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Debbie Millard*

Management Learning and the Greening of SMEs: Moving beyond Problem-solving**

Win-win and eco-efficiency approaches to environmental management that focus on cost benefits from environmental improvement in business have been widely promoted in recent years. However they have been criticized because they are of limited appeal to small and medium sized enterprises (SMEs) and because they do not promote a broader programme of learning and change. Based on qualitative interviews with SMEs in the UK that have participated in a resource efficiency project, the paper aims to identify the conditions under which management learning is occurring, that triggers a process of on-going environmental improvement. The main indicators of management learning identified that lead to a process of learning and change were: cognitive and behaviour change; an approach that went beyond problem-solving; a culture of leadership and participation; a discontinuity that made resource efficiency a priority; a networked, open-minded leader.

Lernen von Managern und die Umweltorientierung von KMU: Mehr als Problemlösung

Win-win- und Ökoeffizienz-Ansätze im Umweltmanagement, die auf die Kosteneinsparung durch Umweltmanagement setzen, wurden in den letzten Jahren verstärkt empfohlen. Sie werden allerdings kritisiert, da sie auf wenig Interesse bei Klein- und Mittleren Unternehmen (KMU) stoßen und nicht unbedingt organisationales Lernen und Organisationsveränderung fördern. Basierend auf qualitativen Interviews mit Vertretern von KMU in Großbritannien, die an einem Ressourceneffizienz-Projekt teilnahmen, identifiziert dieser Aufsatz Bedingungen, unter denen organisationales Lernen stattfindet und ein kontinuierlicher Verbesserungsprozess des Umweltmanagements gefördert wird. Die Hauptfaktoren, die organisationales Lernen fördern und zu einem Prozess des Lernens und der Veränderung führen, waren: Kognitive und Verhaltensänderungen; eine Überwindung des Problemlösungsfokus; eine Kultur der Führung und Partizipation; eine Diskontinuität, die Ressourceneffizienz prioritär macht; ein vernetzter, aufgeschlossener Geschäftsführer.

Key words: **greening, resource efficiency, SMEs, learning**
(JEL: M12, M14, M54, Q01)

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1. Introduction

Environmental issues are increasingly recognized by the public and industry. Win-win approaches to environmental management in businesses have gained ground since the 1990s, with an increasing emphasis on the efficiency and productivity gains to be made from environmental measures. Eco-efficiency has been portrayed as a "win-win" scenario, where more efficient use of resources can enhance competitiveness (eg Porter & van der Linde, 1995; Kolk, 2000; Seiler-Hausmann, Liedtke, & von Weizsäcker, 2004). Policymakers have promoted eco-efficiency in order to start a process of environmental improvement. From the 1990s, resource efficiency projects have been developed in a number of countries to demonstrate the environmental and financial benefits of pollution prevention.

However, there has been widespread criticism of eco-efficiency because too few companies are engaged, particularly too few small and medium sized enterprises (SMEs), who may not recognize the benefits of resource efficiency (eg Revell & Blackburn, 2007) and because change does not go deep enough (Welford, 1997; Hawken et al., 1999; Hagen & Larsaether, 2000; Holliday, Schmidheiny, & Watts, 2002; Harris & Crane, 2002). Evaluations of resource efficiency programmes that have sought to understand the extent of change they result in suggests that they have produced one-off changes but have not kicked off a process of continuous improvement (DeBruijn & Hofman, 2000; Stone, 2006a).

Many authors have argued for greater culture change to promote greening of business (eg Shrivastava, 1995; Wehrmeyer, 1996; Welford, 1997; Harris & Crane, 2002). There is growing evidence of the importance of HRM in improving businesses' environmental performance (eg Wehrmeyer, 1996; Boudreau & Ramstad, 2005; Jabbour & Santos, 2008; Jabbour, Santos, & Nagano, 2010). Stone (2006a) argues that people are the greatest hindrance to improving environmental management in New Zealand companies. According to Wehrmeyer (1996) not technology, but people and their attitudes and motives make for success. Wehrmeyer argues that one of the three main functions of HRM is the promotion and support of organizational dynamics, in particular shaping corporate culture, change management, the improvement of communication and of lateral thinking and interpersonal and team skills. Jabbour and Santos (2008) argue that HRM is important in developing an organizational culture that supports environmental innovation and learning. In order to achieve this, it might be thought that environmental improvement should be incorporated into all aspects of HRM, such as recruitment, training, staff participation and career management.

A number of authors have recognized the usefulness of organizational learning concepts to understand environmental improvement in businesses (eg Hagen & Larsaether, 2000; Hooper et al., 2000; Hansen et al., 2005; Roome & Wijten, 2005; Stone, 2006a, 2006b). However, there is a shortage of conceptual and empirical data that details how these concepts can be operationalized. Moreover, very little of the research on Green HRM or organizational learning and greening relates to SMEs. This is despite the fact that a number of authors have pointed out that concepts developed for large firms cannot necessarily be applied to SMEs.

Based on interviews with SMEs that have participated in a resource efficiency project, this paper seeks to advance understanding of conditions under which a project with limited objectives, can start a process of learning and change in SMEs. The review Sections will now seek to identify factors likely to foster learning and change within the context of SMEs that participated in a resource efficiency project, which will then be tested and further developed during analysis of the interviews.

2. Resource efficiency and environmental improvement

Resource efficiency projects were developed largely from the 1990s, following the proliferation of literature on win-win scenarios and eco-efficiency, seeking to demonstrate that reducing waste produces efficiencies and cost savings which increase business profitability (eg Porter & van der Linde, 1995; von Weizsäcker et al., 1998; Kolk, 2000; Hoffmann, 2000; Tilley, Hooper & Walley, 2003). It is based on concepts such as cleaner technology, which implies an emphasis on reducing waste at source rather than “end of pipe” approaches to pollution prevention. The “waste hierarchy”, which is often cited, suggests that elimination or reduction of waste during (or prior to) production is more desirable than re-use and recycling of waste, with disposal being a last resort. The first projects in the UK were developed in the early 1990s. Resource efficiency has been promoted by business support organizations, such as Envirowise, The Wastes and Resources Action Programme (WRAP), Business Links and the Environment Agency (eg WRAP, 2010).

The emphasis on eco-efficiency has been criticized as inadequate to achieve sustainable development. Two main problems have been highlighted. Firstly, insufficient numbers of companies have taken eco-efficiency on board (Holliday, Schmidheiny & Watts, 2002), notably too few SMEs. The reluctance of SMEs to engage in environmental improvement programmes has been widely documented (eg Smith, 1998; Tilley, 1999; Revell & Rutherford, 2003). Secondly, producing goods and services more efficiently may be insufficient to compensate for increased production, or may even open the door to increased production (von Weizsäcker, Lovins & Lovins, 1998; Holliday, Schmidheiny & Watts, 2002). This implies that eco-efficiency can only be a first step towards sustainable development, implied in staged models of environmental improvement (eg Hart, 1995). Many resource efficiency programmes have been for a short duration and have been evaluated, if at all, shortly after the programmes, based largely on financial savings and in some cases environmental savings. The few attempts to consider long term change as a result of such programmes, notably DeBruijn and Hofman (2000) and Stone (2006a and 2006b) have largely found that projects are a one-off experience that do not result in a process of learning and change. Based on this discussion, an indicator of management learning would be an appreciation of broader principles of resource efficiency or sustainable development, and some level of progression possibly from easier to solve problems to more difficult issues or from end of pipe approaches towards integrating waste prevention into production or design stages.

3. SMEs, resource efficiency and environmental improvement

Promoting a process of learning and change presents particular challenges in SMEs. Much research on environmental improvement in business, Green HRM and the learning organization has focused on large firms, often citing good practice in large multinationals. There have been criticisms that the focus on structures, procedures and systems is less relevant to SMEs. Research on SMEs and the environment has often stressed their poor environmental performance (eg Masurel, 2007), and barriers to greening have been a major focus of research. Barriers highlighted have included lack of resources and lack of awareness of their own ecological footprint or responsibility to protect the environment (Tilley, 1999; Hillary, 2000). According to Revell (2010), concern for the environment among SMEs has increased in recent years. However eco-efficiency and win-win opportunities are often not seen as relevant to SMEs (Simpson et al., 2004; Environment Agency, 2007; Revell, 2007), who may be more motivated by personal concern for the environment (Revell, 2010). Many authors have pointed out that greening processes must be understood in terms of the characteristics of SMEs, focusing on their lack of management teams and dependence on few individuals, flexibility, informality, focus on immediate issues and fire-fighting nature, and the uncertainty of the environment in which they operate (eg Spence, 1999; Gibb, 2000; Envirowise, 2001; Hansen et al., 2002; Tilley, Hooper, & Walley, 2003). Efficiency gains may not be significant for SMEs which operate on a small scale, or up-front investments may be inaccessible. According to Vickers and Cordey-Hayes (1999) many of the necessary structures which foster quality and efficiency-led learning, such as environmental policies, management systems, auditing procedures, and training and awareness, are not in place in SMEs. It has been argued that environmental actions tend to be ad hoc rather than strategic (Hooper, Jukes, & Stubbs, 2000; Schaper, 2002; Simpson, 2004; Revell, 2010). Hooper, Jukes and Stubbs (2000) talk about a "problem-solving" response to environmental issues among SMEs, implying that broader change may be unlikely within the scope of a resource efficiency project. On the other hand according to Brio, Fernandez and Junquera (2007), the strategic integration of environmental issues is a key success factor in companies' environmental performance. This Section has identified a more strategic approach as a further indicator of management learning.

4. The contribution of organizational learning to understanding environmental improvement

Organizational learning concepts are useful to analyze the extent of change as a result of participation in a resource efficiency project. They 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). They help to understand how knowledge is developed and communicated within and between organizations, and how learning takes place. The next Section identifies the following concepts, which, alongside the two concepts mentioned above, will be used to analyze results from the interviews; cognitive and behavioural change; learning in a crisis; involvement of the whole organization; learning in networks.

4.1 Cognitive and behavioural change

A useful concept in understanding the extent of learning from a resource efficiency project is the distinction between cognitive and behavioural change. Fiol and Lyles (1985) argue that cognitive change consists of a change in an organization's understanding of events and behavioural change, change of an organization's response to events. 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. Action taking may reflect a need to do something rather than being symptomatic of any new understanding (Fiol & Lyles, 1985). As discussed in Section 2, evaluations of resource efficiency programmes have so far shown little evidence of cognitive change, often highlighting only changes in behaviour.

4.2 Learning in a crisis

Another useful concept relates to the level of learning. The typology of lower-level and higher-level learning was developed by Bateson (1972) and Argyris and Schön (1978), and this has been further developed by many authors (eg Bourgoyne & Hodgson, 1983; Fiol & Lyles, 1985; Senge, 1990; DiBella et al., 1996; Raelin, 2001). 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 organization's) worldview. A number of authors attach importance to reflection in order to achieve learning (eg Argyris & Schön, 1978; Raelin, 2001). Raelin, writing about learning in projects, argues that public reflection in the presence of trusted peers is needed to diffuse learning beyond the project team to the organization or society. Argyris and Schön (1978) argue that organizational learning is achieved by giving a place for reflection, allowing underlying assumptions to be questioned. Learning has also been classified as tactical and strategic, tactical learning focusing on immediate problem-solving and strategic learning on the development of capacity to build a base for future innovation (Vickers & Cordey-Hayes, 1999). Hagen and Larsaether (2000) have argued that eco-efficiency may represent single-loop learning. Double loop or strategic learning is more likely to foster longer-term environmental improvement which goes beyond the immediate effects of participation in a project.

According to Fiol and Lyles (1985) lower-level learning occurs within a given organizational structure or set of rules, that occurs as a result of routine and repetition, and tends to take place in organizational contexts that are well understood. The impacts are of short duration and only impact on part of what the organization does. 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. Higher-level learning is likely to occur in the context of some form of crisis (March & Simon, 1958; Fiol & Lyles, 1985; Cope, 2003). This may involve a major re-evaluation of goals, which, within the context of a resource efficiency project, may involve a re-orientation towards resource efficiency, as part of a broader strategy of environmental improvement, often associated

with improvements in other areas, such as innovation, quality, and HRM (Cordey-Hayes, 1999; Jabbour & Santos, 2008). This will now be discussed.

4.3 Involvement of the whole organization

There is considerable evidence in Green HRM literature to suggest that senior management leadership and staff participation are important in producing environmental innovations symptomatic of a learning organization (eg Wehrmeyer, 1996; Ramus, 2002; Brio, Fernandez & Junquera, 2007; Jabbour & Santos, 2008). Senge (1990) speaks of the need for both senior management commitment and staff participation in terms of organizational learning. Since higher-level learning impacts on the whole of the organization, it is likely to involve senior management (Fiol & Lyles, 1985). It is widely argued that senior management commitment is essential in environmental improvement (eg Wehrmeyer, 1996; Brio, Fernandez & Junquera, 2007). However, environmental management is implemented by middle managers and operatives (Rothenberg, 2003). Brio, Fernandez and Junquera (2007) found that both employees' motivation and participation and senior management commitment are key success factors in companies' environmental performance. Innovation and learning which leads to environmental improvement are likely to involve people at all levels in the organization (Vickers & Cordey-Hayes, 1999; Ramus, 2002). In fact Ramus identified communication and participation of employees to be the main factors encouraging eco-initiatives.

4.4 Learning in networks

Ramus argues that, as well as involving staff at all levels within an organization, innovation is likely to involve learning from people in other organizations. Hooper, Jukes and Stubbs (2000), Petts (2000) and Tomer (1999) have made the case for looking to the networks in which companies are embedded, particularly in the context of SMEs, where internal resources are limited. The concept of "communities of practice" has become increasingly recognized as a way to describe networks of professionals operating across organizations (Wenger, 1998). In SMEs environmental management is often the responsibility of one individual, who may have other roles (Envirowise, 2001). A resource efficiency group could provide a "community of practice" across a number of firms for learning about environmental improvement that would not be available within the firm.

The above sections have identified the following indicators of organizational learning: approach to resource efficiency; strategic response to environmental improvement; cognitive and behaviour change; learning in a crisis; involvement of the whole organization; learning in networks. Following a description of the Methodology, these concepts will be tested in the Results Section.

5. Methodology

It was decided that the aim of identifying a variety of learning outcomes in SMEs would be best achieved by covering the whole of the UK. In order to be able to explore some of the concepts in sufficient depth and allow respondents to explain the process of learning, it was decided to use qualitative methods based on interviews with the person in the company who had participated in the project. The research consisted

of two phases: (1) Identifying the range of projects and (2) Assessing the level of management learning.

5.1 Identifying the range of projects

Resource efficiency projects in the UK were initially developed with government funding to demonstrate the financial and environmental benefits of resource efficiency. A database on the Envirowise website with a listing of resource efficiency projects was used to identify projects. This was supplemented with interviews with four key informants supporting resource efficiency and co-ordinators of six resource efficiency projects, a literature review of existing typologies of resource efficiency projects, a literature review of organizational learning (above) and environmental networks (described in Millard et al., 2005). Following these, a typology of projects was developed.

The sampling was based on the aim of identifying a wide range of learning outcomes rather than random sampling (Weiss, 2004). It was therefore decided to include in the sample, projects that gave the opportunity for different levels of learning and networking. Projects in the UK have been based both on consultants providing advice and on self-help workshops, where companies learn from each other, often a combination of both. Following the success of early projects in reducing costs, government funding was reduced and there was a greater focus on self-help workshops. The networks upon which the projects have been based have also varied, and have included sectoral networks, supply chain networks, SME networks, groups of companies on the same business park, and broader networks of companies. It has been widely argued that similar companies likely to already know each other may find it easier to develop a common understanding, but on the other hand, familiarity may also limit the scope for learning (see for example Granovetter, 1973; Halme, 2001). In order to incorporate these, the typology developed was based on networking and networks (described in Millard et al., 2005 and Millard 2007).

5.2 Assessing the level of management learning

In order to provide triangulation, suggested as a method to ensure validity in qualitative research (Denzin & Lincoln, 1994), data was collected from a number of sources, notably project reports, face-to-face interviews with project co-ordinators and face-to-face interviews with managers of companies that had participated in each of the five projects. The companies interviewed reflected the project selected. Table 1 gives details of companies and managers interviewed.

Semi-structured face-to-face interviews were carried out in 2004 some time (maximum 3 years) after completion of the project (other than one that was ongoing) with the person who had taken part in the resource efficiency group. In-depth study of one project or a very small number of organizations may have allowed more interviews in each company, but would not have allowed a comparison between projects and companies. The interviews aimed to assess the level of management learning achieved as a result of participation in the project. Influenced by grounded theory, the research involved using the literature review and empirical work to generate results, modifying initial theories as data was collected (Strauss & Corbin, 1994). Thus the approach was not purely inductive, but informed by the literature reviewed above, and

developed further during the analysis. Interviews were also influenced by these concepts, and included questions about what happened as a result of the project and what managers learned as a result of the project (cognitive and behaviour change), as well as broader questions about learning and learning networks. Techniques used to help respondents recall the project included sending a summary of questions in advance of the interview and asking them about "critical events" at the time of the project.

Table 1: Companies interviewed

Co. Id.	Project	Size	Sector	Ownership	Respondent
1	1	Medium	Printing	Independent	Other director
2	1	Medium	Bottle fixtures manufacture	Group	Other manager
3	1	Medium	Packaging manufacture	Group	Quality/HSE manager
4	1	Medium	Printing	Independent	Quality/HSE manager
5	2a	Micro	Foundry	Independent	Owner/MD
6	2a	Medium	Foundry	Independent	Owner/MD
7	2a	Medium	Foundry	Independent	Owner/MD
8	2a	Micro	Foundry	Independent	Owner/MD
9	2b	Medium	Label manufacture	Group	Production director
10	2b	Large	Medical equipment manufacture	Group	Quality/HSE manager
11	3	Small	Chemical storage/blending	Independent	Production manager
12	3	Small	Sausage skin manufacture	Independent	Owner/MD
13	4	Medium	Haulage	Independent	Other manager
14	4	Medium	Haulage	Independent	Owner/MD
15	4	Medium	Vehicle servicing	Independent	General manager
16	5	Medium	Racking manufacture	Independent	Quality/HSE manager
17	5	Medium	Heat exchangers manufacture	Group	Quality/HSE manager
18	5	Medium	Medical equipment manufacture	Group	Production manager
19	5	Medium	Production machinery manufacture	Independent	Other manager

Interviews were recorded and transcribed. They were then entered into a qualitative analysis programme (N8). The interviews were coded thematically and data on the companies was also entered (see above table). Indicators of management learning were developed initially based on the literature review and further developed following the data analysis. The results are presented based on the emerging indicators of management learning.

6. Results: indicators of management learning

The SMEs selected had decided to participate in a resource efficiency project. Thus it may be expected that they have some commitment to environmental improvement. However higher-level learning based on the above criteria was variable, but quite limited, as will now be explained.

6.1 Cognitive and behaviour change

The review of organizational learning pointed to the distinction between cognitive and behavioural change. Cognitive change included reflecting on principles of resource efficiency or the position of the company on the waste hierarchy, or on the importance of resource efficiency to the business, for example the following: *"If we can identify ... a process problem at the beginning of the process and rectify it then we're eliminating waste."* (Company 6) Despite evidence of reflection, behaviour change was not in evidence here. Behaviour changes included; re-using water in the production processes, removing a process from production, fitting energy-saving equipment, adopting ISO14001, and introducing staff suggestion boxes. The following is one example: *"We test our heat exchangers with this pure water and we were disposing of the water after one use... we found out that we can now re-use this water... So that in effect is saving us something like £5000 a year ... I haven't got many problems here... those were the two ones requiring most attention."* (Company 17) Such changes alone do not constitute systemic change and do not reflect management learning. Cognitive change in conjunction with behaviour change proved difficult to identify, although there was some evidence in the companies where the greatest management learning occurred.

The main motivations for participation were: (1) general interest (2) more strategic (3) problem-solving (4) network drivers. They had an important impact on the level of change. Some companies that had participated in order to resolve specific problems tended to take a narrow approach with little evidence of cognitive change. On the other hand, some degree of problem-solving or sense of urgency is needed for behaviour change to occur. Some companies participated because of general interest and networks drivers, such as pressures from customers. They were in most cases not committed to making changes.

More significant change was more likely if managers saw environmental issues as urgent and where solving a problem was accompanied by reflection and learning. A few managers interviewed also spoke of a re-orientation of company values, which encompassed increased environmental commitment as part of broader strategies; these were the companies where learning was greatest. These are now discussed in greater depth.

6.2 Approach to resource efficiency

The review of SMEs and the environment suggested that their response to environmental problems tends to be ad hoc. Other evaluations of pollution prevention programmes also indicate that pollution prevention does not tend to lead to systemic change (DeBruijn & Hofman, 2000; Stone, 2006a, 2006b).

Analysis of the interviews indicated that long-term change is likely to be evidenced by; on-going changes; looking at a variety of issues; integration of resource efficiency into broader strategies; a progression in resource efficiency.

Just over half of the companies (11 of the 19) gave examples of more recent environmental improvements; thus there was some evidence they had continued with environmental improvement. However in many cases a strategic response was lacking. Often changes were one-off and did not involve adopting broader principles, for example Company 17, quoted in Section 6.1. Another manager (Company 12) explained that the company signed up for the project mainly because they were concerned about water use. As a result of the group, they identified and fixed a leak and purchased a water recycler: *"Our water consumption was around 110 – 120 cubic meters a day, and when we'd found the fault we put in a series of things [the consultant] suggested ...we were down to about 20."* These two companies identified these changes as the main results of the project. Reflection on and adoption of broader principles was not in evidence.

6.3 Strategic approach to environmental improvement

Other companies went beyond solving immediate problems and showed some evidence of adopting broader principles, such as the following: *"So, whereas we used to do a primer undercoat and top coat, we've now taken one of those processes out completely, so we've reduced our paint use by a third ... And where did the idea come from? Well ... apart from the XXX Waste Minimization Group encouraging you to look at every process within the company and to look at it, 'Why do you do it?' 'Do you still need to do it?' It seemed like a value chain analysis. Is there anything in that chain that doesn't add value? If it doesn't then take it out."* [Company 19] Although there is some reflection and adoption of principles promoted by the waste minimization group, there is little evidence of a broader strategic response to environmental issues.

Four companies showed awareness of the progression from easy to solve problems towards more difficult to implement measures, including the following two *"In order to convince my fellow directors as to the fact that this was a good project, we took the projects which cost nothing or very little, and from that we showed the benefits, and then the money that we generated from the low cost options I then used for high costs options."* [Company 9] The company with the greatest awareness of both the waste hierarchy and the progression from easier to more difficult options was one that was part of a larger firm, albeit a smaller unit (of 250 employees): *"Waste minimization they had a good handle on to a certain extent, except the top end, you know making more efficient use out of things ... You don't spend a lot of money when you can get savings from spending little money. And that's basically it. Because initially they had no real maintenance structure for addressing leaks in the system ... they were able to demonstrate, 'cos they had sufficient data, that they would be able to get money back from installing more efficient compressors."* [Company 10]

Other companies also took a more strategic response in terms of integrating environmental improvement into broader issues. One company had implemented ISO14001 and a number of companies were considering it. Two companies viewed environmental issues as part of continuous improvement encompassing improved quality, intra-company communications and staff participation, which will now be discussed.

6.4 *Involvement of the whole organization*

The commitment of senior management and of other staff in the company to the resource efficiency programme can be seen in the extent to which they are involved in the programme and the extent to which they are supportive. In almost half of the cases, a senior manager was the key participant in the resource efficiency project. Operatives were in some cases involved in meeting consultants or contributing through suggestion boxes. There were two cases, where the person who attended resource efficiency group meetings was a middle manager, who championed the project but felt the senior management were not committed, for example the following case: *"I think if the managing director is committed to it, then there is much more impetus for things to happen. At the moment because he just says, 'You know more about it, get on with it.' I have to fight other people to get things done."* [Company 17] In other cases, the participant felt the senior management were supportive. There was one case where the enthusiasm of the project participant coincided with commitment by the new manager to cost-cutting, resource efficiency and continuous improvement.

The role of staff in the resource efficiency programme and in environmental improvement generally was reflected in the extent to which there was a culture that promoted participation, communication and continuous improvement. There were essentially three groups of companies (1) those where staff would make changes if directed – two companies (2) those where staff had not been consulted to a great extent – eleven companies (3) more proactive companies that actively sought staff input – six companies. There were six companies that had formal mechanisms for staff input. Four of them had introduced suggestion boxes recently, and two had a formal structure to the waste minimization project, which involved setting up teams amongst the operators. Two of the companies that had introduced suggestion boxes had recently experienced management changes, with new management introducing many changes. Both interviewees said the culture of the company had changed considerably, with numerous initiatives to increase staff involvement, introduce continuous improvement and other changes.

On the other hand, behaviour changes alone, such as introducing suggestion boxes or formal environmental management schemes did not equate with cognitive change and higher level learning. The one company that had introduced ISO14001 for example was not open to learning from networks (discussed in Section 6.6). Another company that had suggestion boxes did not provide evidence of higher level learning as discussed in Section 6.1. This may indicate that formal schemes represent artefacts of organizational culture, and do not reflect deeper change.

6.5 *Learning in a crisis*

Supporting the premise that higher-level learning tends to happen in times of turbulence (Fiol & Lyles, 1985; March & Simon, 1958), there was considerable evidence from the interviews that some form of discontinuity precipitated a focus on resource efficiency.

Five companies interviewed had undergone organizational changes, were looking for new ideas, and were highly receptive to learning, such as the following example: *"We had a new MD. He went, 'I'm going to save £100,000 in a month'... He came in wielding*

the large axe, and chopped out the dinosaurs, effectively ... Now we're looking at excellence, not just what we do, but how we do the work and the knock—on effects, and there's been a lot more focus on actually how we operate ethically, which also ties in with many different things, the quality, health and safety, the environmental benefits from that." [Company 16] This participant, who was very committed to the resource efficiency group, had benefited from an improvement in the corporate culture, and now felt that management support for environmental initiatives and resource efficiency had greatly improved.

In two other cases, companies had been taken over by new owners, which had lead to a greater focus on environmental improvement. More stable companies were less likely to be open to learning. Linked to this, another important element was viewing resource efficiency as crucial to competitiveness, which was the case for the above company (Company 16) and for Company 9 (quoted in Section 6.3), two of the companies that showed the highest degree of learning.

6.6 Learning in networks

The discussion on organizational learning stressed the importance of networks for SMEs. Further evidence of management learning was found in the openness of managers to learn from a variety of sources. By participating in a resource efficiency group, the managers interviewed had taken steps towards participating in networks that would support environmental improvement activities within their company. Thus, to that extent it might be thought they believed in learning from networks. However, the motivation for participation varied. Whereas in some cases individuals were highly motivated, in other cases they participated because someone else asked them to. In the case of the supply chain project, the companies participated at their customer's request. One manager participated at the request of a senior manager. Some participated because they knew the co-ordinator and it was easy to turn up for a few meetings. Such participants may not be committed to change.

Learning networks fell broadly into three groups (1) Three managers said they learned little, or struggled to give examples of whom they might learn from. They included two hauliers, who felt they did not have much waste, and what they did have was reasonably under control. (2) The majority were more open to learning, but learning networks were limited to within the company, business support organizations and consultants, and less from other companies. Some referred to information rather than learning. These included two that had or planned to achieve ISO 14001 accreditation. Similarly to Hansen et al. (2002), it was found that limited time for networking was linked to seeing their environmental issues in narrow terms. For example, a gravity pressure die-casting company interviewed (Company 7) found that the other foundries in the group were sand blasting foundries, so had different waste issues, therefore they felt there was little they could learn from the other companies. (3) A minority of companies were open to learning from anyone, including companies from different sectors, colleagues within the company and social networks, such as ex-colleagues and others. Some participated in other groups. They thought more broadly and displayed facets of cognitive change and behaviour change, suggesting that networking also tends to be symptomatic of higher level learning, such as the following, (Compa-

ny 16), contrasting sharply with Company 7. *"I always listen to what people have got to say and how best to, I suppose translate it into our company."*

The tendency to think in narrow terms was partly a function of the group in which the managers participated. Some resource efficiency groups tended to foster higher level learning to a greater extent than others. Generally, broader groups tended to foster broader thinking. Groups based on a range of different types of companies without specific pre-existing networks tended to foster higher level learning more than groups of similar companies (See Millard, 2007).

7. Discussion: indicators of management learning

The indicators of management learning were slightly refined following the data analysis. Table 2 summarizes the main indicators of management learning identified:

Table 2: Indicators of management learning

1 Cognitive change in conjunction with behaviour change
Reflecting on broad principles and taking action.
2 Beyond problem-solving
Strategic approaches: resource efficiency project is part of a longer-term strategy, on-going changes, progression in cleaner technology.
3 Culture of leadership and participation
Commitment of senior management, promoting participation and suggestions from staff.
4 Discontinuity that made waste minimization a priority
Learning happened during periods of turbulence, where resource efficiency came to be viewed as crucial for competitiveness.
5 A networked, open-minded leader
Managers were open to learning from multiple sources including outside the organization.

A combination of these factors tended to result in management learning. A prerequisite for cognitive change was an internalization of values or principles rather than participating in a project because of external pressures alone. It involved some degree of reflection on the broader principles of resource efficiency, however it appeared that this type of reflection did not necessarily produce on-going learning and change. This was more likely if resource efficiency and environmental issues were part of the broader corporate culture of the company. This necessarily involves the organization as a whole, including senior management, middle managers and staff. It is also likely to involve networking and learning from multiple sources.

Table 3 gives details of the companies where the indicators of management learning were present. It shows that there were no companies where all of the indicators of management learning were present, but four companies where four of the five indicators were present. Three of these had been taken over by new management, which was committed to resource efficiency as part of a re-orientation of company values, encompassing quality, communications and participation (in one case change happened after the project and was not a result of it).

Table 3: Learning by company

Co. Id.	Project	Size	Sector	Ownership	Respondent	Indicators of learning *
1	1	Medium	Printing	Independent	Other director	2,3,4
2	1	Medium	Bottle fixtures manufacture	Group	Other manager	2,3,4,5
3	1	Medium	Packaging manufacture	Group	Quality/HSE manager	2,4
4	1	Medium	Printing	Independent	Quality/HSE manager	2,4
5	2a	Micro	Foundry	Independent	Owner/MD	2,5
6	2a	Medium	Foundry	Independent	Owner/MD	2
7	2a	Medium	Foundry	Independent	Owner/MD	5
8	2a	Micro	Foundry	Independent	Owner/MD	4
9	2b	Medium	Label manufacture	Group	Production director	1,2,3,5
10	2b	Large	Medical equipment manufacture	Group	Quality/HSE manager	1,2,3
11	3	Small	Chemical storage/blending	Independent	Production manager	2,3
12	3	Small	Sausage skin manufacture	Independent	Owner/MD	
13	4	Medium	Haulage	Independent	Other manager	
14	4	Medium	Haulage	Independent	Owner/MD	
15	4	Medium	Vehicle servicing	Independent	General manager	2,3,4,5 (after project)
16	5	Medium	Racking manufacture	Independent	Quality/HSE manager	2,3,4,5
17	5	Medium	Heat exchangers manufacture	Group	Quality/HSE manager	2
18	5	Medium	Medical equipment manufacture	Group	Production manager	1,2,5
19	5	Medium	Production machinery manufacture	Independent	Other manager	1,2

* 1 Cognitive change in conjunction with behaviour change, 2 Beyond problem-solving, 3 Culture of leadership and participation, 4 Discontinuity that made waste minimization a priority, 5 A networked, open-minded leader

At the other end of the continuum, there were three companies where none of the indicators were in evidence. The two haulage companies had barely made any changes as a result of the project. The third company had participated in the project because of concerns about its water use (Company 12). Here, the company's motivations were very much based on a problem-solving approach and they had achieved immediate results, but very little in terms of management learning. Change was also limited in the foundries, a declining sector.

The SMEs in this sample had participated in a range of projects in order to reduce their waste, and thus, had an interest in environmental improvement, but the immediate objectives of the projects were generally fairly limited. They did not neces-

sarily imply major culture change. The paper has argued that, in order to progress in environmental improvement, participation in a resource efficiency project must lead to an on going process of change that goes beyond immediate changes in behaviour. Management learning was most likely if participation in the programme coincided with a strong focus on organizational change in the organization as a whole encompassing resource efficiency, in particular if it were seen as crucial to the competitiveness of the business. It was least likely if the company was stable, waste was not seen as a major issue in the sector or waste reduction was not seen as crucial, or if the focus was on problem-solving alone. It appeared that, in some cases, the resource efficiency programme matched company priorities well. It is important to note that in a number of cases there had been significant changes since the project. In some companies resource efficiency was not a focus at the time of the project, but priorities had changed with a new focus on resource efficiency.

8. Conclusions

A central research question in this paper was to assess the level of management learning arising from participation in a resource efficiency project. The paper has made a contribution to defining the elements that indicate management learning leading to environmental improvement in SMEs. In terms of evaluation, it confirms results from other research, such as Stone (2006a), that evaluating programmes based on the level of organizational change, can have very different results to evaluations based on immediate results in terms of behaviour change. The paper adds to a growing body of evidence highlighting the importance of organizational culture, learning and change in improving the environmental performance of business. There is some resonance with the findings of Hansen et al. (2002), who characterize the innovative capability of SMEs as interplay of competences, strategic orientation and network relations. Taken together with other literature, it suggests that the main elements of management learning relate to HRM (in particular management learning, leadership and participation), strategy and networks.

The paper has used qualitative methods, but interviews were carried out with a range of SMEs, in order to be able to make comparisons and to characterize some of the different elements of management learning. Future research might include testing and developing this framework with different samples of SMEs. Larger samples might cover a broader range of firms, not only those that have already participated in some form of environmental programme. A smaller sample might include in depth work with few organizations encompassing interviews with a range of staff, and more detailed work on HRM characteristics of SMEs that promote eco-innovation. Other ways of defining SMEs might also include innovative, high growth SMEs compared with low growth SMEs, and high growth compared with low growth sectors (see for example Zhang, Macpherson and Jones 2006). The research pointed to the importance of frequent changes in ownership and management. Longitudinal research would be extremely useful to evaluate changes over time.

In terms of developing environmental programmes, the paper points to the importance of working with companies that have some willingness to change or working with companies over a longer period. Engaging the company at the right time for

company is important, in particular at times of turbulence or change, where learning is more likely. It also shows the importance of working on broader programmes of change with companies. Once the company has signed up for a programme, some form of on going engagement could be useful to maintain the momentum. In the case of one of the projects, companies could, after the end of the short-term project, join an environmental support organization, which would offer on going support at a lower level. In another project, an on going waste minimization forum was in place, with also opportunities to employ students for a shorter-term consultancy exercise. Such models help to combine problem-solving with long-term change.

The research also has implications for Green HRM. Integrating environmental issues more widely into corporate culture implies supporting staff in developing eco-initiatives, by encouraging participation, training, support for networking and joining environmental management fora and rewarding staff for making environmental improvements.

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