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(P3U)**

Group-Centered Approaches to the Diffusion of Eco-Efficient Production Practices: Successful Experiences from Brazil

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Summary

This publication is the second part of an exploratory study on the diffusion of eco-efficient production practices among enterprises in Brazil, focusing on the role of and potential for group-centered approaches.¹ The motive for the Pilot Programme for the Promotion of Environmental Management in the Private Sector of Developing Countries (P3U) to undertake this study was straightforward: We wanted to find some answers regarding the question of whether and how the introduction of environmental management may be stimulated by the cooperation between firms. . The findings of this second, empirical part of the study are based on six cases of inter-firm cooperation related to environmental issues in the South and Southeast of Brazil (Table 1 in the Annex gives an overview of the cases). The study draws two main conclusions.

First, although the effort to stimulate inter-firm cooperation with respect to environmental management is a major undertaking as it tries to address two extremely complex issues at the same time, e.g. to stimulate inter-firm cooperation *and* environmental management, some of the empirical cases indicate that instead of multiplying the problems this approach rather reduces them as cooperation is much easier to be achieved when it is related to a fringe activity (from the entrepreneur's perspective), such as environment.

Second, there are four basic constellations regarding the introduction of environmental management in firms: Firms may or may not be under pressure to comply with environmental legislation, eco-standards, etc., and firms may or may not have established detailed cost accounting and embarked on a continuous and systematic search for the tapping of efficiency potentials.

Introducing instruments like environmental cost management² is a promising task in firms with well-established cost accounting systems (even if they are not under legal pressure), and it is an urgent issue in firms under pressure from legislation and eco-standards (even if they do not have detailed cost accounting systems so far). The majority of firms, however, and most micro, small, and medium-sized firms, do not fit into any of these groups. Addressing these target groups presents two challenges: First, how to convince them of the importance of environmental management, and second, how to persuade them to benefit from cooperation among them.

Regarding the first challenge, five alternatives are presented, none of which appears to be a first-best option. Each of them may be appropriate under specific conditions:

- The **wait-and-react approach**: wait for firms to get under pressure from environmental agencies or customers, and support them in coping with it.

1 The first part was a desk study: Jörg Meyer-Stamer, Inter-Firm Cooperation in Environmental Management: Experience from Santa Catarina/Brazil, P3U-Working Paper No. 7e, Bonn, December 1997

2 Regarding the experience with environmental cost management in developing countries see Hartmut Fischer, Case Study on Environmental Cost Management at Cairns Foods Limited, Harare, Zimbabwe 1997, P3U-Working Paper No. 10e, February 1998 and P3U-Update No. 2, June 1998, p. 2

- The **carrot-and-stick approach**: Persuade environmental agencies to put certain industries under pressure, and offer support to them via meso-level institutions, such as business associations.
- The **carrot-and-carrot approach**: Persuade environmental agencies not to punish the more visible, pro-active firms by fining them even more than others, but to stimulate self-monitoring and responsible behavior of firms, and to enhance cooperative relations between pro-active firms and environmental agencies.
- **Cooperate with large companies** in their efforts to support suppliers, i.e. smaller firms, when these are affected through the supply chain by the introduction of environmental management systems such as ISO 14000 in the large firms. .
- **Identify and support a group of firms** which is under high competitive pressure and has substantial potentials for improving eco-efficiency.

Regarding the second challenge, e.g. the persuasion regarding potential benefits of inter-firm cooperation, it is essential to identify a group of firms that is under competitive and/or legal pressure: Only then a profound change in behavior, namely from uncooperative behavior to cooperation, is feasible and likely to occur. Another crucial factor for success is to identify an agent (change agent), preferably a business association, which can effectively facilitate cooperation between firms.

Resumo

Esta publicação, sendo a segunda parte de um estudo sobre a difusão de processos de produção eco-eficientes em empresas no Brasil, foca a importância e o potencial para a criação de núcleos.³ O *Programa Piloto para a Promoção da Gestão Ambiental no Setor Privado dos Países em vias de Desenvolvimento* (P3U) tinha um motivo direto para realizar o estudo: Queria ter umas respostas relativas à questão se e como a introdução da gestão ambiental pode ser estimulada por meio da cooperação entre empresas. Os resultados desta segunda parte empírica do estudo originam de seis casos de cooperação entre empresas, situadas no Sul e Sudeste do Brasil, no âmbito de assuntos ambientais. O estudo chegou a dois conclusões principais:

Primeiro: Ainda que o esforço de estimular a cooperação entre empresas no âmbito da gestão ambiental é um empreendimento maior, visto que tenta tratar simultaneamente dois assuntos extremamente complexos (nomeadamente a estimulação da cooperação entre empresas *bem como* a gestão ambiental), alguns dos casos empíricos indicam que em vez de multiplicar os problemas, esta estratégia os reduz. Isto é porque uma cooperação é mais fácil a estabelecer se for relacionada a uma atividade marginal (do ponto de vista do empreendedor), como o meio ambiente.

Segundo: Existem, ao nível das empresas, quatro constelações básicas com respeito à introdução da gestão ambiental: Por um, uma empresa ou está ou não está sob pressão de cumprir a legislação ambiental, normas ambientais etc., e por outro, uma empresa ou estabeleceu ou não estabeleceu uma contabilidade detalhada, procurando continuamente e sistematicamente potenciais para aumentar a sua eficiência.

Introduzir instrumentos como a gestão dos custos ambientais⁴ é uma tarefa promissora em empresas que têm uma contabilidade bem estabelecida (mesmo se não estão sob pressão de cumprir a legislação), enquanto é um assunto urgente em empresas que estão sob pressão de cumprir leis ou normas ambientais (mesmo se ainda não têm estabelecidas contabilidade detalhada). No entanto, a maioria das empresas, e sobretudo empresas micro, pequenas e médias não fazem parte de nenhum desses grupos. Focar esses grupos alvos apresenta dois desafios: Primeiro, como convence-los da importância da gestão ambiental, e segundo, como convence-los que podiam beneficiar de uma cooperação entre eles.

Em relação ao primeiro desafio, oferecem-se cinco alternativas, nenhuma das quais parece uma opção única. Cada deles podia ser apropriada em circunstâncias específicas:

- A estratégia '**esperar - reagir**': esperar até as empresas encontram-se sob pressão das agências ambientais ou dos clientes, e ajudar-lhes a superar os problemas.

3 A primeira parte é um estudo teórico: Jörg Meyer-Stamer, *Cooperação entre Empresas no âmbito da gestão ambiental: A experiência de Santa Catarina/Brasil*, P3U-Documento de Trabalho No. 7e, Bonn, Agosto de 1998

4 Para as experiências com a gestão dos custos ambientais nos países em vias de desenvolvimento, vd. Hartmut Fischer, *Case Study on Environmental Cost Management at Cairns Foods Limited*, Harare, Zimbabwe 1997, P3U-Documento de Trabalho No. 10e, Fevereiro de 1998 e P3U-Update No. 2, Junho de 1998, p. 2

- A estratégia '**pressão - assistência**': Convencer as agências ambientais para meter certas indústrias sob pressão, e oferecer lhes assistência através de instituições intermediárias, como p. ex. associações comerciais e industriais.
- A estratégia das **relações cooperativas**: Convencer as agências ambientais para não multar, ainda mais que outras, as empresas proativas e mais visíveis, mas ao contrário estimular o automonitoramento e um comportamento responsável das empresas, promovendo relações cooperativas entre empresas proativas e as agências ambientais.
- **Cooperar com grandes empresas** no apoio aos seus fornecedores, geralmente pequenas empresas, cuja produção é afetada pela introdução de sistemas da gestão ambiental (como ISO 14000) nas grandes empresas.
- **Identificar e apoiar um grupo de empresas** sob pressão de ser competitivas e que tem um potencial significativo para melhorar a sua eco-eficiência.

Em relação ao esforço de convencer as empresas dos benefícios potenciais de uma cooperação entre empresas, é essencial identificar um grupo de empresas que está sob pressão, ou em termos de competitividade ou em termos do cumprimento à legislação: É principalmente nestas circunstâncias que uma transformação do comportamento, nomeadamente da não-cooperação para a cooperação, é possível e provável. Outro fator decisivo para o êxito é a identificação de um agente (de transformação), de preferência uma associação comercial, que é capaz de efetivamente facilitar a cooperação entre empresas.

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Abbreviations

ABTS	Associação Brasileira de Tratamento de Superfície
ACIB	Associação Comercial e Industrial de Blumenau
ACIJ	Associação Comercial e Industrial de Joinville
APETS	Associação Paranaense de Empresas de Tratamento de Superfície
BMBF	Bundesministerium für Bildung und Wissenschaft
CEFET	Centro Federal de Educação Tecnológica
CEO	Chief Executive Officer
CITPAR	Centro de Integração de Tecnologia do Paraná
CNPq	Conselho Nacional de Pesquisa
CONFAZ	Conselho das Secretarias de Fazenda
COPEL	Companhia Paranaense de Eletricidade
FATMA	Fundação do Meio Ambiente
FAEMA	
IAP	Instituto Ambiental do Paraná
IBAMA	Instituto Brasileiro do Meio Ambiente
IBD	Integrierter Beratungsdienst für die Wirtschaft
IEL	Instituto Euvaldo Lodi
INT	Instituto Nacional de Tecnologia
ITV	Institut für textile Verfahrenstechnik
MSTQ	Measurement, standards, testing, quality assurance
NMA	Núcleo do Meio Ambiente
RZ	Resíduo Zero
SEBRAE	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas
SENAI	Serviço Nacional de Aprendizagem Industrial
SME	Small and Medium Enterprise
UFPR	Unversidade Federal do Paraná

1 Introduction

This paper documents six cases of inter-firm cooperation on environmental issues in Brazil. It is based on field research that took place between March 16 and April 9, 1998, on behalf of the Pilot Programme for the Promotion of Environmental Management in the Private Sector of Developing Countries (P3U) of the German Technical Cooperation Agency (GTZ). The point of departure is the observation that inter-firm cooperation can increase problem consciousness and increase the speed of learning processes, not only in the field of environmental management. At the same time, inter-firm cooperation often does not take place, even in cases where its potential benefits are obvious. Both observations have led technical cooperation agencies to developing an increasing interest in inter-firm cooperation. Stimulating inter-firm cooperation can be more cost-effective than support for individual firms, it is also causing less distortions regarding the functioning of markets, and it may establish a sustained dynamism of collective learning. However, the question remains under which conditions and by which means it is possible to stimulate inter-firm cooperation. The aim of this paper is to offer some answers.

The paper is organized as follows. Section 2 gives some background information that is important to understand firms' behavior. Section 3 presents six case studies. Section 4 compares the six experiences according to different analytical categories. Section 5 gives an interpretation of the experiences in a systemic perspective. Section 6 presents recommendations for the P3U project.

2 Background information

In order to better understand the following cases, it is essential to know about two crucial elements of the framework conditions firms are facing.

General economic framework conditions

Brazil had been a **closed economy** pursuing an industrialization strategy based on import-substitution until 1990, and it was a high-inflation economy until 1994. Both features were closely interrelated, i.e. high inflation was a result of macro-economic distortions created by the import-substitution strategy (Meyer-Stamer 1997a, 46 ff.). Both features – low competition in a closed market, high inflation with its potential for mark-up pricing – have shaped the behavior of Brazilian firms. The main determinant of their survival was financial management rather than productive investment, productivity, quality, or innovativeness. The economy was gradually opened to the world market starting in 1990, and inflation was minimized with the stabilization plan that was launched at the end of 1993 and that in July 1994 established a new currency, the Real (thus the policy was called "Plano Real").

Ever since, firms have been struggling to cope with completely changed determinants of success. They have been **upgrading** their management systems ("quality and productivity" have become the buzzwords in industry since the early 1990s; Fleury 1995), and they have

invested in **new equipment** although this was complicated due to high interest rates (which, in real terms, fluctuated between 15 and 35 per cent).

Profound changes in firms' behavior also affected **inter-firm relationships**. The closed market / high inflation-era was an environment which encouraged high vertical integration and stimulated arms-length and low-trust relationships between firms.⁵ In the new, open-market environment firms begin to understand that it is necessary to build longer-term relationships with other firms (like suppliers of inputs) and to enter into joint learning efforts with other firms, including competitors, since trying to go it alone increasingly is a dysfunctional behavioral disposition.

Environmental policy framework

Brazil has been implementing an environmental policy since the 1970s. Points of departure were the severe environmental damage caused by sugar refineries in the interior of São Paulo in the mid-1970s and by the petrochemical and metallurgical industry around Cubatão (located between São Paulo and Santos) in the late 1970s. Brazil has created a **federal** environmental agency, IBAMA; **states** have created their own environmental agencies (FATMA in Santa Catarina, IAP in Paraná); and even some **municipalities** (like Joinville and Blumenau) have active environmental agencies of their own.

The division of responsibilities between these agencies is often not clearly defined, and their mode of action is extremely diverse. A large firm in an urban agglomeration is likely to be controlled strictly, whereas small firms in small towns may not have suffered any control so far even if they are highly polluting. In any case, there is not only legislation but also **implementation** so that firms are under pressure to reduce their environmental impact. An important instrument in this context is the **certification** formal sector firms have to obtain from the environmental agency. The need to get a license first arises when building a new plant (licença prévia / provisional license at the initiation of a project, licença de construção / construction license before start of construction); afterwards the license for operation (licença de operação) usually has to be renewed on a fixed-term basis (with differences in the actual practise; firms in Joinville complain that they have to renew the license annually, at a substantial cost).

3 Case studies

The following six case studies describe experiences in inter-firm cooperation in environmental management. They cover a wide spectrum regarding types of cooperation, of firms involved, and of the role of business associations and government. They are all from the industrially more advanced South and Southeast of the country (although no case from the state of São Paulo, the most important state in terms of industrial production, is included).

5 For a detailed discussion see Meyer-Stamer (1997b) and Addis (1997).

They cover different types of business structures: mostly domestic firms in the cases of Santa Catarina and Rio de Janeiro, and production systems that include domestic suppliers and foreign-owned final producers in Paraná.

The purpose of this section is twofold. First, it documents cases where firms did actually cooperate. Firms which have no experience in inter-firm cooperation often find it difficult to imagine that cooperation can take place at all, especially among competitors. Referring to these cases can be useful when trying to persuade businesspeople to give it a try. Second, it provides the empirical background for the more systematic analysis of the subsequent sections.

3.1 Núcleo do Meio Ambiente, Joinville

The *Núcleo do Meio Ambiente* (NMA) of the *Associação Comercial Industrial de Joinville* (Association of Commerce and Industry, ACIJ) was created in March 1993. It is essential to know three factors to understand its creation.

First, firms in Joinville were under pressure to improve their **environmental performance**. Joinville is the largest city and the most important industrial town in Santa Catarina; it locates a number of large, well-known firms, mainly from four branches: electromechanical industry (Embraco, Multibrás, Schulz, Wayne-Wetzel), metal-engineering industry (Fundição Tupy, Carrocerias Nielson, Fundição Wetzel, Embraco Fundição, Docol), plastics industry (Tigre, Akros), and textiles industry (Döhler, Lepper). The state environmental agency, FATMA, at that time followed the principle that large firms are the main polluters and thus the main targets of controls. In the specific case of the Joinville firms, this particularly meant intense controls of their wastewater effluents and pressure to build wastewater treatment stations. This was motivated by the high level of pollution of local rivers and the high water-intensity of many firms (particularly in sectors like textiles).

Second, a number of medium-sized and large firms had an – albeit brief – **history of cooperation** on a concrete environmental problem. In 1989, they had created the "Group of 19", consisting of the owners or CEOs of 19 leading local firms, to find a solution for the problem of disposing solid waste; the municipal landfill site did not offer adequate installations for the disposal of industrial waste.⁶

Third, ACIJ was a partner in a **German technical cooperation project** that had started in 1991. It involved several ACIs from the northeastern part of Santa Catarina and the Chamber of Arts and Crafts of Munich and Upper Bavaria. A key contribution of this project was to induce the creation of working groups within ACIs ("núcleos"), not just by suggesting the possibility and referring to successful experiences in Germany but also by organizing the process of starting and supporting them (see the overview of the typical work cycle of a núcleo in Annex 3). Thus, even though the notion that it might be possible to set up a work-

6 It took no less than eight years until the industrial landfill site finally went into operation. The delay was mainly due to problems of acquiring a piece of real estate, although all actors involved had in 1991 agreed to use a certain area.

ing group ran against the predominant local business paradigm,⁷ there were already a few cases which proved that there was an alternative.

The working modus of the Núcleo do Meio Ambiente

The format of the NMA is as follows. It had 31 member firms at the end of 1997. Each member firm is represented by an employee (i.e. not the owner or CEO), typically the manager / engineer in charge of wastewater treatment, environmental management, or utility issues. It meets every fortnight. The work is facilitated by a consultant employed by the ACIJ⁸ who has a long experience in the environmental field, both in the public and the private sector, something that gives him a high standing with the firms' representatives. He sees to the administrative work, convenes the participants, prepares material for the meetings, moderates the meetings, and takes care of the follow-up. A typical meeting lasts about three hours and is attended by 15 firm representatives (although deviation is very high, from as few as six participants to as many as 34, i.e. including representatives from firms which are not member of the núcleo).

Results of the work of the NMA

Initially the NMA addressed mostly the issue of **wastewater treatment**. Over time, there has been both a broadening and a deepening of the focus of the work. The NMA has started to address **new issues**, like environmental management or the Local Agenda 21 (see Annex 2 for an overview of the topics addressed in 1997 and the planned schedule for 1998). And the NMA has produced a **manual** for wastewater treatment in industrial firms, 5,000 copies of which are now distributed among local firms, particularly SMEs.

Participants point out that, apart from the issues raised in the meetings, the NMA has played a crucial role in creating a **culture of easy information exchange** between firms' professionals. This is an important aspect as this runs contrary to the local business culture. Firms just did not have informal exchange of information and experiences (Meyer-Stamer et al 1996, Meyer-Stamer 1998), particularly not among employees. Owners and CEOs met at the ACI and socially (but they did not discuss firm issues there), but employees hardly met at all (there are also no professional associations which might stimulate information exchange). In this context, participants point out that it is an important feature of the NMA that it **consists exclusively of employees**. The presence of owners / CEOs would make frank communication much more complicated.

7 The local proverb to describe this paradigm is "cada um por si e deus por todos", i.e. everybody for himself and God for everybody.

8 This, at least, is the prevailing notion and the usual pattern regarding persons who accompany the work of núcleos. In fact, the consultant in charge of NMA is technically not an employee of ACIJ but of a cooperative that has been founded by the "Club of 19". However, he has his office at the ACIJ like everybody else, and he acts as if he were an employee of ACIJ.

A further contribution of the NMA's work has been a profound **change in the firms' relationship with FATMA**, the state environmental agency, which used to be highly conflictive in the past. The NMA has repeatedly invited FATMA officials to its meetings. This gave rise to a mutual learning process where firm representatives started to understand the logic, necessities, and pressures behind FATMAs acting, and vice versa. A result was that a certain level of trust evolved between FATMA and the NMA member firms.

The change in the relationship can be illustrated with two examples. First, it sometimes happens that a technical defect disables a firm's wastewater treatment station. The firm will then get in contact with FATMA to inform it about the problem and the schedule to solve it. FATMA normally accepts this and refrains from fining the firm. Second, firms and FATMA are in the process of setting up a system of self-monitoring where firms will constantly control the composition of their effluents to assure that they comply with legally established standards. At the time of the field research for this paper firms and FATMA were stuck in a conflict on the number of substances to be controlled. FATMA proposed a comprehensive list to be applied to all firms that included various substances that were not used at all by some of the firms, whereas firms suggested to check only a limited number of substances, thus reducing the monthly cost of the tests from about R\$ 6000 to about R\$ 2000. Local actors were optimistic regarding the resolution of this conflict and the possibility of creating an arrangement that counts on the responsible behavior of firms.

Another impact of the NMA's work is increased awareness for environmental issues both in member firms and in the business community as a whole. The NMA is locally well-known, *inter alia* because it received the environmental prize established by a business magazine.⁹

The **future work** of the NMA will probably focus on two issues. First, there is **environmental management**. So far, the technical discussions have mostly been focused at end-of-pipe-technologies, particularly in wastewater treatment. Firms have only recently started to move beyond this towards environmental management systems. This is the obvious next step on the typical trajectory of firms' dealings with environmental issues. At the same time, some firms are suffering a pressure from their customers to get active in this field and to seek a certification according to QS-9000¹⁰ or ISO-14000. There is a general agreement among participants that the NMA will be a highly useful forum to organize information exchange on environmental management, thus accelerating and leveraging the learning process in each firm.

Second, the NMA will become more involved with the **community** (*comunidade*). In the perspective of participants, community involvement has already been one of the foci of the NMA, especially regarding the production and dissemination of the wastewater treatment manual and the involvement of NMA members in discussions on a Local Agenda 21. In the future the NMA participants are keen to support local micro and small firms. They are also

9 This magazine, *Expressão*, thus each year highlights the environmental effort of several individual firms. The NMA's activities gave rise to a special prize for collective action.ⁿ

10 QS-9000 is a quality standard used by U.S. car manufacturers. It builds on ISO 9000 but goes beyond it; among other features it includes certain environmental features. European car manufacturers are using a similar system.

interested in stimulating a broader dialogue on environmental issues; as a first step they invited a number of local environmentalist groups for a joint discussion.

In explaining the success of the NMA it is important not to forget the emotional side. Being the person in charge of environmental affairs so far meant mostly to be responsible for wastewater treatment and solid waste, and to make sure that the firm was fined as little as possible by the environmental authorities. In their respective firm, the NMA participants were often in a marginal position, tolerated but associated with one of the unpleasant sides of the firm, a side that mostly causes costs and conflicts with authorities. Thus, the emotional stress was quite high. Sharing their problems and experiences with colleagues suffering from the same problem help professionals in dealing with this stress.

3.2 Grupo de Aterro Industrial, Blumenau

In 1995, the local administration in Blumenau noticed that it was running out of space in the **municipal landfill site**. In order to delay the closure of the landfill site, it notified firms that it planned to reserve the landfill site for domestic waste. Thus arose the question how dispose of **industrial sludge** which with 3,000 tons per month made up the largest part of the solid waste generated by firms. The massive generation of sludge is the result of high investment in wastewater treatment stations; essentially all large firms in Blumenau, most of them from the textiles industry, have their own stations. They were mostly built in the second half of the 1980s in response to pressures from FATMA and foreign customers.

Within the local Chamber of Industry and Commerce (ACIB), a **working group** of ten industrial firms was formed to deal with the problem.¹¹ Among the options pursued by the group was the installation of a sludge incinerator. This idea was not feasible, mostly for financial reasons (it would have involved an investment of some R\$ 60 million) but also for the toxic content of its emissions. The most realistic option, it turned out, was a two-track-approach: reduce the generation of sludge and initiate the construction of an industrial landfill site.

In order to reduce sludge, the firms contracted a small local engineering firm specialized in wastewater treatment, Resíduo Zero (RZ). It suggested a **different biological treatment process** which reduced the generation of sludge by 80 % at 20 % less cost (compared to the established process). However, the process itself is **tricky** as it requires a roughly stable consistency of the effluent entering the station. Currently, the firm is refining the process to make it more stable, for example resilient against vast oscillations in the pH value of the effluent (which are due, for instance, to the practice of some textiles firms to conduct certain types of finishing activities, like mercerizing, only once per week).

Regarding the industrial landfill site, the group identified a **local firm** in the waste business which was willing to invest in the construction. The firm visited installations elsewhere in Bra-

11 ACIB is taking part in the same technical assistance project as ACIJ, but the working group preferred not to employ the núcleo methodology, apparently because nobody at ACIB had the idea that this might have been a good idea.

zil and abroad in order to make sure that its installation would reflect the current best practice in this field. The new landfill site has been completed recently.

During the process, ACIB professionals repeatedly pointed out to the firms that the disposal of waste in the new installation was bound to be much **more expensive** than the R\$ 6 per ton firms had to pay at the municipal landfill site. In fact, the waste firm is going to charge according to the water content of the waste. Whereas waste with a water content of less than 20 % per ton will cost R\$ 20, waste with a water content of more than 80 % will cost R\$ 75 per ton; depositing humid waste involves high costs since it has to be mixed with concrete and lime. This has created a further incentive for firms to generate less sludge.

Reducing the generation of sludge by firm is ecologically desirable, but it may compromise the economic viability of the landfill site. To counter this, the Chamber has informally encouraged the waste firm to identify, within a circle of 100 km around Blumenau, firms which do not dispose their sludge adequately and to notify the authorities. As the firm is in charge of disposing of industrial waste in the region, it is easily in the position to observe irregular behavior by firms.

Cooperation among the firms so far has been **restricted** to the issues mentioned before, i.e. reducing the generation of sludge and discussing the sludge issue with the waste firm. A culture of intense communication, like in the NMA in Joinville, did not emerge so far. Possible explanations are a local business culture that is maybe even more hostile to cooperation, and the fact that the group did not establish a clear distinction between the participation of owners and employees. However, being confronted with the Joinville experience firms' representatives liked the idea of continuing to work in the group, but with a broader focus, like environmental management. It is probable that it will depend largely on ACIB whether this materializes: If it invites firms and facilitates the work of the group, an experience similar to the one in Joinville may occur.

3.3 Small Printing Shops, Blumenau

In 1996, the local environmental protection agency in Blumenau, FAEMA, started to control more intensively local **micro-firms** in the **textiles printing** industry. The existing several dozens of firms were estimated to generate 1,200 cubic meters of effluent with high dye-contents and high pH-values without any attempt to clean this. Being threatened to be shut down, the micro-firms got in contact with the ACIB and asked for support in identifying a technically and financially feasible solution; some workshops consisted in just one self-employed person, earning about US\$ 300 per month with this activity.

Commercially available small wastewater treatment stations proved to be too expensive. A commercial firm proposed a central treatment station for the micro-firms; in this case transport would have been too expensive.

ACIB again got in contact with Resíduo Zero (RZ) which developed a **tailor-made, cheap solution**. It consisted in building a tank where the wastewater was deposited. RZ identified a chemical substance which, at a cost of R\$ 10 - 20 per month, binds the dyestuff and reduces the pH-value, thus generating water clean enough to be reused in the production process

and a sand-like sludge which can be disposed as ordinary waste. The cost of the construction material for a new tank was usually about R\$ 400, although RZ found ways of cutting this down to R\$ 250 by using recycled construction material. RZ visited 60 to 70 firms which might have used this process. It also assisted firms in constructing the tank and understanding the process without charging for this service; part of the cost was covered by ACIB, part was written off as investment in establishing RZ as a competent and credible service provider. In the end the process was installed at about 30 firms; many of the other firms had gone out of business due to economic reasons in the meantime. The project involved no direct cooperation between the micro-firms except for visits of microempresarios at the site of pilot installations.

3.4 Projeto Ecogoman, SC

The project Ecogoman involved Brazilian and German textiles and starch firms, government, and research organizations. It aimed at adapting to the specific Brazilian circumstances a process to **recycle starch** used in the finishing of textiles fabric. So far, the starch content in effluents poses significant problems for wastewater treatment as it causes a high demand for oxygen. GTV, a German machine building firm, had developed an equipment which not only recycled 85 % of the starch but also reduced use of water and electricity and allowed the recycling of other inputs like colours and caustic soda. This equipment, however, had been developed to deal with synthetic starch whereas Brazilian firms commonly use natural starch based on manioc.

The project was launched in 1995 due to the initiative of the textiles research institute in Denkendorf / Germany (ITV), which had been working with firms in Brazil before. It persuaded a group of Brazilian firms to lobby for a joint project under the umbrella of scientific-technological cooperation between Germany (BMFT / BMBF) and Brazil (Ministry of Foreign Affairs). A group of six Brazilian firms was formed: four home textiles firms (Artex, Döhler, and Karsten from Santa Catarina, and Alpargatas Santista from São Paulo) and two starch producers (Inpal, Inquil). They joined a project with a group of seven German manufacturers of equipment, starch, and textiles. The project is governed by a steering committee that consists of CNPq (Brazil's national science council), IEL/SC,¹² BMBF and DLR (as executive agency of BMBF). The costs of the project which have been estimated at R\$ 6 million were divided between the governments of Germany, Brazil, and the state of Santa Catarina, and the firms involved.

The first phase of the project involved the training of Brazilian engineers in Germany, starting in November 1995. The first months of 1996 saw the testing of starches, conducted by Brazilian researchers in Brazil. In June 1996 the equipment from Germany arrived. Getting it through customs, avoiding to pay import taxes which would have amounted to about R\$ 1.5

12 IEL (Instituto Euvaldo Lodi) is a branch of the Federation of Industries. Its traditional task was to organize internships for university students in firms. In the specific case of Santa Catarina, IEL has widened its scope of activity, starting to offer real services to firms. Apart from the Ecogoman project this included information dissemination on ISO 14000, the coordination of a benchmarking study with firms, and the creation of a venture capital fund.

million, was no easy task. It was mainly due to IEL's effort that both aims were achieved. Most spectacularly, IEL succeeded in persuading the state government to give a waiver on import duties; it pointed out that this was, first of all, a research project and not a commercial venture. When the equipment arrived by mistake in Santos in the state of São Paulo rather than a port in Santa Catarina, IEL persuaded the secretary of finance of Santa Catarina to seek a waiver from CONFAZ, the council of the state secretaries of finance, a fact that may have positive implications for future projects of this kind which may also count on import duty exemption.

Practical tests started in August 1996 at a plant of Alparbatas Santista in São Paulo. They were conducted by a team of five Brazilian engineers who were employed on a full-time basis, German engineers who repeatedly stayed in Brazil for several weeks, and firm's engineers who worked with the project as a part of the regular workload. It soon became obvious that adapting the equipment to natural starch would be more **complicated** than expected; at the end of the test phase at Alparbatas the expected recycling ratio was still missed by far. However, there was a learning process, and things improved after the equipment was transferred to Döhler in Joinville in March 1997. In November 1997 the equipment was transferred to Karsten in Blumenau. By March 1998, the recycling ratio had got close to the desired level of 85 %, and recycling ratios for other inputs were above expectations.

The Ecogoman project does not involve direct technical cooperation between the participating Brazilian textile firms. Nevertheless, persuading firms to open themselves for technological development, and **sharing their learning processes** with engineers external to the firm, is seen as quite an achievement by local actors. Before this, firms were, due to secrecy considerations, unwilling to let anybody look into their production technology.

The Ecogoman project will probably lead to **sustained capacity building**. The Brazilian engineers involved in the project are going to be employed at the Environmental Center of SENAI in Blumenau; the idea is to use their know-how to offer support to firms for further upgrading in environmental technology. At the time of the field research, there was still one firm left where the equipment was to be tested. What will happen with the equipment afterwards was unclear.

3.5 Associação Paranaense de Empresas de Tratamento de Superfície, Curitiba, Paraná

The formation of the Paraná Association of Surface Treatment Firms (Associação Paranaense de Empresas de Tratamento de Superfície, APETS) was the result of an initiative started by a technical cooperation project between CITPAR and GTZ. CITPAR, the technology integration center, is an entity that aims at giving technological support to firms in Paraná; it is attached to the Federation of Industries of Paraná. The German technical cooperation project supports parts of its activities. From GTZ side, it is part of the IBD program (integrated advisory service for the private sector); it was started in 1992 and will terminate at the end of 1998.

To understand the APETS story it is important to look at the evolution of the IBD project. Initially, its main goal was to generate exports by upgrading SMEs in Paraná. However, it

soon became obvious that the overwhelming number of SMEs in Paraná were so utterly uncompetitive that exports were a remote possibility. The project thus changed its focus towards improving the survival conditions of firms which were struggling fiercely to cope with the new framework after the opening of the market, and more so after the end of inflation. Among other things, it focused on small garment firms which together employed ten of thousands of workers and where exit rates were very high.

The problem was that the project's activities were not very visible. Therefore, it decided to **create a success story**, i.e. some activity that would yield a quick and visible impact. In order to identify possible points of departure, project personnel got in contact with different agents, inter alia the association of the metal-engineering industry (Sindicato da Indústria Metalmeccânica). CITPAR thus organized a first workshop in 1995 where it was suggested that the galvanic industry might be an interesting target group. On the one hand, it mainly consisted of small firms with all sorts of technical and management deficits, including severe environmental problems. On the other hand, it had good growth perspectives, especially due to new foreign direct investment in the passenger car industry (Renault, Audi, Chrysler).

The first step in addressing the galvanic industry was to prepare a diagnosis of the sector, which was based on visits to 51 formal-sector firms (altogether, it was estimated that the sector consisted of about 80 formal and maybe 200 informal firms). CITPAR then organized another workshop to present the results and to define actions. Apart from the firms, it invited a number of representatives from other agencies

- the Federal University of Paraná (UFPR),
- the local technology institute TECPAR which, in fact, is mostly an MSTQ organization,
- the local technical school of SENAI,
- the CEFET technical college,
- the Association for Surface Treatment (ABTS), which apparently is dominated by the suppliers of chemical inputs,
- the metal-engineering industry association,
- banks,
- the SME support organization SEBRAE,
- the state government,
- the state environmental agency IAP.

The output of this workshop was a plan of action which defined the responsibilities of several agencies.

An important consecutive activity was to invite a technical expert from Germany (a professor from Fachhochschule Aalen, a polytechnic, who specializes in surface treatment) to visit,

during 15 days, five firms as well as the laboratories at TECPAR and UFPR. He suggested a number of **improvements** which could be implemented in firms **with little investment**, and he started to train a UFPR professor in identifying and implementing such measures. The most obvious improvements were the implementation of the Lancy cleaning process for parts which had been treated with cyanide (a relatively cheap and easy process which is, however, not used by technologically more advanced European firms), the introduction of cascades (i.e. a small basin with three chambers instead of the usual one, a measure that dramatically reduces the water consumption), the change of the zinc treatment from cyanide to acid, changes in factory layout, and others. For instance, in one firm the installation of the cascade bath reduced the water consumption in the phosphatizing process from 240,000 to 10,500 liters / month. Another firm reduced its overall water consumption by 80 %, thus saving about R\$ 800 per month with an investment in cascade tanks of about R\$ 2000. The implementation of the improvements was accompanied and supported by a student of FH Aalen who stayed for five months and wrote his diploma thesis on the experience; the thesis is now being translated and adapted to create a manual for firms.

The creation of APETS, which has about 40 member firms, took the whole process one step further. The idea behind this initiative was to create a **forum for the ongoing cooperation** between firms, and to create the conditions for a sustainable solution to the wastewater problem. APETS is a forum where firms discuss their problems and possible solutions. This includes ongoing cooperation with UFPR in terms of upgrading of processes and training of employees, inviting (at the cost of the firms) external specialists for seminars, and joint visits to fairs. A further incentive for firms to participate in APETS is that its members will receive electrical energy at a lower rate than non-members, a benefit that was negotiated between CITPAR and the local electricity utility COPEL.

In order to tackle the wastewater problem, about ten of the member firms decided to form a **cooperative** to set up a **wastewater treatment station**; another eleven firms have joined since. They defined, together with the UFPR professor, a technically and economically viable solution which requires an investment of about R\$ 150,000. The largest part of that will probably be financed with funds from the Ministry of Science and Technology which has a special line of support for joint university-industry projects. It will be decided in June 1998 whether funds will be allocated to this project. Firms who take part in this venture will for one to two years not be fined by IAP for not disposing of sludge (provided that the sludge gets stored adequately, without causing a health hazard).

A further effect of the initiative was that TECPAR trained an engineer and set up a special **laboratory for testing** the galvanization baths of firms. Behind this activity is the following observation. The quality of galvanizing baths deteriorates over time, and there are two possible options in dealing with this: add more chemicals or replace the whole bath. In the past, the tests of galvanizing baths were usually conducted by technicians of the firms which supply the inputs. There is little doubt that they had a certain bias to declare baths unusable prematurely as this increased their sales. Setting up a laboratory at TECPAR gives firms another option: If the results of a given galvanizing process are no longer satisfactory, they can send a sample of a given bath to TECPAR for testing in order to identify the exact cause of the problem, and to suggest possible solutions like filtration or adding a specific chemical in a precise dose. Interestingly, a parallel laboratory is being created at UFPR to make sure

that there is no monopoly, i.e. to exert performance pressure on providers of testing services.

The incentives which convinced firms to start all these efforts are less obvious than in other cases. Apparently, there was a series of factors:

- Firms were aware of their environmental problems and were willing to do something about them.
- There was little immediate pressure from IAP, the state environmental agency, but as firms were aware of their problems they perceived that they might come under intense pressure at any given time. Moreover, as the certificate for operation has to be renewed every two years, problems with IAP were foreseeable. However, 60 % of APETS member firms so far are not registered with IAP, and would prefer to keep things this way.
- There was little immediate pressure from customers, although this has changed in the meantime. For instance, first-tier suppliers of firms like Volvo are under pressure to implement the QS-9000 system or its equivalents, and they pass this pressure on to their subcontractors. Moreover, as some of them are running just-in-time inventory schemes, they do not want to run the risk that a supplier all of a sudden is closed down by the environmental agencies.
- Firms that did something to improve their environmental record also hoped that this might in the end lead to a constellation where competitors without any such effort, and with accordingly lower costs and prices, might be squeezed out of the market, either by customers or by the environmental agencies.
- Overall awareness of environmental issues increased to the extent that Curitiba began to present itself as a showcase of urban environmental policy.

3.6 Pilot Plants in Energy Efficiency, Rio de Janeiro

In 1996 SEBRAE-RJ, the branch of Brazil's parastatal SME-support organization responsible for the state of Rio de Janeiro, started a joint project with GTZ to stimulate a move towards efficient use of energy in industry, especially in SMEs. One of the motivating factors was the observation that, whereas energy intensity in industry had been reduced substantially in advanced countries, in some cases by more than 50 %, it had remained stable in Brazil between 1970 and 1990, and that in 1990 the energy efficiency of Brazilian industry was low (Table 1).

The first step was to establish cooperation with other organizations which have an interest in this field; these were the vocational training system (SENAI) and a government-funded MSTQ and technological research institute (Instituto Nacional de Tecnologia, INT). The second step was to identify particularly energy-intensive industries, namely manufacturing of bricks, refurbishing of tyres, coffee roasting, manufacturing of sausages, and bakeries. The third step was to identify firms who would be willing to take part in an exercise to examine energy efficiency potentials.

Table 1: Energy efficiency in industry (energy consumption in industry in MJ / US\$ gdp 1985)

Country	1970	1980	1990	% change 90/70
USA	6.7	5.3	4.0	-40.3
Canada	7.7	8.0	6.1	-20.8
France	5.6	4.3	3.0	-46.4
Germany	7.9	6.0	4.1	-48.1
Italy	6.2	4.5	3.7	-40.3
UK	10.4	6.4	4.5	-56.7
Japan	7.7	4.9	3.5	-51.4
Spain	6.0	6.1	5.0	-16.7
Brazil	7.3	7.1	7.1	-2.7

The basic idea was to identify firms which for some reason were open to change, and to take them as **pilot plants** for energy efficiency measures. Such firms had to commit themselves to permit **visitors** from other firms to visit their factory; this was one of the features that were laid down in a contract that included fines in case a firm did not permit visitors into its factory. The hope was that the success in the pilot plants would convince other entrepreneurs not only of the viability but also of the economic potential of energy efficiency measures, particularly in terms of improved competitiveness.

The project has been cooperating with ten firms so far (four brick manufacturers, two firms in the tyre refurbishing business, two coffee roasters, one sausage producer, and one bakery). The energy efficiency potential in these firms has exceeded the expectations. The following table gives an overview of possible measures in the brick industry. To assess these data it is important to know that Brazilian brick manufacturers tend to be way behind best practice; they usually employ circle ovens or Hoffmann ovens, i.e. 19th century technology. The first of the pilot firms is only right now setting up a tunnel oven, a technology developed in the early 20th century in industrialized countries. With an investment of about R\$ 310,000 it will have a payback period, based on energy savings alone, of about one year. Apart from that, it will improve the quality of the bricks and reduce scrap from 7 % to 1.5 %.

Table 2: Energy Efficiency Potentials in the traditional Brick Industry

	investment (R\$)	annual savings (R\$)	life cycle of equipment (years)
<i>Electrical</i>			
Correction of power factors	1,800	3,600	5 - 10
Installation of high-efficiency motors	5,693	7,420	10 - 15
<i>Thermal</i>			
Reuse of heat from circle ovens	31,000	29,440	5 - 10
Reduce the heat stores in circle ovens	96,000	13,380	2 - 6
Equipment to dry bricks before burning	50,000	102,000	10 - 15
Improve burning in Hoffmann oven	5,000	4,581	5 - 10

In the particular case of the **brick industry** the project could build on an existing initiative of brick manufacturers in the northern part of the state. They started to upgrade in the 1980s,

stimulated both by increasing demands, especially in terms of quality, from their main customers (large civil construction firms), and by visits to fairs and brick factories in Europe, revealing the gap with best practice. In 1991, these firms set up their own association (Sindicato de Cerâmica para Construção e Olaria do Médio Vale do Paraíba, Sincovap) as they were frustrated with the lack of support and services offered by the existing association that was organized on a statewide basis.

Firms were already looking for energy efficiency potentials when they got in contact with the SEBRAE/GTZ-project. As they had been in contact with consultants who specialized only in isolated parts of the production process, the efficiency potentials revealed by the SEBRAE/GTZ-project consultants exceeded their expectations by far. These **efficiency potentials** were discovered by engineers at INT and a professor from the Federal University of Rio de Janeiro; they amounted to 22 % of electrical and 53 % of thermal energy input. An indirect effect of the project is a changed modus of communication with the representatives of equipment vendors who often exaggerated potential benefits of new equipment and are more honest and modest now that the firms are better informed due to close contact with SEBRAE, SENAI, and INT.

Apart from the direct work with firms the project aims at setting up a database and producing information material on energy efficiency (at SEBRAE), and training numerous entrepreneurs, employees, consultants, and teachers as well as producing teaching material to be used for distance learning with firms' employees (at SENAI). In fact, one of the main effects of the project has been to **establish cooperation** between firms, SEBRAE, SENAI, and INT. A further contribution of the project is to get firms and banks in contact with each other. This is motivated by the observation that improving energy efficiency often requires investment in new equipment, and that SMEs find it difficult to get access to credits for equipment purchases, a phenomenon that reflects the poor development of Brazil's finance system – while it was brilliant in dealing with hyperinflation, it never developed (for the same reasons) a practice of conceding medium-term credits to private firms, especially SMEs.

4 Comparison of the experiences

The following section compares the different experiences by using eight analytical categories:

- point of departure,
- type of firms involved,
- incentives for firms to participate,
- mode of organization, formal work modus, informal aspects, and development trajectory,
- organizing agent,
- role of German technical assistance,

- competition aspects.

The table in Annex 1 gives an overview of features in a comparative view.

4.1 Point of departure

When looking at the different experiences it is useful to distinguish **supply- and demand-driven cases**. NMA and the two cases in Blumenau are clearly demand-driven: firms were under acute pressure to resolve a well-defined environmental problem. The Ecogoman project also fits into this pattern as firms were determined to do something about starch-rich effluents due to general pressure from the environmental agency; in this case a certain element of supply-drive was involved due to the acquisition activities of ITV. The experiences in Paraná and Rio de Janeiro are both supply-driven, i.e. have been initiated by German technical assistance projects. However, both could count on a target group that was already motivated to get things going; a typical problem of technical assistance, namely convincing the target group of its own deficiencies, was no issue here. Apparently, these days it is not difficult for an agency seeking to assist the private sector in Brazil to identify groups of firms which are open to change as the pressure on firms to improve their performance has increased tremendously with the opening of the market and the stabilization of the macro-economic framework, even though this does not necessarily mean that firms most in need of assistance are most open to change and support.

4.2 Type of firms involved

A broad spectrum of types of firms was involved in the experiences – from world-class large-scale firms (some of the participants of NMA) to one-person-workshops in the case of printing shops in Blumenau. Nevertheless, the observations do not fit nicely in the preconception of a clear correlation between size / competitiveness and environmental awareness. Things are more complicated:

- Although they are mostly small firms, the galvanic firms in Paraná were fully aware of the environmental problems they cause, and were seriously seeking for a resolution. If one assumes that there is a "natural" trajectory for a firm (from end-of-pipe treatment to process-integrated measures to environmental management), the small galvanic firms were more or less on par with some large firms in Joinville, which are leaders and global players in their respective industries but which – because they are in the metal-engineering and electromechanical industry and intensive in assembly rather than transformation – are less likely targets of environmental control. The experiences in Brazil thus indicate that **firms' level of environmental activity is more correlated with the branch and intensity of environmental impacts created than with the size of firms**.
- There is also **no clear pattern regarding the role of multinational firms**. Some of the galvanic firms in Paraná are second- or third-tier suppliers to firms like Volvo and Siemens. First tier suppliers to Volvo report that the company has so far not defined a strategy towards ISO 14000, and that their pressure on galvanic firms is rather due to the fact that they fear a disruption of their just-in-time delivery schedule with Volvo in case a galvanic firm is closed due to environmental violations. In Blumenau, the participants in

the landfill site group include a subsidiary of an U.S. cardboard manufacturer and the local franchise of Coca-Cola. The cardboard firm recently received instructions from headquarters to conduct an environmental audit. Support from headquarters, however, meant nothing more than sending a checklist and an auditor; there was no further support like instruction manuals describing the reasons for the exercise, the philosophy behind it, and the practical procedures. On the other hand, Coca-Cola Inc. has clearly defined that its franchises have to be certified according to ISO 14000 by 1999. Assistance to franchises includes printed material and workshops, but also creative measures like support for recycling campaigns. The Blumenau franchise is involved in a campaign in which pupils are stimulated to collect empty Coca-Cola cans. If they collect a given quantity, their school receives a PC for free.

4.3 Incentives for firms to participate

Firms participate in the different activities for **different reasons**. Immediate **pressure** was important in the cases of Joinville and Blumenau. This pressure arose mostly from the state environmental agency. In the cases of the Ecogoman project and in Paraná and Rio de Janeiro it was imminent rather than immediate pressure that convinced firms to do something about the environmental burden they caused.

Pressure from customers played a lesser role. Textile firms in Santa Catarina used to suffer this pressure in the past. As they have invested in wastewater treatment and substituted hazardous inputs in their production process this pressure is less relevant today. Moreover, it is restricted to manufacturers of home textiles since clothing producers have largely stopped their exports to Europe where pressure from customers is most intense. It has already been noted that multinationals in Paraná like Volvo or Siemens do not exert much pressure regarding the introduction of environmental management so far.

One further remark is in order here: Being under pressure is a relative notion. If a given firm feels under pressure at a given point in time, it is still possible that pressure will get more intense in the future. In other words, if a firm explains that it pursues a given activity because it feels under pressure it is important to discuss the quality of the pressure.

4.4 Mode of organization, formal work modus, informal aspects, and development trajectory

The **intensity of cooperation among firms varied vastly**. It was most intense in the case of the NMA, and also quite intense in the cases in Paraná and Rio de Janeiro; in the latter, close cooperation had started before the firms got involved with the SEBRAE/GTZ-project.

Environment-related cooperation among firms reflects a broader trend in Brazilian industry. In the past, there was very little cooperation among firms, a feature that reflects the specific circumstances not so much of latecomer industrialization but mostly of the economically unstable high-inflation environment. We have hypothesized that environmental issues are a promising point to entry for inter-firm cooperation as firms do not perceive it as a core activity (at least as long as environmental activities mainly refer to end-of-pipe-measures) and have

thus less misgivings regarding possible loss of business secrets (Meyer-Stamer et al 1996). The experiences documented in this paper support this hypothesis, although certain modifications are in order:

- There is **not a "natural" trajectory from a single-issue activity to a broader focus** – not even in the environmental field. In certain cases, the focus of cooperation has constantly widened; this is most prominent in the cases of NMA Joinville and Paraná / galvanic firms. This has not occurred in the two cases in Blumenau. In the case of Paraná, the widening scope of cooperation increasingly touches on the key activities of firms and involves collective technological learning processes. In the case of the NMA, it is likely that something similar will happen if the núcleo becomes the focal point for information exchange on environmental management. The Ecogoman experience may give rise to further technology cooperation projects among leading textile manufacturers, although only little enthusiasm can be detected in this regard at the level of executive boards.
- The Rio de Janeiro / energy efficiency experience illustrates that **other points of entry** to inter-firm cooperation exist. In the case of the association of brick manufacturers, three points apparently have been crucial: a strong pressure from customers regarding product quality, a strong local leadership, and a we-against-them constellation between firms in the northern part of the state and less competitive firms (and a not-too-active association) elsewhere.

4.5 Organizing agent

A further essential point regarding inter-firm cooperation regards the role of **business associations**. All the cases documented in this paper involved business associations. More precisely, they involved business associations that are in a **profound transformation process**. Brazilian business associations were created by law as part of a corporatist system in the 1930. This legal framework still exists, and many business associations still reflect the corporatist heritage – as membership is mandatory, they show little inclination to do anything to secure the legitimation of their organization with its members apart from ad-hoc lobbying efforts. It is interesting to note that things were not much different at associations with voluntary membership, i.e. the ACIs. The situation changes to the extent that **internal democratization processes** occur within corporatist business associations, allowing frustrated members to take over their association and to start to restructure it so that it offers real services. The alternative is, like in the cases in Paraná and Rio de Janeiro, to found **new associations**.

In any case, there is strong evidence that business associations do **play an essential role in organizing inter-firm cooperation**. To do this on a sustained basis, it is critical that they have a minimum number of professional staff, at the very least to take care of the administrative work involved in cooperation projects. ACIs in Joinville and Blumenau as well as IEL-SC have this staff. In the cases of Paraná and Rio, associations so far are maintained through voluntary work of members. This, however, is only feasible because administrative capacity is available elsewhere – at CITPAR in the case of Paraná, at SEBRAE in the case of Rio de Janeiro.

4.6 Role of German technical assistance

All the examined projects involved some kind of cooperation with Germany (technical assistance in five cases, scientific-technological cooperation in the case of Ecogoman). In the case of the technical assistance projects, **two different patterns** can be identified:

- indirect, facilitating activities,
- issue-oriented, stimulating activities.

The cooperation project with ACIs in Santa Catarina exemplifies the first type. It aimed at organizational development in ACIs, i.e. reshaping ACIs in such a way that they react flexibly to new challenges and opportunities, or are even able to actively create new opportunities. Organizing núcleos was instrumental towards achieving this goal. Neither of the three cases in Joinville and Blumenau was the direct result of the technical assistance project. They reflect a more responsive mode of action of the ACIs, something that according to local actors has to a significant degree been stimulated by the technical assistance project.

The projects in Paraná and Rio de Janeiro exemplify the second type, i.e. issue-oriented, stimulating activities. The project in Rio was deliberately started to address energy efficiency issues in industry. The project in Paraná perceived environmental problems of the galvanic industry as an opportunity to solve one of its main problems, namely to find a way to contribute to firms' quest for competitiveness in an environment where there was little tradition and experience with interaction between firms and institutions at the mesolevel. The project in Rio de Janeiro has not been designed to contribute to organizational development in one of the organizations involved (SEBRAE, SENAI, INT), whereas it does stimulate a much closer cooperation between these organizations. The project in Paraná has stimulated organizational development within CITPAR, an organization that has existed since the mid-1980s which, according to local observers, is nowadays much more dynamic and firm-oriented than it was before the project started.

4.7 Competition aspects

Many Brazilian businesspeople find the notion that firms should cooperate on whatever issue not convincing at all. In their view, firms are competitors, and as such there is just **no way how they might cooperate**. Moreover, cooperation may have had a specific meaning in the past. One of the ABETS member firms mentioned that it had once before tried to organize an association. The immediate effect was that it was blacklisted by one of its main customers who suspected that the firm was trying to organize a cartel.

At the same time, it is largely undisputed that, especially in industrialized countries, competition and cooperation not only go hand in hand but that cooperation is actually a necessary prerequisite to survive in a highly competitive environment; neologisms like "**coopetition**" have been created to address this observation. This includes both **formal cooperation**, like in strategic alliances, and **informal cooperation** through various means of communication (e.g. communication with suppliers and customers, and with competitors in fora like confer-

ences and professional associations). "**Learning by interaction**" is an essential means of coping with the increasing velocity of technical change and surviving in competitive markets.

All this means that stimulating cooperation among firms, even with respect to environmental issues, is by no means an easy task. It involves a lot of effort by leaders in the business sector, by business associations, and by other agents like SME support organizations. The experiences presented in this paper show that cooperation is possible, even in activities that are close to technological core competences and among firms who are direct rivals, like in the case of the Ecogoman project. It appears that, once cooperation has started to work well, it is a self-reinforcing mechanism. For instance, representatives from the NMA firms are quite enthusiastic about their núcleo and find it extremely complicated to explain why such cooperation so rarely takes place. After a certain period firms find it quite natural to balance cooperation and competition concerns.

5 Interpreting the experiences in a systemic perspective

In order to put the experiences presented before in perspective, it is useful to look at them from the viewpoint of the "Systemic Competitiveness" framework (Eßer et al 1996, Altenburg, Hillebrand and Meyer-Stamer 1998). It entails four different levels of analysis (the meta-, macro-, meso- and microlevels). In addition to the microlevel of firm activities and the macrolevel of national economic policy, the metalevel addresses such factors as the capacity of a society for social integration and its ability to formulate and implement strategies. The mesolevel concerns the supporting structures, including sector-specific policies which encourage, supplement, and increase the efforts at the company level, and supporting institutions in fields like training, technology, and financing.

An important starting point in most of the cases presented in this paper are changes at the **metalevel**, i.e. changes in values which lead to increasing **environmental awareness**. A recurrent message in many of the interviews with firms during the field research was that environmental awareness has increased substantially over the last years. This has two kinds of repercussions. First, there is interaction between **meta- and microlevel** – environmental awareness inside firms increases as well. It is no longer just external pressure that forces firms to do something about the environment. To be sure, external pressure remains important, especially to stimulate changes in firms still lagging behind. This is, second, reinforced by **feedbacks within the metalevel** – increasing environmental awareness reduces the tolerance for environmental damage caused by firms and leads to an increasing number of citizens' complaints at environmental agencies. Enforcement of environmental legislation due to complaints is an important feature, especially regarding micro and small firms which so far often evaded supervision by environmental agencies.

Another important causal chain runs **from the meta- to the macro- to the microlevel**. Changes at the metalevel (i.e. increasing frustration with the hyperturbulent high-inflation framework) lead to stabilization of the macroeconomic framework and a profound change of the incentive structure due to the opening up of the economy. Competitive pressure rose, and with the demise of high inflation it was no longer possible to disguise low efficiency. At the microlevel, increasing awareness of efficiency problems leads to increasing interest in

eco-efficiency. At the same time firms learned to perceive environmental issues as a cross-sectoral rather than isolated activity, i.e. moving from building wastewater treatment stations towards integrated processes and environmental management, thus combining environmental improvements with increased efficiency.

Taking both changes at the metalevel together it is easier to understand change at the microlevel, i.e. **why firms begin to cooperate**. The change to an efficiency-oriented mindset creates an incentive to seek for the benefits of collective learning. Increasing environmental awareness stimulates cooperation with like-minded firms.

There has also been an important change in the type of relationship between meso- and microlevel. Whereas the **relationship between environmental control agencies and firms** used to be hostile in the past, it has given way to cautious cooperation (this could be observed both in Santa Catarina and Paraná). As firms have started to accept that they have to do something about the environment, and even more if they discover eco-efficiency potentials, there is less need for control and pressure. Moreover, the competence gap reverses. While in the initial setup, i.e. before the firms start to deal with environmental issues, environmental agencies may be technically more competent, engineers in firms will soon gain superior knowledge about eco-efficiency potentials and technological alternatives once they have started to deal systematically with environmental issues.

Finally, there is also a **change in the relationship between micro- and mesolevel**. First, firms increase their demand for support from business associations, for instance in moderating and administrating environment-oriented cooperation. Second, especially SMEs seek support from mesolevel institutions in fields like training and technology.

6 Recommendations for P3U: How to stimulate inter-firm cooperation

The purpose of this final section is to draw a number of conclusions for the work of P3U. It addresses two main issues. First, is combining two difficult tasks, namely stimulating inter-firm cooperation and environmental management, a promising venture? Second, how can different types of target groups and partner constellations be addressed?

Trajectories in inter-firm cooperation and in environmental management

An effort to stimulate inter-firm cooperation in environmental management faces an enormous challenge as it tries to **combine two extremely complex issues**:

- Convincing firms to cooperate is a difficult task, especially if they do not have a previous experience with cooperation and hence view the idea of inter-firm cooperation with suspicion and reluctance..
- Convincing firms to deal with environmental management, which normally is perceived as just adding costs to production, is no less complicated.

At the same time, the cases presented before illustrate that **cooperation is possible**, even in an environment in which inter-firm cooperation hardly existed in the past, and in which trust among firms is low. In fact, some of the cases seem to indicate that combining the two difficult tasks – stimulating cooperation *and* environmental management – does not multiply the problems but actually reduces them. In order to understand this point, it is useful to take a look at the process, i.e. to understand typical trajectories in both inter-firm cooperation and environmental management.

Inter-firm cooperation follows the normal logic of cooperation (Axelrod 1984), i.e. it is strongly path-dependent. If there is little or no cooperation, there will probably be little trust between firms, and firms will be unwilling to disclose information. The preconditions for any attempt to involve firms in cooperation are unfavorable. If one actor tries to break through this negative circle of non-cooperation and if the entrepreneurs do not perceive positive results this will reinforce their reluctance to cooperate with each other. If the outcome is positive, this will over time lead to intense cooperation. Asked by an external observer for the reason for this cooperation, company representatives will then consider inter-firm cooperation perfectly obvious. Hence, cooperation is often a self-reinforcing process in which trust is continuously being strengthened.

This **desirable process of change** from reluctance to cooperation, towards a positive experience stimulated by a change agent and a self-reinforcing tendency towards further and closer cooperation between firms, requires

- a careful selection of the change agent,
- an equally careful selection of the issue to be addressed by the initial cooperation,
- the facilitation of the subsequent steps of cooperation.

A move from non-cooperation to cooperation will hardly occur without a major change in the mindset of entrepreneurs, something that is often induced by crisis or external shocks. In order to sustain cooperation it is necessary to accompany, facilitate, and evaluate at least one whole cycle of cooperation, with a view to creating organizational conditions for a repeatable process rather than concentrating on one specific single output.

Stimulating cooperation, i.e. inducing the very profound change from a non-cooperative to a cooperative game, is a **demanding task**. In the case of Brazil we documented certain cases where the change took place in the face of a heavy crisis which uncovered the dysfunctionality of traditional un-cooperative behavior (Meyer-Stamer 1998). Clearly identifiable, individual local change agents have played a crucial role in these changes. In the case of ACIs in Santa Catarina, a German technical assistance project played a major role.

Stimulating cooperation is a **time-consuming process** since it involves the fragile process of accumulating trust. It is more promising in fields with little incentive to default. Trying to start cooperation in a field like marketing of technology is thus not promising. Things are different when it comes to **environmental issues**.

- These are often seen as a secondary issue inside the firm.

- There is often an environmental agency or an important client who is expected to put pressure on firms to comply with environmental requirements, i.e. there is an external "enemy" that helps to convince the "victims" of the value added of joint action.

Regarding **environmental management**, firms in Brazil seem to follow the same trajectory that has been observed in industrialized countries (Porter and Linde 1995), as Brazilian environmental policy has been applying the same patterns as in Europe and the US. It begins with the enforcement of environmental legislation and/or demands of customers, which typically leads firms to implement end-of-pipe measures and to substitute certain inputs (e.g. hazardous dyestuff in the textile industry). Subsequently, firms examine their production processes from a different angle, e.g. they reduce the generation of sludge (which is costly to dispose of) or substitute certain inputs altogether, modifying their production process. This sequence often includes the identification of so-far undiscovered potentials to increase productivity or quality; in the innovation economics terminology: it challenges path dependency and thus changes the innovation trajectory, leading to a new search pattern to optimize production processes and implement organizational changes.

Once they have reached the latter stage, firms begin to understand that environmental issues are not just a nuisance and an additional cost-factor, but may actually reveal competitiveness potentials by identifying win-win-options. This is reinforced when new equipment becomes available that increases both productivity and product quality and in most cases allows for an improved environmental performance. Firms then develop a real interest in environmental management systems as these are helpful to both comply with environmental legislation and improve business performance. Leading companies in Santa Catarina have reached the stage where they prepare for ISO 14000 certification (one textile firm in Blumenau was the first national firm to be certified), and they go on examining how to integrate environmental management in a more systematic and consistent way into their overall management system.

The case of the NMA Joinville shows how these **two trajectories can reinforce each other**. At the outset, there was very little cooperation and no environmental management. The NMA initially was a rather strange activity that involved individuals from the fringes of firms to deal with just one specific problem. Then two things happened:

- Ongoing work in the núcleo created trust and the focus of the group widened to include new and broader issues.
- Environmental issues became more important as firms followed the learning trajectory in environmental management described before.

Currently, it seems very likely that the NMA may become the main forum for joint learning on environmental management, an issue that has attained high priority in many of the participating firms. Environmental management is becoming an important element of creating a competitive advantage. Some years ago, firms would have found the idea of a joint learning process on a key management issue ridiculous. Today it seems perfectly obvious, thanks to the experience of the NMA.

It is, however, essential to acknowledge that **several factors** coincided which made this case of inter-firm cooperation in environmental management possible, and that some or all of them would also be required in other cases:

- external pressure, which may be acute or imminent (like in the case of Paraná),
- at the outset clearly defined, measurable goals of cooperation (to avoid the impression of futility among the participants),
- professional facilitation of the cooperation process by an agent external to the firms,
- a certain consistence of the group which helps to create trust and commitment (in the case of the NMA all participants repeatedly pointed out how important it was that only professionals, and no owners, were part of the group).

Addressing different types of firms and constellations

There are **four basic constellations** regarding the introduction of environmental management in firms: Firms may or may not be under pressure to comply with environmental legislation, eco-standards, etc., and firms may or may not have established detailed cost accounting and embarked on a continuous and systematic search for efficiency potentials.

The importance of environmental pressure on firms has repeatedly been stressed in this paper; in nearly all of the cases (i.e. except energy efficiency / Rio de Janeiro) it was the most important or at least a crucial factor. The issue of cost accounting and search for efficiency has not been addressed so far. Reducing a complex reality to a simple dichotomy, **two types of firms** can be distinguished regarding these issues. On the one hand, there are firms which have established detailed cost accounting and which are systematically searching for potentials to raise efficiency. Contrary to popular perceptions, they are a minority, even in industrialized countries. The popularity and wide application of concepts like lean manufacturing, re-engineering, and total cost management illustrates this observation. In the specific case of Brazil, very few firms, even among the leading ones, actually had detailed cost accounting systems until the early 1990s (Fleury and Humphrey 1993). This was not a high priority at that time because limited efficiency was no problem in the closed market. What determined the success of a firm was not productive efficiency but effective financial management, i.e. keeping liquidity high and indebtedness low and understanding quickly the new rules of the game after the frequent macroeconomic stabilization plans.

So, on the other hand, there is a huge majority of firms, mostly micro, small and medium-sized firms, which do not have sophisticated cost accounting systems and pursue, at best, idiosyncratic efforts to raise efficiency. The latter feature has been acknowledged by economists as an ubiquitous phenomenon; they have been described and explained by terms like "satisficing", "bounded rationality", and "path dependence". **Satisficing** refers to the observation that firms may not seek to maximize their profit but rather be contented with stabilizing a certain level of profitability, especially if seeking higher profit implies much higher risks. **Bounded rationality** refers to the observation that it may actually be inefficient or even impossible for an economic agent to check all possible alternatives when he makes a decision

so that he rather bases his decisions on recent experiences and rules of thumb. **Path dependence** refers to the observation that past decisions limit current options: for instance, if a firm has opted for a given cost accounting software package it will not easily switch to another one, even if after some months of operation major flaws become visible.

Combining these features leads to the following matrix with four stylized constellations:

	Detailed cost accounting, systematic effort to raise efficiency	No / general cost accounting, idiosyncratic effort to raise efficiency
Pressure to comply with environmental legislation / eco-standards	(1)	(3)
No pressure	(2)	(4)

There may be good prospects for measures to stimulate environmental management in the fields 1, 2, and 3, whereas they do not appear promising in field 4. From the perspective of a technical cooperation pilot programme like P3U, the problem is that probably the majority of firms in a country like Brazil do belong to field 4. Field 1 typically refers to well-organized, competitive firms like those participating in the NMA Joinville and the Ecogoman project. There were no obvious field 2 examples involved in the research for this paper, except for a few participants of the landfill group in Blumenau. Field 3 refers to firms like the small printing shops in Blumenau and the galvanic firms in Paraná. The important point is that it is unpredictable when such firms will move from field 4 to field 3. Environmental agencies admit that they cannot systematically control all firms, i.e. a large number of micro, small, and medium-sized firms in their jurisdiction is never visited by inspectors, and many are not even known to the authorities. The selection of firms that are actually being controlled is mainly based on complaints, for instance by neighbors noticing who denounce odors or colorful effluents.

At the same time, firms in fields 3 and 4 are the typical target group of technical assistance projects in both the private sector development and environmental management areas. One can conceive several ways of bringing the message of environmental management to these firms:

- The first and easiest option is **to wait** until these firms come under environmental pressure. The drawback is that it may take years for this to happen. However, this must not be bad news for support organizations that can only deal with a limited number of customers, and one may suppose that the number of industries and firms coming under environmental pressure will continuously grow, especially as large firms have their environmental management systems established and become effective and as environmental agencies shift their focus to micro, small and medium-sized firms. Therefore, just dealing with firms under pressure may employ all the resources available to existing support organizations.
- A second option is to team up with environmental agencies to pursue a **carrot-and-stick approach**. The idea is to formulate sectoral programs for certain heavily polluting industries, where environmental agencies implement existing legislation (preferably in a cooperative way and without a bias for end-of-pipe measures) and SME support organizations come in to help firms in coping with this pressure. The drawback is that pressure from the

environmental agency will probably create a hostile atmosphere which hampers interaction with the SME support institution, especially if business owners perceive the latter as another government agency, thus deterring the use of voluntary instruments of environmental management at the company level.

- A third alternative is a **carrot-and-carrot approach**. The idea is that environmental agencies give preferential treatment to pro-active firms which are seriously engaged in the introduction of environmental management, like in the case of Paraná where galvanic firms participating in the treatment station project are exempted from fines for storing their galvanic sludge. It is important to understand that in the past things often worked the other way around: Firms with established environmental measures were more visible and hence inspected more intensely, and often were fined more consequently, than firms without any such measures. Inspectors of environmental agencies found it easier to check on well-organized firms with transparent processes, whereas, for instance, controlling a disorganized firm with a multitude of emission sources was much more complicated. It is obvious that this created perverse "incentives": Firms with well-established environment-related activities and environmental management systems are more vulnerable to government enforcement. This is due to Murphy's law, i.e. even in a well-organized firm some things will go wrong sometimes, and it is easier to detect such occurrences. Moreover, environmental legislation may be inconsistent or establish unrealistic standards. As long as the performance of inspectors is implicitly or explicitly measured against the number of fines they impose, it will be complicated to move from perverse to sound incentives. The cases both of Santa Catarina and Paraná show that some environmental agencies are moving from conflictive towards cautiously cooperative relations with firms. Under such conditions a carrot-and-carrot approach may work. At the same time, it is important to note that, as long as perverse incentives prevail, firms may hesitate to implement techniques like environmental cost management, even if they promise substantial savings in costs and materials, as long as this increases their vulnerability to enforcement.
- A fourth option is to **cooperate with large companies** in their efforts to support smaller firms. Especially in the environmental field large firms play a crucial role as certification according to the ISO 14000 system of standards implies the extension of environmental management towards suppliers, mostly small and medium-sized firms. It is by no means certain that large firms have the means and willingness to support their suppliers in introducing environmental management, especially if foreign firms do not get adequate support from headquarters. Partnership with SME support organizations, which in turn are typical partners of international technical assistance, appears as a promising option. The problem is that a substantial part of the small business sector would not be targeted as it is not part of supply chains.
- A fifth option is to identify a group of **firms under high competitive pressure with substantial potential for eco-efficiency** (e.g. brick manufacturing was chosen in Rio de Janeiro due to its enormous potential in energy efficiency). However, this approach is risky as firms may perceive that other measures (like cheap credit for modern equipment, training of employees, or lobbying for protection against pressure) appear more promising than addressing the competitiveness issue from an eco-efficiency angle. It also ignores the typical learning trajectory outlined above. If firms had occasional conflicts with environmental enforcement, and even more if they never had such contact and rely on hear-

say, they tend to have a highly developed a-priori skepticism regarding anything related to environment.

None of these alternatives seems to be a first-best option. Each of them may be appropriate under specific conditions.

When firms actually start to deal with environmental management and are willing to do this collectively, it is crucial to understand that cooperation is an evolutionary process. The **first step** in stimulating a group-centered approach is to **identify a group of firms** that, for some reason, is under pressure to do something about its environmental impact and its competitiveness. Firms which have been under immediate pressure by an environmental agency or by customers face clear incentives and are the easier target group for support in environmental management. Additional pressure resulting from the need to reduce costs of resource consumption in order to stay in the market or become more competitive is helpful. Such firms may find the idea of forming a group to react collectively instead of individually to external pressure immediately convincing, so that it is easier to overcome their cooperation-unfriendly predisposition.

The **second step** is to **identify an organization or a person** that can organize and **facilitate the work of the group**, i.e. who is both credible and competent (with respect to technical issues as well as the moderation of group processes). The experiences from Santa Catarina and Paraná indicate that business associations are promising candidates, provided they have professionals who are up to this task. In order to get the group to move and go, it is useful to refer to the methodology refined by Fundação Empreender (see Annex). It is, however, essential to understand that **business associations are in a complicated situation** when it comes to environmental issues. On the one hand, an association with a minimum of strategic capacity will stimulate environmental learning processes among its member firms since experience shows that environmental pressure does increase sooner or later. On the other hand, member firms will expect the association to delay this process as much as possible, i.e. to lobby against strict environmental measures. This means that officials of business associations may have to develop a somewhat schizophrenic attitude. To overcome this, a business association may try to push a proposal for the carrot-and-carrot approach outlined above.

In order to actually **facilitate the work** of the group it is important to accept that it takes some time for learning processes to occur. It is unlikely that a short-track can be found to circumvent the typical sequence outlined above (although supporting agents may succeed in creating a learning curve steeper than usual). It is important to consider the psychology of firm owners in this context. Businesspeople seem to have a kind of natural tendency to perceive environmental concerns as a middle-class luxury, something they cannot afford, especially if they own micro or small firms. They tend to see themselves as heroic entrepreneurs fighting for survival in a hostile environment anyway, and environmental concerns appear to be just another invention to make survival more complicated. Regarding environmental management, there are specific obstacles in micro, small and medium-sized firms.

In the case of **micro and small firms**, selling environmental management to businessowners is all the more complicated as, in the first place, they often do not really have a management *system* worth this name. In other words, the introduction of environmental man-

agement is a synonym for a transition from improvised to systematic management, which, in turn, means that the introduction of environmental management offers the opportunity to upgrade the overall management system. This process, however, involves a lot of training and learning, and thus will take time; in addition, it can make an important contribution to economic dynamism.

This has two implications for agencies that try to disseminate environmental management tools. On the one hand, it is unlikely that such firms will immediately hop onto the environmental management wagon. On the other hand, however, they may be promising candidates for no-cost and low-cost instruments like good housekeeping (GTZ-P3U 1998). It will be essential to emphasize cost reduction potentials and to keep the environmental issue in the background, perhaps even to avoid environmental terminology altogether, at least initially.

In the case of **medium-sized firms** in which a certain degree of division of labor exists, the situation is different since owners tend to delegate environmental issues, like managing wastewater treatment or solid waste, to specialized employees. In this case, moving along the trajectory from end-of-pipe measures to environmental management involves profound changes in the internal power structures of the firm as the environmental person moves from a fringe to a core position. It is unrealistic to expect the process to be quick and smooth. What can be expected is that support via technical assistance reduces some of the pains and the time needed for this process.

A further important conclusion is that it is useful to **involve environmental agencies** in stimulating eco-efficiency. Their pressure is an important reason why firms do something about the environment. Combining carrot and stick, i.e. not only put pressure on firms but also support them in complying with ecological requirements, appears to be a plausible approach. However, the degree to which an environmental agency can support firms is necessarily limited. At the same time, it is important to acknowledge that the learning trajectory mentioned above includes important learning processes inside environmental agencies. They tend to have a profoundly hostile view of firms as they perceive them, often correctly, as major environmental hazards. In dealing with firms, they tend to think that the better the stick is, the better. The problem is that their officials often have no on-hands experience inside firms and therefore do not easily understand how businesspeople think and act. The understanding of each others mode of activity and incentives was an important outcome of contacts between the NMA Joinville and FATMA. As soon as firms deal systematically with environmental issues, they tend to develop environmental consciousness, a tendency that environmental agencies do not always appreciate. Agency officials keep believing in the big carrot approach, something that often leads them to enforce implementation of environmental measures in an inflexible and dysfunctional way, namely by insisting on certain methods and technologies rather than stimulating firms' creativity to not only come up with the most efficient solution for a given problem but also to embark on a new trajectory of continuous improvement to minimize environmental impact.

Support is mostly required from other **meso-level organizations**, which can also help in moderating interaction between the environmental agency and firms. It has been mentioned above that government agencies, including SME support agencies, may not be the most promising candidates to support companies in the environmental field because firms see

them as a potential Trojan Horse, i.e. fear that they disclose information on environmental impact to their colleagues at the environmental agency.

In the case of Brazil, it appears that organizations like SEBRAE and SENAI have credibility vis-à-vis firms when it comes to environmental issues (although both are sometimes seen by firms as government agencies, which is not true in the case of SENAI and only part of the truth in the case of SEBRAE). The credibility of business associations varies widely, but it is indisputable that several of them are in a profound process of restructuring to change their traditional work mode (little responsiveness, top-down-organization, domination by large firms, few services to members, little effective lobbying).

With respect to the stimulation of cooperation between firms, business associations are better prepared to do this job than SEBRAE and SENAI. Actually, business associations should be the result of inter-firm cooperation (which many of them are not because they were founded by the state, who established a corporatist system sixty years ago). At least, the restructured business associations have become an important forum of inter-firm cooperation. SEBRAE and SENAI have very little experience in stimulating inter-firm cooperation; and especially SENAI has to cope with the challenge of stimulating cooperation between its own schools and member companies before it can consider moving to other cooperation issues.

In order to stimulate group-centered approaches to the diffusion of eco-efficient production practices, it is also useful to **propagate positive experiences** – both of environmental management within firms and of successful group activities, like those documented in this paper. Based on the experiences of Fundação Empreender, the organization that accompanies the organizational development process in ACIs in Santa Catarina, it is particularly useful to organize workshops on environmental management and group-centered approaches, including visits to factory sites, with the participation of successful businessowners / managers / engineers since they are much more credible in dealing with other businesspeople than technical assistance experts or SME support organization officials.

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Annex 1: Overview of Key Aspects of Inter-Firm Cooperation Arrangements in the Environmental Field in Brazil

	<i>Núcleo do Meio Ambiente, Joinville</i>	<i>Grupo de Aterro Industrial, Blumenau</i>	<i>Small Printing Shops, Blumenau</i>	<i>Projeto Ecogoman, SC</i>	<i>Galvanic industry, Paraná</i>	<i>Pilot plants in energy efficiency, Rio de Janeiro</i>
<i>Point of departure</i>	pressure to do something about effluents	forseeable closure of municipal landfill site for firms' sludge	pollution of untreated dyeing effluent	proposal of technological cooperation project between Brazil and Germany	search of CITPAR for a success case	SEBRAE / GTZ-project to stimulate energy efficiency in industry
<i>Type of firms involved</i>	medium and large firms of different branches	medium and large firms of different branches	micro-firms / textile printing workshops	large manufacturers of home textiles	small- and medium-sized galvanization firms	small- and medium-sized firms in different branches
<i>Modus of organization</i>	núcleo	informal working group	interaction between small R&D firm and workshops, coordinated by Chamber	public-private partnership	formal working group, association	pilot users / demonstration plants, open to visits from other firms
<i>Formal work modus</i>	regular biweekly meetings	occasional meetings	cooperation through ACIB	occasional meetings of steering committee	biweekly meetings, occasional workshops of participating firms and institutions	individual visits to demonstration plants

	<i>Núcleo do Meio Ambiente, Joinville</i>	<i>Grupo de Aterro Industrial, Blumenau</i>	<i>Small Printing Shops, Blumenau</i>	<i>Projeto Ecogoman, SC</i>	<i>Galvanic industry, Paraná</i>	<i>Pilot plants in energy efficiency, Rio de Janeiro</i>
<i>Informal aspects</i>	creating culture of information exchange outside meetings	success experience may create consciousness of benefits of joint action		success experience may create consciousness of benefits of technology alliances	creating culture of information exchange among firms	encouraging information exchange between firms
<i>Development trajectory</i>	constantly widening the scope of activities	single-issue activity	single-issue activity	single-issue activity with widening scope, generating ideas for further projects	widening scope of activity	so far single-issue activity
<i>Organizing agent</i>	Chamber of Industry and Commerce	Chamber of Industry and Commerce	Chamber of Industry and Commerce	CNPq / IEL-SC / BMFT / DLR / ITV	CITPAR, UFPA	SEBRAE / GTZ
<i>Role of German technical assistance</i>	indirect (stimulating more active role of ACI, núcleo methodology)	indirect (stimulating more active role of ACI)	indirect (stimulating more active role of ACI)	financial support through Scientific-Technological Cooperation (BMBW)	direct (need for success story, inviting German experts, sending Brazilian specialists to Germany for training)	direct (raising the issue, providing specific know-how and funds)
<i>Competition aspects</i>	Little competition between participating firms	Competition between participating firms	Competition between participating firms (but little direct cooperation)	Fierce competition between participating firms	Competition between participating firms, growing market	Competition between participating firms

Annex 2: Meetings of the NMA 1997/98

<i>Date</i>	<i>no. partic.</i>	<i>issue</i>
06.02.97	13	Regular meeting: analysis of federal law on hydro-resources, planning of activities in 1997
27.02.97	14	Regular meeting: editorial discussion of the final version of the manual on treatment of effluents
06.03.97	14	Meeting with FATMA officials: discussion of effluent issues
20.03.97	8	Regular meeting: discussion of issues regarding solid waste deposit
09.04.97		Participation in meeting organized by FATMA on cooperation between municipalities on water issues
10.04.97	14	Regular meeting: discussion of cooperation with FIESC to analyze legislation
24.04.97	13	Meeting with the Secretary of Agriculture and Environment of the Municipality of Joinville
08.05.97	11	Regular meeting: Metaplan on pollution problems of the main local river
22.05.97	20	Meeting with engineers from an Italian firm to discuss mobile stations for treatment and disintoxication of solid waste and effluents
23.05.97	23	Visit to the solid waste deposit of the local textiles manufacturer Döhler
05.06.97	14	Regular meeting: discussion of the two meetings before, election of a new board
19.06.97	34	Meeting with FATMA officials on self-monitoring of effluents
03.07.97	6	Regular meeting
17.07.97	9	Regular meeting: discussion of legal issues, organization of a workshop on treatment of effluents
31.07.97	13	Workshop on treatment of effluents
14.08.97	15	Presentation on the issue of waste of water
28.08.97	14	Regular meeting: creation of a working group on Local Agenda 21
11.09.97	17	Presentation on the issue of recycling of oil, colors, resins, etc.
25.09.97	12	Workshop with regional directors of FATMA on monitoring of effluents
09.10.97	12	Regular meeting: discussion on Local Agenda 21, presentation of FATMA's manual on monitoring
23.10.97	29	Presentation on biological treatment of effluents
06.11.97	10	Presentation on environmental management in firms
20.11.97	9	Regular meeting: evaluation of the two meetings before
04.12.97	23	Meeting with FATMA on self-monitoring
18.12.97	11	Regular meeting: end of year
26.02.98		Presentation of an Italian firm on disintoxication of industrial solid waste
12.03.98		Organization of the visit to the IFAT fair in Germany
26.03.98		Visit to firm Embraco
09.04.98		Presentation on environmental management at firm Hering
23.04.98		Regular meeting: discussion the possibility of producing more manuals
07.05.98		Presentation of firm Copesul
04.06.98		Presentation by Wirtschaftsförderung Sachsen on treatment of effluents
16.07.98		Organization of a seminar to evaluate the structure of the recycling sector
13.08.98		Presentation by firm Confors on air pollution
10.09.98		Visit to firm Malharia Manz
24.09.98		Presentation by Jörg Meyer-Stamer

Fundação Empreender, SC, Brasil

"Núcleos"
(industry-branch working groups)

in Brazilian Commerce and Industry
Associations (ACI)

Annex 3 Fundação Empreender, SC, Brasil / Nucl-71e.ppt

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This presentation is "freeware". It is available in Portuguese, Spanish, English and German. It can be obtained as a Powerpoint file from the author (jms@cs.tu-berlin.de) or from Fundação Empreender (acihwk@netville.com.br) or from Rainer Müller-Glodde (mueglo@internet.de).

Annex 4: Potential speakers on group-centered approaches to the diffusion of eco-efficient production practices

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List of P3U Working Papers

No.	Title
1	Umweltkostenmanagement
1e	Environmental Cost Management
1f	La gestion des coûts environnementaux
	Gestão dos custos ambientais: Resumo (Portuguese summary of WP No. 1)
	Environmental Cost Management (English summary of WP No. 1)
2	Schlüsseldokumente zum Thema Umweltorientierte Unternehmensführung
3	Auswertung von Geberprogrammen zu umweltorientierter Unternehmensführung
3e	Analysis of Donor Programmes for the Promotion of Environmental Management
4	Leitfäden zum Umweltmanagement: Überprüfung ihrer Anwendbarkeit auf kleine und mittlere Unternehmen in Entwicklungsländern
	Assessment of Manuals on Environmental Management (English summary of WP No. 4)

	(Spanish summary of WP No. 4)
	Avaliação de manuais sobre a gestão ambiental (Portuguese summary of WP No. 4)
5	ISO 9000, ISO 14001, EMAS: Inhalte, Vor- und Nachteile, mögliche Synergien
5f	ISO 9000, ISO 14001, les EMAS: les avantages et les inconvénients, des synergies éventuelles
6	Kooperationsmöglichkeiten und Unterstützungsbedarf in Fragen der umweltorientierten Unternehmensführung: Ergebnisse der Umfrage bei GTZ-Ansprechpartnerinnen und -partnern mit fachlichem Schwerpunkt in den Abteilungen 402, 414 und 415
7e	Inter-Firm Cooperation in Environmental Management: Experience from Santa Catarina/Brazil
8	Qualitäts- und Umweltmanagement in KMU in Entwicklungsländern. Workshop-Bericht
9e	Good-Housekeeping Guide for Small- and Medium-Sized Enterprises
9f	La Bonne Gestion d'Entreprise - Manuel de mesures concrètes dans les Petites et Moyennes Entreprises (PME)
10e	Case Study Environmental Cost Management at Cairns Food Ltd. Harare
	Estudo de caso: Gestão dos Custos Ambientais na empresa Cairns Food Limited, Harare / Zimbabwe, 1997 (Portuguese summary of WP No. 10e)
11	Begriffe, Definitionen und Konzept im Bereich der umweltorientierten Unternehmensführung
12e	Environmental Cost Management: Transparencies for presentation
12f	La gestion des coûts environnementaux: Transparentes de présentation
12s	Gestión de costos ambientales: Transparencias de presentación
13e	ISO 14.000 series in Asia - Indian Experience and General Conclusions
14	Leitfäden zum Umweltmanagement: Überprüfung ihrer Anwendbarkeit auf kleine und mittlere Unternehmen in Entwicklungsländern (Teil 2)
15	Finanzinstrumente für Umweltinvestitionen von KMU in ausgewählten Entwicklungsländern
16e	Group-centered Approaches to the diffusion of eco-efficient production practices: experiences from Brazil
17e	Training module on company-based resource management for SME (CEFE Methodology)
	Módulo de Formação sobre a Gestão dos Recursos Naturais em Pequenas e Médias Empresas (Portuguese summary of WP No. 17e)
18	Auswertung von Aus- und Fortbildungsprogrammen im Bereich UUF in Deutschland

Further P3U Publications

Project Description (in German, English, French, Spanish and Portuguese)
Angebote ausgewählter deutscher Handwerksinstitutionen im Bereich umweltorientierter Unternehmensführung
Environmental management systems and their application by small enterprises: Summary of a review among German crafts institutions (also in German, French and Portuguese)
Workshop-Dokumentation: Vernetzung ökologischer und sozialer Zeicheninitiativen für Produkte aus Entwicklungsländern
P3U Update (German, English, French, Portuguese)
Acuerdos voluntarios como instrumento de gestión ambiental