very limited. Therefore, the question of the extent to which they can act as a catalyst to broader change has largely remained unanswered.

The little evaluation of projects that has been carried out tends to reveal that their impact has been limited. Cheeseman and Phillips (2001) point out that only a small proportion of firms have been affected by the projects. Relatively few companies have participated in each waste minimisation project, and many projects have ended once the initial period of funding has finished; thus it has been argued that their impact has tended to be localised and short-term (Shearlock et al 2000). Similar criticisms that the breadth and the depth of projects has been limited have been leveled at those carried out in the Netherlands. DeBruijn and Hofman (2000) point out that it has been proactive firms and not laggards that have participated, that their impact has been short-term and that pollution prevention

projects are unlikely to lead to an on-going learning process which will move them towards sustainable development.

However, since, the achievement of even the level of environmental management, which, arguably, does not go beyond the first phases of pollution prevention, has progressed slowly and unevenly, it can be argued, that more significant change is a long way off.

(4) SMEs and the Environment

The consensus is that SMEs are at a much lower level in terms of environmental awareness and elimination of environmental damage than larger firms. In the past research on business and the environment has concentrated on larger firms. However, more recently, this has begun to change. Statistics abound outlining the economic significance of Small and Medium-sized Enterprises (SMEs). In the UK, the 3.5 million plus SME population (Curran and Storey 2000) are responsible for over half of all employment and business turnover (DTI 2000). It is also claimed that the sector makes a significant contribution to environmental degradation, although only rather vague estimates as to the extent of the contribution have been made (eg Marshall 1998).

As a result, in recent years, greater attempts have been made to examine specifically the processes of environmental improvement in SMEs, and a literature has emerged on the greening of SMEs.

The main issues raised by these authors can be summarised as the following:

1) Some authors point to the ***lack of theoretical rigour*** in studies of SMEs and the environment (Gladwin 1993, Geiser and Crul 1996, Friedman and Miles 2002, Revell 2004). Some authors have recently begun to consider theoretical frameworks for analysing environmental improvement in SMEs (eg Walley and Stubbs 1999, Revell 2003). Hooper et al (2000) and Petts (2000) have looked at the greening of SMEs based on organisational learning theory.
2) Greening processes must be understood in terms of the ***characteristics of SMEs***. Attempts have been made to develop a general understanding of greening processes in SMEs based on characteristics of the SME 'sector' (eg Storey and Sykes 1996, Spence 1999). SMEs are characterised as informal and flexible. They do not have the bureaucratic structures of larger firms, but may be reliant on one or two individuals who will be involved in all aspects of the firm's operations. Storey and Sykes (1996) characterise them as adopting an ad hoc, reactive stance, making use of the flexibility afforded by their size. Spence (1999) summarises the main characteristics of small firms as owner-managed, independent, multi-tasking, fire-fighting, cash-limited, and based on personal relationships and informality.
3) However, a number of authors warn against homogenisation of an extremely ***diverse group of companies*** (Tilley 1999, Walley and Stubbs 1999, Hillary 2000). Hillary (2000), for example, recommends undertaking studies of sub-group within the SME 'sectors' based for example on size bands – micro, small and medium, and industrial sectors.
4) Whilst a list of drivers and barriers to greening in SMEs has emerged, more attention has been paid to ***barriers to greening in SMEs***. Barriers have focussed

on lack of awareness, lack of eco-literacy and lack of recognition of their own ecological footprint or responsibility to protect the environment.

5) Another area of development, based on some of the findings listed above, has been related to suggested approaches towards ***facilitating environmental management in SMEs***, as well as specific management tools developed or adapted for SMEs (eg Friedman and Miles 2002, Envirowise 2002, Perez-Sanchez and Bower 2003). This has included waste minimisation techniques.

The policy-making community and academic researchers have stressed the relatively poor environmental performance of SMEs, and measures to promote greening of SMEs have tended to focus on palatable measures, which do not require major changes in orientation and are easy to achieve, to an even greater extent than those aimed at larger firms. Waste minimization projects were thought to be an environmental management tool, which was suited to SMEs, since the relatively simple techniques and waste minimization measures have been recognized as achievable by SMEs. Whereas early waste minimization projects in the mid 1990s mainly attracted large firms, more recently, the membership has broadened and more SMEs have taken part. In the late 1990s, in an effort to attract more SMEs, methodologies have been developed specifically for SMEs.

(5) Organizational Learning, Organizational Knowledge and Organizational Culture

As mentioned above, some initial work has started to develop theories to understand environmental improvement in SMEs. This has included the application of organizational learning theories (Hooper et al 2000, Petts 2000). Organizational learning and organizational knowledge theories offer considerable potential to analyse the learning processes that SMEs engage in when embarking upon a waste minimisation project, since they may help in understanding the potential for incremental change, or which waste minimisation programmes may lead to broader environmental improvement. This Section will consider how this can be developed.

Organizational learning, organizational knowledge and organizational culture concepts were developed from earlier contributions to organizational theory, in particular from the work of March and Simon (1958), Cyert and March (1963) and Schein (1992), help to understand how knowledge is developed and communicated within and between organisations, and how learning takes place. Whilst these areas have developed separately, recently attempt have been made to integrate them. These three areas will be discussed separately and their links will then be identified.

Organizational Learning

The two main dimensions of organizational learning have concerned the nature of learning and the level of learning. The main discussion in terms of the nature of learning has been the distinction between cognitive change and behavioural change (eg Fiol and Lyles 1985). Cognitive change would consist of a change in an organisation's understanding of events and behavioural change organisation's its response to events. Whereas learning is viewed by some as change in the potential behaviour, others suggest

that actual behaviour must have changed for learning to have occurred (Beach 1965). According to Beach, *'learning can be defined as that human process by which skills, knowledge, habits, and attitudes are acquired and utilized in such a way that behaviour is modified.'* (page 321) Beach argues that a person must demonstrate his/her learning by completion of a task. Fiol and Lyles similarly imply in their working definition, that behavioural change is needed in order to be able to assert that learning has occurred, *'Organizational learning means the processes of improving actions through better knowledge and understanding*.' According to Fiol and Lyles, cognition and behaviour represent two different phenomena, which are not necessarily reflective of each other. Changes in behaviour may occur without any cognitive change and cognitive change may occur without changes in behaviour. They point out that small changes in behaviour do not necessarily represent cognitive change, and that major changes in action can take place in the absence of cognitive change, in fact action-making may even reflect a need to do something rather than being symptomatic of any understanding (Fiol and Lyles 1985).

On the other hand Huber's definition of learning indicates that potential change is sufficient, *'An entity learns if, through its processing of information, the range of potential behaviours is changed'* (1991, p. 89). The problem with such a definition is that cognitive change, not demonstrated by behavioural change, is difficult to measure (Cope and Watts 2000). Additionally, as highlighted by a number of authors who argue for the need to demonstrate learning with behaviour change, cognitive change is only useful if accompanied by some form of change in behaviour (eg Beach 1965, Hansen et al 2003).

The other dimension identified by many authors, is that of the level of learning. The level of learning has been generally seen as lower and higher level learning. Lower learning is described as factual learning, not accompanied by a major change in values, whereas higher level learning is associated with more fundamental cognitive changes, which represent changes to an individual's (or organisation's) worldview. The typology of lower-level and higher-level learning was developed by Bateson (1972) and Argyris and Schön (1978), and many authors have since contributed to this debate by adding their own understanding of lower-level and higher-level learning (Bourgoyne and Hodgson 1983, Fiol and Lyles 1985, Senge 1990, DiBella 1996, Pedler et al. 1991, Raelin 2001). Terms used by some of these authors include; single loop and double loop learning, lower level and higher level learning, adaptive learning and generative learning, incremental learning and transformational learning, implementing and improving.

According to Argyris (1999), single loop learning occurs when matches are created or mismatches are corrected by changing actions. *When an error is detected and corrected without questioning or altering the underlying values of the system, … the learning is single loop*" (page 68) Double loop learning, on the other hand, involves first examining and altering the governing variables and then the actions.

Fiol and Lyles provide a useful distinction between lower level learning which occurs within a given organizational structure or given set of rules. *"It leads to the development of some rudimentary associations of behaviour and outcomes, but these usually are of short duration and impact only part of what the organization does."* (1985 page 807) Such learning is a result of routine and repetition, and thus tends to take place in

organizational contexts which are well understood. On the other hand, higher-level learning aims to adjust overall rules and norms rather than specific activities or behaviours. It is more likely to have long-term effects and the context is more likely to be complex, ambiguous and ill-defined. They tend to associate lower level learning with lower and middle management and higher level learning with upper management, although lower and higher level learning are also not equated with lower and higher level organizational levels, and both can occur at both levels. They also point to considerable evidence that it is most likely to occur in the context of some form of crisis, which involves a major re-evaluation of goals or missions.

Some typologies, including that of Pedler et al, Bourgoyne and Hodgson and Raelin identify three levels of learning. According to Burgoyne and Hodgson's empirical results, level 1 learning involved taking in factual data which only had immediate relevance, level 2 learning involved learning something which was transferable to a different situation and involved changing conceptions about an aspects of the world. Level 3 involved changing conceptions about the world in general, how they were formed and how s/he might change them. It is interesting that their findings indicate that the deepest changes they identified came about as a result of a process of gradual and tacit change which they describe as a single loop of *'gradually eroding one belief and building another with a gradual accumulation of evidence and experience.'* (1983 page 398).

A number of authors have further examined the processes of achieving different levels of learning. Senge identifies the following 'core disciplines' needed in order to develop a learning organization: systems thinking, personal mastery, mental models, shared vision and team learning. Systems thinking involves seeing whole systems and the interconnections between things, rather than taking snapshots of isolated part of the whole. Personal mastery involves continually clarifying and deepening personal vision, focusing energy, developing patience and seeing reality objectively. He defines, mental models as '*deeply ingrained assumptions, generalizations or even pictures or images that influences how we understand the world and how we take action.'* (1990 page 8). Whilst mental models are powerful and influence our way of thinking deeply, they are also tacit, and we may not be aware of them. They result in us taking in information selectively. Building shared vision in organisations is distinguished from the vision of a charismatic leader or from a crisis that temporarily galvanises everyone, but rather should involve sustained goals, values or mission deeply shared within an organisation. And team learning involves genuine dialogue, as opposed to discussion, and surfacing of patterns of defensiveness which undermine learning.

For Argyris and Schön, espoused theories, theories-in-use and organizational defence routines are central concepts. They understand espoused theory as the theory which is advanced to explain a certain type of activity, whereas theory in use is '*the theory of action which is implicit in the performance of that pattern of activity*' (Argyris and Schön 1996 page 13). Theories in use are tacit and do not necessarily match the organisation's espoused theory. Argyris defines organizational defensive routines as actions, policies or practice that prevents individuals in organisations from experiencing embarrassment or threat and, but that prevent them from discovering the causes of the embarrassment or threat. Thus they inhibit genuine learning. They prevent learning from going beyond

finding the best way to solve traditional problems. Attempts to promote 'double loop' learning can trigger 'defensive routines', which ensure that new priorities and ways of seeing always fail to pass the tests of old evaluation metrics. Mental models are thereby effectively insulated from examination.

A number of authors attach importance to reflection in order to achieve learning. Raelin (2001), writing in the context of learning from projects, considers public reflection as the basis of learning. Raelin is of the opinion that public reflection in the presence of trusted peers is needed in order to diffuse learning beyond the project team to the organisation or indeed society. For Argyris and Schön, organizational learning is achieved by giving a place for reflection, and allowing underlying assumptions to be questioned.

Organizational Culture

Schein's work on organizational culture (Schein 1992) is linked closely to such concepts that underlie organizational learning. He considers three levels of culture;

(1) Artifacts – visible organizational structures and processes
(2) espoused values – strategies, goals and philosophies
(3) basic underlying assumptions – unconscious, taken-for-granted beliefs, perceptions, thoughts and feelings

Schein views the first level, of artifacts as easy to observe, but difficult to decipher, since deciphering them will reflect ones own feelings and reactions. Espoused values in an organisation are those which are documented and articulated, but they do not necessarily reflect a shared value or belief, and certainly not a shared assumption. Should such values be reinforced by a perception of their part in achieving success, they may eventually be transformed into shared values and ultimately shared assumptions. The third level of basic underlying assumptions is defined similar to Argyris and Schön's theories-in-use. They are so fundamental, that behaviour based on any other premise would be inconceivable. They, rather than espoused values, are the assumptions that actually guide behaviour. However, we never or very rarely confront or debate them, so they are extremely difficult to change.

Organizational Knowledge

Organizational knowledge is closely related to organizational learning, and some concepts related to the creation and transfer of knowledge are extremely useful in terms of developing an understanding of knowledge and learning within the context of waste minimisation projects.

A large literature now seeks to understand the problem of transferring knowledge within organisations and between organisations. The argument that there are two dimensions to knowledge has been particularly important. The explicit dimension of knowledge can be easily codified, whereas the tacit knowledge dimension, which is embodied in ways of working and unspoken codes of practice, cannot easily be codified. Such knowledge can best be transferred by face-to-face contact (Polyani 1958, Nonaka 1994). Others have used the terms 'sticky' and 'leaky' to describe knowledge. Explicit knowledge is 'leaky', or is difficult to contain within organizations, whereas tacit knowledge is 'sticky' or difficult to transfer (Brown and Duguid 2001).

Communities of Practice

Brown and Duguid view communities of practice, a concept pioneered by Lave and Wenger (1991), as a useful way of understanding the stickiness and leakiness of knowledge. Their development can be traced back to March and Simon's work. Their discussion of communication networks in organisations, points to the importance of links between similar individuals and specifically those within professions *'The possession by two persons, or two organization units, of a common, efficient language, facilitates communication. Thus, links between members of a common profession, tend to be used in the communications system'"* (page 189). They argue that this is reinforced by frequent contacts, which tends to result in professions having similar worldviews. Proponents of communities of practice (eg Lave and Wenger 1991, Wenger 1998, Brown and Duguid 2001) argue that knowledge and learning are situated in work practices. They arise from groups of individuals, such as those in the same profession, developing common work practices and a common culture. Swan et al (2002), highlight the usefulness of the concept of a community of practice as a counterpoint to the role of cognition in terms of understanding knowledge and learning, since it portrays knowledge as situated in work practices. Brown and Duguid (2001) make the distinction between communities of practice, which are based on the common practice of day-to-day activities and networks of practice, which they view as loose couplings of people working in the same type of practice, but whose day to day practice is not connected. Members of a network of practice are unlikely to know each other, but may share common practices.

Integration of Organizational Learning, Organizational Knowledge and Organizational Culture

The areas of organizational learning, organizational knowledge and organizational culture employ very similar concepts. Recent developments have sought to integrate some of these areas, in particular organizational learning and organizational knowledge, contributions being those of Chiva and Alegre (2005) and Hansen et al (2003).

Chiva and Alegre (2005) describe two strands of theory in each area, which they call (1) the cognitive-possession perspective and (2) the social-process perspective. The first, more established line of enquiry portrays knowledge as constructed in individuals and shared or communicated through social processes, whereas, according to the second perspective, which is becoming more important, knowledge is created through social interactions. Whereas the first perspective would tend to see knowledge and learning as separate, the second, social-process perspective views them as similar, and facilitates integration of the two areas of organizational learning and organizational knowledge. They place Nonaka's work in the first category, which sees knowledge as created in individuals, whereas they associate this second, social perspective with communities of practice and the work of Lave and Wenger and Brown and Duguid (2001).

Hansen et al (2003) discuss how knowledge is created and communicated in companies and sectors, applying this to the communication of knowledge about the environmental properties of chemicals. They suggest ways to overcome some of the differences in ways of understanding knowledge and learning. They understand knowledge as practice, meaning that the knowledge is demonstrated by its application, as situated, meaning that knowledge is neither individual nor collective, but rather enacted in 'the interaction

between individuals and collectives in a social context', and enacted, meaning that knowing is enacted by creating histories in order to make sense in fields of practice. They view the communicative acts in fields of practice as the enactment of knowledge.

Thus, such approaches, which emphasise the social construction of knowledge within communities, allow for the integration of organizational learning and organizational knowledge, and provide a useful way of considering knowledge transfer.

Networks

Whilst most environmentally-oriented organizational learning research focuses on internal learning capacity within companies, some authors, such as Hooper et al (2000), Petts (2000) and Tomer (1999) have made the case for looking beyond the firm to the networks in which it is embedded. The discussion of communities of practice clearly directs attention to inter-organizational networks, since communities of practice are not confined to within organisations. SMEs are unlikely to be large enough to have a department devoted to environmental issues, thus the reference group or community of practice of managers may be other professionals in other firms. Waste minimisation projects can encourage the development of such communities, which is discussed in greater depth in an earlier publication on this same piece of research (see Millard et al 2005).

(6) Discussion: Understanding SME Organizational Learning in Waste Minimization Projects

Studying the impact of waste minimisation schemes on SMEs offers an excellent opportunity to understand whether eco-efficiency and win-win inspires the kind of learning necessary for a fundamental cultural shift towards sustainable development. Hooper et al (2000) found evidence of a 'problem-solving' approach to environmental improvement in SMEs, whereby small changes were made that involved solving a specific problem and then moving on. There was little evidence of more systemic and deep-seated change. DeBruijn and Hofman (2000) considered the extent to which pollution prevention projects in the Netherlands were the catalyst to a learning process, which might for example involve a move from pollution prevention to product stewardship and then sustainable development. Their findings indicated that this was not happening.

Evalution of waste minimisation projects in the UK has tended to involve measures of their success confined to reporting how many companies took part, how many waste minimisation measures were found and implemented, calculations of cost savings, and other such indicators. Such indicators do not give any indication of whether a waste minimisation project is likely to instigate a learning process of continuous environmental improvement. This research therefore is careful not to measures success based on a list of measures. It is rather informed by theories of organizational knowledge and learning, which provide a useful framework for examining the extent to which such a learning process ensues from a waste minimisation project.

A review of the organisational learning, culture and knowledge literature can enhance theoretical sensitivity when conducting fieldwork in this area, and seven concepts have emerged as particularly promising for appreciating the absence or presence of organisational learning in the context of SME waste minimisation projects. In a few cases, examples from the data are used to further examine the usefulness of the concept.

Evidence of Questioning Underlying Assumptions

Most fundamental is that higher level learning goes beyond factual learning which is specific to the situation in which it occurs. It involves learning which can be applied in a different context, or according to some, involves questioning underlying assumptions. Systems thinking is, according to Senge, important in organizational learning. As such, it would appear that some wider appreciation of the aims and objectives of the waste minimization project must be in evidence in order to demonstrate higher level learning. In terms of the waste hierarchy, movement towards the cleaner technology end of waste minimization (ie towards waste prevention) or questioning and changing the nature of the relationship between the business and the environment may be associated with higher level learning. A movement beyond waste minimization towards product stewardship or sustainable development may be associated with systems thinking and might demonstrate higher level learning.

Approach to Cleaner Technology
In waste minimization, often the first steps have involved 'good housekeeping', such as fixing leaks and switching off lights and machines when not in use. Whilst this in a sense can be classed as prevention, at the top of the waste hierarchy, it also does not appear to be symptomatic of commitment or evidence of questioning underlying assumptions. When such simple changes have been made, the company then might go on to start considering process changes and investments in new technology. Cleaner technology has often been presented as move from 'end of pipe' changes, which tend not be symptomatic of a change in thinking associated with organizational learning, to small modifications to processes and more significant changes aimed at preventing waste occurring by re-thinking processes, which are more likely to demonstrate organizational learning (Hooper and Gibbs 1995).

Emphasis on Long-term Effects
Higher level learning is generally seen as having a long-term effect. Therefore changes that have a long-term effect in terms of environmental improvement should be sought. As such, an on-going commitment to waste minimization and possibly to broader environmental improvement may be associated with higher level learning. This would include engagement of the whole organization, possibly investments in cleaner technology of the type that require rethinking processes, and may involve the start of an on-going programme of broader environmental change (eg according to Hart's move from pollution prevention towards sustainable development).

Engagement of Whole Organization (Including Senior Management)
According to Fiol and Lyles, higher level learning is more likely to be associated with higher level management, although they are careful to point out that it should not be equated with senior management. Senge also cautions against equating the vision of a leader with that of the organization and talks about the need for 'shared vision'. Nevertheless, there is considerable evidence that, for change to happen, senior management must be committed. This is widely reported in terms of waste minimization projects. However, as mentioned above, the commitment of the whole organization is also crucial. The importance of the involvement of senior management and the importance of wide participation in the company came across as crucial to the success of the projects in the interviews. Organizational changes, such as individuals leaving and wider change and changes to ownership happened in several cases. Cases were found, due to such changes, where there was no knowledge at all of the project two or three years later. Even in the more committed companies, waste minimization was frequently driven by one individual and there is an obvious risk that ongoing engagement could be dependent on this individual staying with the organization.

Evidence of a Sense of Crisis
It is also pointed out that the reorientation of a company's goals tends to occur in contexts which are ill-defined, or at a time of crisis. Some literature associates management learning with crisis and in some cases with 'hard knocks' (see Snell

1992). On the other hand, Bourgoyne and Hodgson find that higher level learning can stem from a gradual erosion of beliefs. Also learning in a crisis may contradict the need for change to be long term, if change purely constitutes a short-term response to a crisis, also a point made by Senge. It may be thought that some sense of crisis or urgency would precipitate higher level learning, however the nature of this will become evident only following analysis of the interviews (for example whether there is a threat to the immediate survival of the company or whether a crisis can be about the longer term situation of the company or the threats to the environment, such as that of climate change). In some of the companies interviewed, there was a sense of crisis in the sense of threats to the competitiveness of their firms, often linked to the lack of competitiveness of the sector. In some cases this made the company work harder to minimize waste as part of a cost-cutting exercise.

Evidence of Reflection

Argyris and Schön, Raelin, and Bourgoyne and Hodgson all point to the role of reflection in realizing higher level learning. According to Bourgoyne and Hodgson, reflection when the person is not 'in the thick of it' is common in level 2 learning. Therefore, there is some implication that higher level learning may occur during a period of reflection following some form of crisis. According to Raelin, this is most effective in a group of trusted peers, and would appear important in terms of changing an organization as opposed to an individual's worldview. This is also close to the 'social process' perspective in organizational knowledge espoused by the community of practice concept. Clearly, waste minimization projects provide such an opportunity to stand back and reflect.

Beyond the Organization: Systems Thinking and Networks

Involvement of a wider range of actors in terms of the lifecycle of a product may constitute a move beyond pollution prevention (De Bruijn and Hofman 2000). This may consist of co-operation with suppliers and customers, for example. This may be limited to the exchange of information and ideas, or may be developed into firmer co-operation, such as waste exchange, and industrial symbiosis, frequently among companies on business parks, a concept increasingly being promoted and developed. However, so far there is little evidence of waste minimization programmes having developed in this way.

A combination of the above, inter-related concepts is likely to be symptomatic of the type of higher level learning needed for a move beyond the first stage of waste minimisation towards more fundamental change. These concepts will be further developed and refined through analysis of the interviews to propose a framework to understand the instigation of a learning process beginning with a few, simple changes, and leading to a broader engagement with environmental improvement. So far, there is little evidence that such a process has developed. It is hoped that further analysis may add to understanding of the conditions which tend to foster such a process. With this in mind, considerable attention has also been paid to the context of learning, and projects were selected based on the types most likely to promote organisational learning, for example those based on self-help and those where there was considerable consultant input, and those based on

different types of networks (discussed in Millard et al 2005). The features identified here will inform assessment of extent and nature of learning occurring in these different types of projects.

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