

Pollution Prevention in Small and Medium-Sized Enterprises: Evoking Structural Changes through Partnerships

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Source: *Greener Management International*, No. 30, Small and Medium-Sized Enterprises and Environment-Oriented Networks and Alliances (Summer 2000), pp. 71-82

Published by: Greenleaf Publishing

Stable URL: <https://www.jstor.org/stable/10.2307/greemanainte.30.71>

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# Pollution Prevention in Small and Medium-Sized Enterprises

## Evoking Structural Changes through Partnerships

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Over the last few years major attempts have been made to transform small and medium-sized enterprises (SMEs) into more sustainable companies. In essence, these attempts aim at improving the organisational and technical capabilities of companies. Whereas larger companies have been able to appropriate the concept of pollution prevention, in many cases SMEs lack the resources to develop this new capability. SMEs may have to rely on the initiatives, knowledge and capacities of other actors. This paper reviews whether partnerships can overcome the deficiencies of SMEs by analysing the results of a decade of promotion of pollution prevention in the Netherlands. We focus on two issues. First, we evaluate the effects of partnership networks for the promotion of pollution prevention in SMEs. Second, we analyse the different roles partners can play within such networks. We conclude that most pollution prevention projects succeed in realising environmental improvements for the participating companies, but for the majority it is a one-time experience. Not much is learned about the art of pollution prevention itself. Another problem is that current partnerships are not able to involve more defensive companies through voluntary pollution prevention projects.

- Pollution prevention
- Partnerships
- Environmental policy
- SMEs
- Netherlands

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ORIGINALLY, POLICIES TO URGE BUSINESS TOWARDS ENVIRONMENTALLY FRIENDLY behaviour relied mostly on direct regulation. In the past, specific standards and end-of-pipe technologies prescribed the way companies had to deal with the environment. Recent approaches leave much room for discretion to the companies, inducing environmental change by means of the networks in which firms operate. Central to these approaches is a more conscious and efficient use of resources and a reduction of emissions. Such a development assumes that the transition to sustainability requires co-operation between various stakeholders who negotiate a shared vision of the future and co-ordinate their resources to reach common goals (Hartman *et al.* 1999). It is argued that these approaches are more cost-effective as new technologies avoid the need for short-term standards that are likely to be suboptimal in the long term (Ashford 1996; Harrison 1999). Furthermore, it is of crucial importance that environmental problems be addressed at source through preventative measures. Therefore, companies have to learn the art of pollution prevention.

Over the past decade pollution prevention has evolved into a proven, practical method (Oldenburg and Geiser 1997: 104). The majority of larger companies have now adopted the concepts of pollution prevention and environmental management as cornerstones of a strategy to achieve increased efficiency (Berry and Rondinelli 1998; Hart 1995). In the early 1980s, front-runner companies such as Dow Chemical and 3M reported that with the integration of pollution prevention in company policy the quantity of wastes and emissions was reduced by 25%–50% within a period of ten years (Freeman 1990; Nota 1991; Porter and van der Linde 1995).

There is less clarity about whether small and medium-sized enterprises (SMEs) are able and willing to integrate environmental issues into their management practices (Hartman *et al.* 1999; Hoevenagel and Nouws 1997). Since the late 1980s pollution prevention (waste minimisation) has nevertheless become a concept which is extensively used to influence the behaviour of SMEs.

This paper focuses on two issues. First, we evaluate the effects of partnership networks for the promotion of pollution prevention in SMEs. Second, we analyse the different roles partners can play within such a network. By identifying the factors that contribute to success we are able to make recommendations on how to improve networks and the effectiveness of various partners within those networks.

In Section 1 we outline our data sources before we proceed in Section 2 to explore recent theoretical and empirical insights into corporate environmental change and the role of pollution prevention. In Section 3 we focus on different types of pollution prevention project and their relevance to SMEs. The results of these projects are discussed in Section 4. In Section 5 we examine the roles of the various partners and their contribution to processes of environmental change in SMEs. Conclusions are presented in Section 6. In Box 1 we give two examples of companies that have each participated in a different pollution prevention project.

## 1 Sources of data

During the past few years we have evaluated a variety of pollution prevention projects in the Netherlands. We used data mainly from two different evaluation studies of pollution prevention projects. First, we refer to an evaluation study commissioned by the Dutch Ministry of Housing, Spatial Planning and Environment (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer [VROM]) in which we studied 24 projects carried

**Company A**

Company A is an autonomous company, established in 1935. It produces different styles of furniture for the mass market. The company has 45 employees, one of whom acts as the quality and environment co-ordinator.

Company A participated in a PRISMA (Project Industriële Successen Met Afvalpreventie [Project for Success in Pollution Prevention in Industry]) in 1993. It invested 25 days in the project. This resulted in some 35 options, of which almost 25 measures were eventually taken; for example:

- ▶ Exact sizes of raw materials (mostly wooden balks and plates) are now ordered, leading to less waste.
- ▶ Work planning has been improved, resulting in a decreased loss of material; such planning is now fully computerised.
- ▶ New welding technologies have been installed, resulting in less waste material.
- ▶ Returned packaging is now re-used, leading to a decreased use of raw materials.
- ▶ A new paint process has been installed (including a distillation process), optimising the paint cabin.

The project resulted in positive financial and environmental effects, although our respondent could not give exact figures. Since the conclusion of the project company A has continued to work on pollution prevention. It periodically investigates its material flows and has developed a number of options.

**Company B**

Company B is a furniture manufacturer with 40 employees. In 1996 the company participated in a quick-scan project in which it invested only one day. The quick scan resulted in five related options that were all realised. These concerned the separation of waste from one waste flow to five waste flows. Three flows are now being re-used externally (two wood flows; one paper flow). The company is satisfied with the project. Its knowledge of waste flows has been improved and as a result of the project the company has been able to resolve some of its problems with legal authorities. Since the project company B has not generated any new options. For them it was a positive one-off experience. The concept of pollution prevention plays no further role in the company.

**Box 1** TWO COMPANIES' EXPERIENCE WITH POLLUTION PREVENTION PROJECTS

out in different parts in the Netherlands. More than 1,500 companies participated in this study (de Bruijn *et al.* 1995, 1996). Second, we have made use of an evaluation study of 11 projects carried out under the aegis of the province of North Holland with the participation of 182 companies (de Bruijn and Hofman 1998).

To evaluate the effects of the total of 35 projects we interviewed 65 companies. The interviews were semi-structured and carried out face to face. We also analysed all the written material that was available per company. Finally, we talked to consulting agencies and other research groups that implement projects as well as to representatives of provinces regarding the role of government departments and agencies as initiators of projects.

## 2 Processes of environmental change in small and medium-sized enterprises

Over the past few years major attempts have been made to transform SMEs into more sustainable companies. In essence these attempts aim at improving the organisational and

technical capabilities of companies. Hart (1995) identifies three strategic capabilities at the core of a firm's environmental management that contribute to sustained competitive advantage: pollution prevention, product stewardship and sustainable development. In order to acquire these capabilities, companies increasingly need to employ more complex collaborative strategies.

Pollution prevention involves optimal use of resources and minimisation of emissions along with technology that requires tacit skills. Product stewardship centres on the minimisation of the life-cycle costs of products and involves socially complex skills and involvement of (and collaboration with) external stakeholders. Sustainable development requires minimisation of the environmental burden of the firm's activities, development and product systems. It involves dialogue, consultation and collaboration with stakeholders regarding company performance and company values at both the local level and the global level. Furthermore, these three capabilities are interconnected and support each other (Hart 1995).

Whereas Hart's framework is predominantly built on the experience of larger companies, Medina-Muñoz and García-Falcón (1998) apply the framework to SMEs. They argue that SMEs can gain competitive advantages at the local level, for example through establishing linkages with communities that aim at conserving the local cultural and environmental heritage. However, environmental initiatives in SMEs, such as the start-up of pollution prevention, are frequently impeded by a lack of resources, capacity and capability. It is suggested that partnerships can play an important role in overcoming some of these obstacles. SMEs may form partnerships with various organisations such as trade associations, public and private institutions as well as local business networks.

The objectives of these partnerships range from implementing environmental management systems, incorporating the concept of pollution prevention, to providing information on environmental business opportunities and technological options (Biondi *et al.* 1998; Hines 1998). For example, according to Biondi *et al.* (1998), small businesses working together in groups find collaboration a useful and efficient way of adopting environmental management systems. This is because SMEs can learn from one another, create synergies in reducing their collective environmental impact and develop relations with authorities and other stakeholders in the community.

To summarise, according to Hart's model, progress towards more sustainable production takes place in three phases, of which the first phase is pollution prevention. In many cases SMEs lack the resources to develop new capabilities such as those required for pollution prevention. Networks seem to help via partnerships and collaboration. These will be discussed in the next section.

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### 3 Partnership networks in pollution prevention projects

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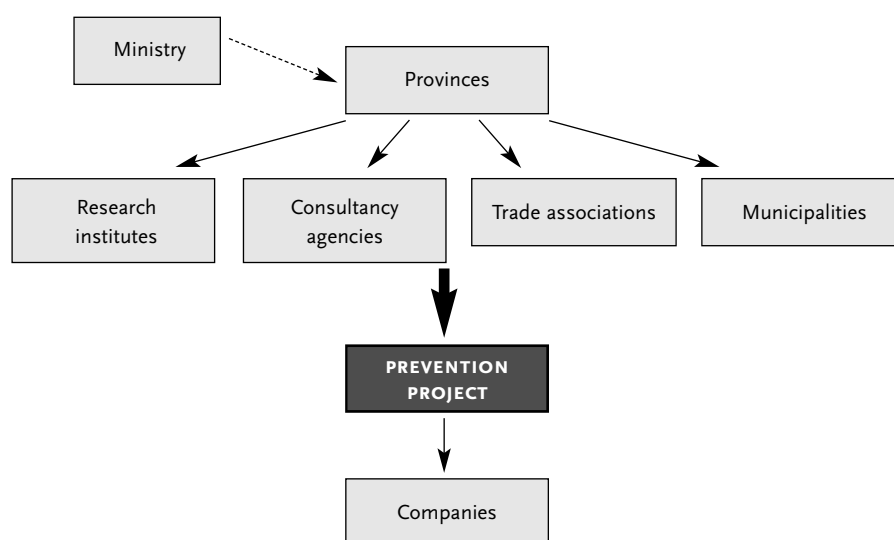
The Netherlands is front-runner in the field of pollution prevention. As part of its national environmental policy, prevention activities within companies have been stimulated throughout the past decade. This policy has resulted in different projects that vary in methods used, mode of implementation and financial structure. Pollution prevention is usually seen as attractive because it both increases efficiency and reduces environmental impact. 'Pollution prevention pays' is the slogan used to draw the attention of companies to these two aspects. In Hart's (1995) model, described in the previous section, pollution prevention is viewed as a necessary first step in progressing towards sustainability.

In pollution prevention projects, various organisations are seen to collaborate, such as municipalities, trade associations, universities and consultancy agencies. Each organisation

applies different techniques, such as applying the 'quick-scan' method (see Section 3.2), producing fact sheets, applying the PRISMA (Project Industriële Successen Met Afvalpreventie [Project for Success in Pollution Prevention in Industry]; see Section 3.1) or helping with the use and interpretation of indicators. In addition to this voluntary approach, legal authorities can now impose certain elements of pollution prevention on companies. Laggard companies can be forced to carry out an audit and formulate a prevention plan to reduce emissions. In this section we describe in more detail the partnerships that are used to stimulate the introduction of pollution prevention in SMEs.

Provincial bodies play the main role. Almost all provinces in the Netherlands have established a special unit called a 'prevention team' in their organisational structure. These teams initiate and co-ordinate pollution prevention projects. Often they also provide financial resources. VROM sets out long-term targets regarding the reduction of waste and emissions, it specifies the level of importance to be given to prevention strategies in companies and it supports projects by providing some financial resources. Consultancies or specialised research institutes (such as research teams based at a university) often carry out the actual implementation of projects. They assist companies and perform some of the tasks needed (e.g. analysis of material flows). Other partners include intermediate organisations and municipalities. Intermediary organisations (e.g. trade associations) provide specific knowledge (such as knowledge of environmental problems and possible solutions for a certain sector of industry), assist in contacting companies and play a role in informing companies and others about the results of projects. Municipalities can also assist in attracting companies to participate in a scheme. Figure 1 illustrates the partners that work together in pollution prevention projects.

**Figure 1** PARTNERS IN A POLLUTION PREVENTION PROJECT



Projects make use of different pollution prevention methods. We may distinguish between two main methods:

- ▶ The PRISMA method
- ▶ The 'quick-scan' method

These will each be discussed in turn in Sections 3.1 and 3.2.

### 3.1 Pollution prevention projects according to the PRISMA method

The first experiences with pollution prevention made use of the so-called PRISMA method. This method was developed on the basis of a pollution prevention manual produced by the US Environmental Protection Agency (see EPA 1989). The method consists of four steps: (1) planning and organisation; (2) assessment; (3) the carrying-out of a feasibility study; and (4) implementation. It essentially implies a comprehensive analysis of material flows, leading to the generation and implementation of a number of prevention options (Dieleman and de Hoo 1993).

Initially, most pollution prevention projects in the Netherlands made use of this method, sometimes in a slightly moderated form. These projects required the active involvement of the participating companies as they played a significant role in the gathering of data, the analysis of material flows and the generation of prevention options. Thus, the PRISMA method demands a significant investment in terms of time and money. For example, in the first PRISMA the first two stages of planning and organisation and of assessment typically took around 30–70 days for the company to complete, and around 20 advisory days for the external partner (Dieleman and de Hoo 1993: 251). In subsequent projects these experiences were drawn on in order to manage time more efficiently, with an average of 20 days spent by companies on the whole project (de Bruijn *et al.* 1995: 78).

During the early years of pollution prevention, government agencies and companies (mainly the larger ones) were able to afford the necessary investments. Later, a call for greater efficiency and the involvement of SMEs, with less financial strength, increased the need for cheaper and less time-consuming pollution prevention methods. These new methods are based on a quicker means of assessing opportunities for pollution prevention in companies and are less comprehensive than the original PRISMA method. They are termed 'quick-scan' methods and are described in more detail in the next section.

### 3.2 Pollution prevention projects relying on a quick-scan method

The basic idea of the quick-scan method is reflected in its name: the material flows of a company are 'scanned' quickly in order to assess the scope for pollution prevention. Companies participating in such projects have a relatively passive role. In most cases the majority of data is gathered by external experts during a number of visits, with other data provided by the company. This leads to a picture of the overall material flows and gives an idea of the most promising areas for a focused assessment of possible prevention options. It can also lead to a number of specific options that were relatively easy to identify during the quick scan. It is then expected that companies will further explore additional prevention options.

The number of days invested in these projects is considerably lower than that invested in PRISMAs, varying between half a day to around three days (de Bruijn and Hofman 1998: 22). In most cases the scan is focused on the material flows in the company concerned, but it is often accompanied by an examination of any equipment installed in order to

assess the technical capabilities of the company. This is done mainly in industrial sectors where production techniques are similar from company to another. Improvements are then partly customised by prescribing state-of-the-art techniques and/or equipment.

An evaluation of the various pollution prevention projects used over the years highlights that project methods have shifted from the (extensive) PRISMA method to less time-consuming, quick-scan methods. For external partners this implies a widening of the tasks they can perform within the company concerned. Instead of playing simply an expert role within a company's internal project team and taking care of project management, external partners are increasingly carrying out most of the work needed for that firm. In the next section we present the results of our study of pollution prevention projects before going on to discuss the consequences of the above-described shift in the work of external experts (Section 5).

## 4 Results of analysis of pollution prevention projects

We have divided our discussion of the results of the projects into two parts. In the first we consider the direct effects of the projects in terms of the resulting implementation of prevention options (Section 4.1). We then discuss the long-term effects in terms of companies' follow-up of pollution prevention recommendations (Section 4.2). Information on the results of pollution prevention projects is based on the in-depth study of the impact of projects at the company level (for more details of data sources, see Section 1).

### 4.1 Direct effects of pollution prevention projects

The term 'direct effect' refers to options and measures that arise directly from a project and can be compared with the cost of that project (in a broad sense). Among other things, we looked at the total costs of a project and the level of companies' involvement. Moreover, we looked at the number of participating companies. Table 1 summarises some of the outcomes.

**Table 1** CHARACTERISTICS AND RESULTS OF POLLUTION PREVENTION PROJECTS  
Source: de Bruijn and Hofman 1998; de Bruijn *et al.* 1995, 1996

Criterion (as average)	PRISMAs	Quickscans	Average score for 35 projects
Number of companies per project	27	33	29
Options per company	23	15	19
Measures per company (implemented options)	7	5	6
Costs per project (€)	210,000	111,000	179,000
Costs per company	7,776	3,359	6,172
Costs per option	338	224	325
Costs per measure	1,111	672	1,028
Companies' involvement in number of days	20	7	13



During the early 1990s most projects used the PRISMA method. Follow-up projects had to become more efficient. Quick scans served that need. This means that the scores for specific projects may deviate considerably from the averages, as shown in Table 1. For example, PRISMAS generated 23 options on average, whereas quick scans generated only 15 options on average.

Only a small number of the generated options have actually been implemented by the companies concerned. The most decisive factor in this is cost. Options are implemented only when they have a relatively short payback period. It is striking that where companies had implemented the options they were not able to give much detail regarding the effects of those measures, either financially or environmentally. However, the general picture is that investments were paid back over a period of two to five years through cost reductions. The measures have led to lower environmental impacts through reductions in energy use, material use and waste as well as in waste-water.

An analysis of all projects shows that the amount of time invested by a company in the project is positively correlated to the quality of the options produced (de Bruijn and Hofman 1998: 42; de Bruijn *et al.* 1995: 94). Environmental success does not come at a bargain price. Good results require commitment, time and money. The PRISMAS, therefore, have produced measures of superior quality to those produced by quick-scan methods. The measures sometimes implied the need for fundamental changes to production processes and to the way in which those processes are organised. In projects dominated by the quick-scan method most of the implemented options can be characterised as good-housekeeping measures.

#### 4.2 Long-term effects of pollution prevention projects

We investigated whether the pollution prevention projects discussed above have had a sustained impact on the behaviour of companies. We asked four questions:

- ▶ To what extent has the project led to increased knowledge of the firm regarding material flows?
- ▶ Has there been any follow up to the project?
- ▶ To what degree does the company make use of the concept or method of pollution prevention used in the schemes?
- ▶ Did the company generate and implement options independently after the project?

The following results were found:

- ▶ Most companies indicated that a positive relationship exists between their knowledge of material flows and the pollution prevention project.
- ▶ For a majority of companies taking part in the projects there has been a follow-up to the project; the follow-up took various forms, from independently and periodically generating options to undertaking further research on material flows and waste-streams.
- ▶ Although some companies generated options independently after the project, most companies indicated that no further use was made of the method used in the pollution prevention project.

We went on to analyse the level and form of environmental management in participating firms, both before and after the project, and estimated the impact of the pollution

prevention project on the level of environmental management. We looked at investment patterns, the use of information and the implementation of an environmental management system.

- ▶ Most of the companies (90%) indicated that environmental issues have played a role in the shaping of investment patterns; however, none of the companies indicated that there has been a change of course as a result of the pollution prevention project.
- ▶ With regard to information on environmental issues, more than half of the companies indicated that trade associations were the most important source, and suppliers were mentioned by one-third of the companies. The findings suggest that use of information sources has not shifted in companies as a result of the pollution prevention projects.
- ▶ At the beginning of the project most companies had a positive attitude towards the environment and were in the initial stages of implementing some form of environmental management (see Table 2).
- ▶ A significant number of companies were active in addressing environmental affairs and had a partial or fully functioning environmental management system.
- ▶ None of the companies participating in the projects was regarded as defensive with regard to environmental issues; it can be concluded that in general pollution prevention projects do not reach companies that are laggards in environmental management

We also assessed the level of environmental management after the project (see Table 2). For about one-third of the companies involved, advances were made in environmental management after the pollution prevention project (according to our respondents). In a number of cases, the prevention project had played a major part in this.

## 5 The role of partnerships in pollution prevention

Pollution prevention has proven to be a valuable method, because of its primary focus on material flows (where the causes for environmental problems can be found) and its emphasis on minimisation of environmental effects. Most pollution prevention projects succeed in realising environmental improvements for the participating companies. However, our analysis has also shown that pollution prevention does not necessarily lead to fundamental changes to production processes. For the majority of companies the pollution prevention project is a one-off experience. Therefore, not much has changed in most of the participating companies in terms of environmental management and investment patterns.

**Table 2** ENVIRONMENTAL MANAGEMENT IN COMPANIES BEFORE AND AFTER THE POLLUTION PREVENTION PROJECT

<i>Level of environmental management</i>	<i>Percentage of companies</i>	
	<i>Before project</i>	<i>In 1998</i>
Defensive	–	–
Beginner or positive	60	40
Active	35	40
Proactive	5	20

It appears that purely defensive companies are hard to reach through voluntary pollution prevention projects. Companies that opt for pollution prevention already belong to the set of relatively active companies.

These shortcomings make it doubtful whether the pollution prevention approach will lead to an ongoing learning process towards product stewardship and sustainable development. To overcome these shortcomings, partnership networks and the tasks they involve need to be re-evaluated. Two basic questions need to be answered:

- ▶ Are the right partners involved?
- ▶ Do these partners carry out the right tasks?

### 5.1 Composition of the partnership

We asked our respondents who should be the main partner in pollution prevention schemes. The majority of companies named trade associations, with municipalities mentioned second (de Bruijn *et al.* 1995: 87). The main partner for SMEs proved to be their trade association because of its credibility and availability over a long period of time (de Bruijn and Lulofs 2000). As consultancy agencies are the major partners in current pollution prevention projects (during the implementation phase) the partnerships involved need to be reconsidered.

An interesting approach concerning companies that are difficult to reach is applied by several provinces in the Netherlands (see Molier *et al.* 1996). Recent changes in environmental regulation imply that certain aspects of pollution prevention, such as an analysis of material flows, must be met before a new permit is issued. In the Netherlands most companies need to apply to the local municipality for an environmental permit. In order for municipalities to require companies to take pollution prevention measures before issuing a permit, a training programme has been set up. In this training programme civil servants working in environmental departments are made familiar with the concept of pollution prevention, in order to be prepared when negotiating with companies about issuing or renewing environmental permits.

This second approach (in terms of measures taken within companies, costs of the project, etc.) is less productive than those pollution prevention projects in which intermediate organisations are main actors (de Bruijn and Hofman 1998: 46). However, in terms of the types of company that are reached, it is very promising. Municipalities can identify the laggards, as this group consistently has problems with permits.

In general, it might be beneficial to include partners in the network that have a relationship with companies based on power (e.g. legal authorities, clients). Then the use of that power may facilitate the diffusion of the concept of pollution prevention.

### 5.2 The division of tasks between partners

Use of quick-scan methods has become widespread in pollution prevention projects. They are relatively easy to carry out; they are relatively cheap; and they are more efficient than are PRISMA methods and often involve more companies per project (see Table 1). However, there is little engagement and commitment among the companies subject to quick scans. This also has implications for the number and nature of options generated and implemented. In projects where companies invest more time in the pollution prevention project the options produced are better tailored to the company and are likely to be more profound. The number of implemented options in companies is also higher in PRISMAs. A

comprehensive, PRISMA-like approach may therefore seem favourable. However, the downside is that it has proven to be difficult to engage smaller companies in such comprehensive projects.

Pollution prevention projects need to be cost-effective without weakening the process. Quick scans can be valuable in arousing interest in pollution prevention, but an appropriate follow-up is needed. In general, our analysis has shown that external stimulation often needs to be continuous in order to keep pollution prevention on the agenda. The data has shown that company commitment and involvement in the project is also vital; otherwise, the concept of pollution prevention will not become embedded into the organisation. Sustainable development asks at the very least for a continuous process of improvement. The contribution of a one-off project is limited.

According to Hart's (1995) model the next step after pollution prevention is product stewardship. In pollution prevention the focus is on waste-streams and emissions rather than on products and their effects. Product orientation therefore is clearly undervalued in pollution prevention. Also, pollution prevention in current practice is aimed at individual companies instead of co-operation: for instance, in the supply chain (Oldenburg and Geiser 1997: 104) or between companies on industrial estates. There are existing partnerships that can be used. Companies are, of course, used to collaborating with suppliers and customers, and many industrial parks have their own associations. All these connections offer frameworks for initiating concerted activities in the field of pollution prevention.

## 6 Concluding remarks

This paper takes a close look at the way in which pollution prevention projects in the Netherlands have been conducted over the past decade. Our main conclusion is that pollution prevention is a powerful method, albeit with some weaknesses. By broadening the scope of pollution prevention, the results can be improved.

A major problem lies in the continuation of pollution prevention after the end of the project (particularly when it was initiated by actors outside the company). Our research indicates that, in order to move beyond one-off pollution prevention projects, and have pollution prevention used as a tool of environmental management, it is necessary for companies to enter into a learning process. This implies that companies must invest significant time in those projects and should play an active rather than a passive role in them. External partners can play an expert role (by providing knowledge and expertise) in this learning process. Furthermore, they have a role to play in project management.

However, we know that these types of project are relatively expensive, both for initiators (governments) and for the companies involved. Another option might be to take advantage of the initiatives, knowledge and capacities of other partners—for instance trade associations, consultancies, chambers of commerce, universities and research institutes. These partners can help in reaching companies (particularly SMEs), in implementing projects and in keeping pollution prevention on the agenda. Such an approach would lighten the burden placed on individual organisations, such as the provincial governments that are active in running pollution prevention programmes. There is a need for a (regional) network or consortium that initiates and co-ordinates pollution prevention activities and by doing so generates an ongoing process of environmental change.

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