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"Sustainability, Corporations and Institutional Arrangements"

**Environmental management in the
chemical sector in Mexico: obstacles and opportunities**

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Abstract

This paper presents current research on the evaluation of the types of voluntary environmental management initiatives being adopted and implemented by chemical companies operating in Mexico. The research had four main objectives:

- i) to find out what has been motivating chemical companies to adopt and implement voluntary environmental management initiatives;
- ii) to examine the obstacles that have been hindering this process;
- iii) to evaluate the role of relevant stakeholders (i.e. governmental agencies, industrial associations and non-governmental institutions) in the process of promotion and implementation of voluntary environmental management initiatives; and
- iv) to explore the implications of these initiatives on future environmental management in Mexico. Particular consideration was given to the current relationship between these initiatives and state industrial environmental regulation in Mexico.

In this paper, the background and relevance of this investigation is explained, followed by a discussion of the methodology employed and the challenges experienced during the field-work. Then a general overview of Mexican industry environmental regulation is given highlighting its relationship to voluntary environmental initiatives. Finally, an outline of the findings of the research is presented with some conclusions drawn regarding the significance of voluntary initiatives in environmental management in Mexico based on research data from chemical companies operating in Mexico City and the State of Mexico. The paper also addresses some of the challenges of such initiatives to move businesses to sustainability.

1. Background and relevance of the research

Achieving sustainable development is an economic, social and environmental challenge for Mexico. Economic activities have generated intense pressures on the environment, including high levels of pollution and in a number of cases, unsustainable uses of natural resources. Until recently, environmental considerations have not played a prominent role in development in Mexico and consequently the environment has suffered in certain areas (OECD,1998). Since the late 1980s and early 1990s Mexico has engaged in a wide range of structural reforms of its economy. Clear examples of this are the signing of the North American Free Trade Agreement (NAFTA) in 1993, and becoming a member of the Organisation of Economic Co-operation and Development (OECD) in 1994.

The resulting changes provide the context for current profound reforms in environmental policies and environmental management that aim to reduce pollution and foster the sustainable use of natural resources. Examples of this environmental reform are the enactment of the General Law of Ecological Equilibrium and Environmental Equilibrium (LGEEPA) in 1986, and the creation of the Ministry of Environment, Natural Resources and Fisheries (SEMARNAP) in 1994.

On the other hand, industrial growth has played an important role in the development of Mexico. In recent years, industries have come under pressures from a range of stakeholders to address their environmental responsibilities. One of the foremost responses, has been the adoption and implementation of proactive voluntary initiatives such as environmental management programmes, aimed at improving companies' performance in accordance with environmental principles. These practices have been increasingly being adopted by companies around the world.

By definition, voluntary initiatives are not driven by regulatory requirements. That is, they are voluntary in the sense that governments do not have to order them to be undertaken. In theory, such initiatives would represent a shift away from an adversarial relationship between industry and government towards a new approach of environmental management which incorporates environmental, economic and ideally social aspects as well (Gibson, 1999).

Other advantages of voluntary initiatives are:

- can lead to long-term cultural changes in environmental management shifting from reactionary to more proactive sides (ILO, 1999);
- help to improve environmental performance beyond legal requirements (OECD,1999);
- preferable to regulatory obligations because they give greater flexibility to firms to find solutions and meet environmental targets while providing them adaptability to the market (Gibson,1999); and
- provide more efficient and cost-effective means to achieve environmental improvements when compared with the 'command and control' practices (ILO, 1999).

Nevertheless, these initiatives have also received strong criticisms. For example, Utting (2000) and Jenkins (2001) point out the following:

- a lack of independent monitoring to ensure that they are not just general statements of business principles, but actually regulations that are exercised in the company's operations and those of its suppliers;
- they can be successful only when participants can be persuaded to change their actions voluntarily. A careful analysis of opportunities and participant motivations is appropriate before choosing a voluntary approach; and
- as the prospect of sanctions of non-compliance tends to be absent or weak, voluntary programmes may not be compelling enough to actually change firms behaviour;

- credible monitoring, evaluation and reporting components are needed to establish credibility with relevant stakeholders;

However, the sceptics' main concern is that voluntary initiatives in some circumstances, have been proposed and adopted as substitutes for regulation, and justifications for dismantling regulatory capacity (Gibson, 1999). Clearly, the relationship between environmental regulations and voluntary initiatives is critical. The existent controversies only reinforce the appropriateness of this investigation as a piece of work aiming to contribute to the study of such relationship.

In Mexico, there are an increasing number of voluntary environmental initiatives being developed and implemented by enterprises. One example is the Environmental Audit Programme, it has been promoted as a voluntary initiative since 1992 by the Federal Attorney for Environmental Protection (PROFEPA) which is part of SEMARNAP. Over 1,763 companies in Mexico have participated in this programme and it has been indicated that companies in this programme have obtained benefits such as: verifying the degree of environmental regulatory compliance; addressing other aspects not contemplated by regulations; establishing actions in a defined schedule to minimise risks towards the environment and nearby communities; and obtaining economic savings by adequate management of raw resources (PROFEPA, 2001).¹

Another important example for the chemical sector is the Responsible Care programme, whereby chemical companies commit themselves to the improvement of all aspects of their performance that relate to the protection of safety, health and the environment. In Mexico, the programme was adopted in 1991 through the National Association of Chemical Industries (ANIQ), representing 210 company associates (90% of private chemical manufacturing capacity) committed to implement Responsible Care.

Nevertheless, there is much more to be done in order to enrich environmental management and ideally improve environmental performance in firms operating in Mexico. For example, much more support and investment are required to modernise small and medium sized enterprises to help them deploy cleaner technologies and therefore increase their competitiveness and environmental performance. Moreover, voluntary environmental programmes need to be adapted to their specific circumstances. This is of essential importance if we consider that around 80-90% of industries in Mexico are medium to small sized enterprises.

On the other hand, larger companies with stronger economic capacity have started to take further steps to improve their environmental performance and consequently have incorporated what Elkington (1997) calls the economic and environmental bottom lines. However, further efforts have to be developed in order to incorporate the social bottom line, the third branch of this 'triple bottom line' which is crucial in the path towards sustainability. This is why, in the coming years companies will be challenged to develop clean technologies that drastically reduce the environmental pollution burden while simultaneously increase the quality of life of local population.

In light of the above, this research focused on the evaluation of the types of voluntary environmental management initiatives that have been adopted and implemented by the chemical sector (e.g. Responsible Care, Environmental Audit Programme, ISO 14001, etc.). It studies the drivers for a firm to take up and implement voluntary environmental initiatives, the barriers that need to overcome in order to do so and the outcomes of such environmental responses. This investigation adopted a qualitative approach using interviews, participatory observation, and documentary analysis as the principal research methods.

¹ PROFEPA, (2001): Data presented at the "First Mexican Round Table for Pollution Prevention", Organised by the Mexican Centre for Cleaner Production and the Commission for North American Environmental Co-operation. Querétaro, Mexico, August, 2001

At the centre of this research, are 17 chemical companies (9 multinational and 8 Mexican) operating in Mexico City and the State of Mexico. However, a significant number of interviews were also conducted with representatives of other relevant stakeholders such as local and federal environmental agencies, industry associations and chambers, and non-governmental institutions.

This investigation took an environmental management approach that examines companies' decision making and attitudes regarding the environment, within an economic, political and institutional context. It also analyses administrative strategies and tools related to companies'

environmental issues, at the same time, it considers role of stakeholders, regulations and other external influences. This interdisciplinary perspective is necessary to understand firms' roles in the 'transition to sustainability'.

This approach is very significant given the current status quo in the world (which is characterised by a lack of physical boundaries, globalising processes and continuous changes in technologies and cultures), in which the corporate power will continue to rise in the future. In this context, businesses should start to acknowledge the important role they can play on the environment and towards achieving sustainable development.

Furthermore, this investigation can be relevant for decision-makers in governmental agencies and business organisations), as it can put forward issues related on how to improve voluntary environmental management initiatives by getting insights on their drivers, obstacles, actors, weaknesses, strengths, and outcomes.

2. Overview of Mexican environmental regulation and its relationship to voluntary initiatives

Looking back to the evolution of Mexico's environmental policies, several continuities come to the fore despite changes of presidents, government institutions, laws, economic situation, international integration, and state-society relations. Firstly, developments of international and external actors have contributed to the progress of Mexico's environmental policy, and a positive image has always been important for the Mexican government. This became even more evident since negotiations of the North American Free Trade Agreement (NAFTA) with Canada and the US were undertaken in the early 1990s (Hogenboom, 2000). Secondly, the political role and policy input of actors outside of the state apparatus, such as non governmental-organisations and the private sector has been limited. Although in recent years this situation has changed, especially when the development and implementation of voluntary environmental agreements and norms with the business sector started to take place.

Since the late 1980s and early 1990s a wide array of industry environmental regulation instruments have been developed and applied basically by three Mexican governmental agencies: the National Institute of Ecology (INE) and the Attorney General for Environmental Protection (PROFEPA), and the National Water Commission (CNA). These instruments range from 'command and control' practices to voluntary environmental initiatives. They are summarised in Table 1.

Regulation Instrument	Responsible Governmental Institution	Purpose
<i>I 'Command and Control' Instruments:</i> Official Mexican Norms (NOM)	INE PROFEPA	Define the series of minimum environmental conditions under which industries must operate
Single Environmental Licence	INE, PROFEPA, CNA	Integration of all environmental requirements at federal level. Administrative simplification: the report is presented to a single governmental agency (INE).
Annual Certificate of Operation	INE, PROFEPA	Identify opportunity areas for pollution prevention in companies. Helps to detect transfer of pollution from one media to another (air, water, soil). Provides information to build up the Register of Emissions and Pollutant transfers (RETC).
Environmental Impact Reports	INE, PROFEPA	Very useful tool to know environmental impacts at long and short terms that certain activities could cause in a specific place.
Hazardous Wastes Reports	INE, PROFEPA	Identify and characterise hazardous wastes generated, and ways used to transport, recycle, or confine them.
Concessions of national waters use and Permits for residual water discharges	CNA, PROFEPA	Control over consumption and discharges on federal waters.
Industrial Verification Programme	PROFEPA	Check via inspection visits that companies under federal jurisdiction are in environmental compliance.
Evaluation scheme via Indexes of Environmental Regulation Compliance	PROFEPA	Carry out exhaustive inspection visits. Improves follow up of firms specially of infractions.
<i>II Voluntary Environmental Initiatives:</i> Voluntary Norms (NMx)	INE, businesses involved	Fill in regulation voids that could be very costly to cover with NOMs. Promote an attitude of environmental responsibility with private sector.
Voluntary environmental agreements	INE, businesses involved	Involve authorities, companies, industry associations in commitments to undertake actions to improve environmental performance.
Voluntary Environmental Management Programme (PVG)	INE	Conceptualised as the most important scheme to promote environmental self-regulation, through co-responsibility between authorities and firms.
Environmental Audit Programme	PROFEPA	Assess environmental policies and practises. Includes corrective and preventive measures that allow practices which surpass environmental compliance. Companies. When environmental actions are completed companies get a 'Clean Industry Certificate'.
Register of Emissions and Pollutants Transfer (RETC)	INE	Integrate the information of emissions and transfer of 105 pollutants to air, water and soil.

Table 1: Environmental regulation instruments for industry in Mexico

The above regulation instruments form the Integrated System for Industrial Environmental Regulation and Management (SIRG)² conceptualised in 1997. It aims to be a more efficient programme for environmental industry regulation by applying direct ('command and control') and voluntary instruments. It seeks to have a multimedia approach (i.e. considering atmosphere, water and soil), and promote that environmental agencies work in a more co-ordinated way. The SIRG has made important progresses for example: increase the number of inspections to industries; simplify environmental requirements for companies by integrating all of the environmental requirements at federal level; increase environmental aspects covered by Official Mexican Norms; and develop the framework for the first Register of Emissions and Pollutants Transfer (RETC) in Mexico.³

However, from interviews with governmental officials, industry associations, and managers in companies these environmental regulation instruments face several limitations. Governmental agencies responsible for industry environmental regulation have not been efficient in their implementation and enforcement, firstly, due to the lack of efficient co-ordination and communication among governmental agencies. Secondly, because some of these instruments have experienced bad processing of information, which makes difficult to manage data efficiently and consequently is hard to develop environmental policy based on it. Moreover, information reported by industries is not regularly verified nor there are clear sanction mechanisms in some of the instruments. Thirdly, resources in some of these instruments have been insufficient, which in a way reflects not only the low priority of environmental policy in Mexican government but also government's budgetary limitation as a result of economic crisis.

Regarding the promotion and implementation of voluntary environmental initiatives by Mexican government there have been some successful instruments especially in the case of the Environmental Audit programme. On the other hand, others have faced economic restrictions and have not been implemented since its theoretical conceptualisation (e.g. PVG), lack of specific focus (e.g. voluntary environmental agreements), and low participation of firms (e.g. RETC).

3. Methodology and research questions

This investigation adopted a qualitative approach using semi-structured interviews, participatory observation and documentary analysis as main research methods. It aimed to be flexible but performed in a systematic way as this is one of the important characteristics of qualitative research. The empirical research was carry out in two phases: a) exploratory field work with a consequent development of research questions; and b) main field work.

a) Exploratory field work and development of research questions

This phase was undertaken in Mexico during April and May 1999. The aim was to identify the relevant actors involved in the process of adoption and implementation of voluntary environmental management initiatives. From there, develop a general understanding of the role they play in the improvement of environmental management in chemical industries operating in Mexico. During this stage 16 interviews were carried out involving: governmental agencies (e.g. INE, PROFEPA); industry associations (e.g. the National Association of Chemical Industries (ANIQ)); non-governmental institutions (e.g. the Global Environmental Management Initiative (GEMI), the Mexican Centre for Cleaner Production (MCCP)), international organisations (North American Commission for Environmental Co-operation (CEC)); and industrial

² SIRG: from Spanish, *Sistema Integrado de Regulación y Gestión a la Industria*.

³ The RETC in Mexico is the equivalent to the US Pollutants Release Inventory. The RETC in Mexico is required by the parallel environmental agreement of NAFTA.

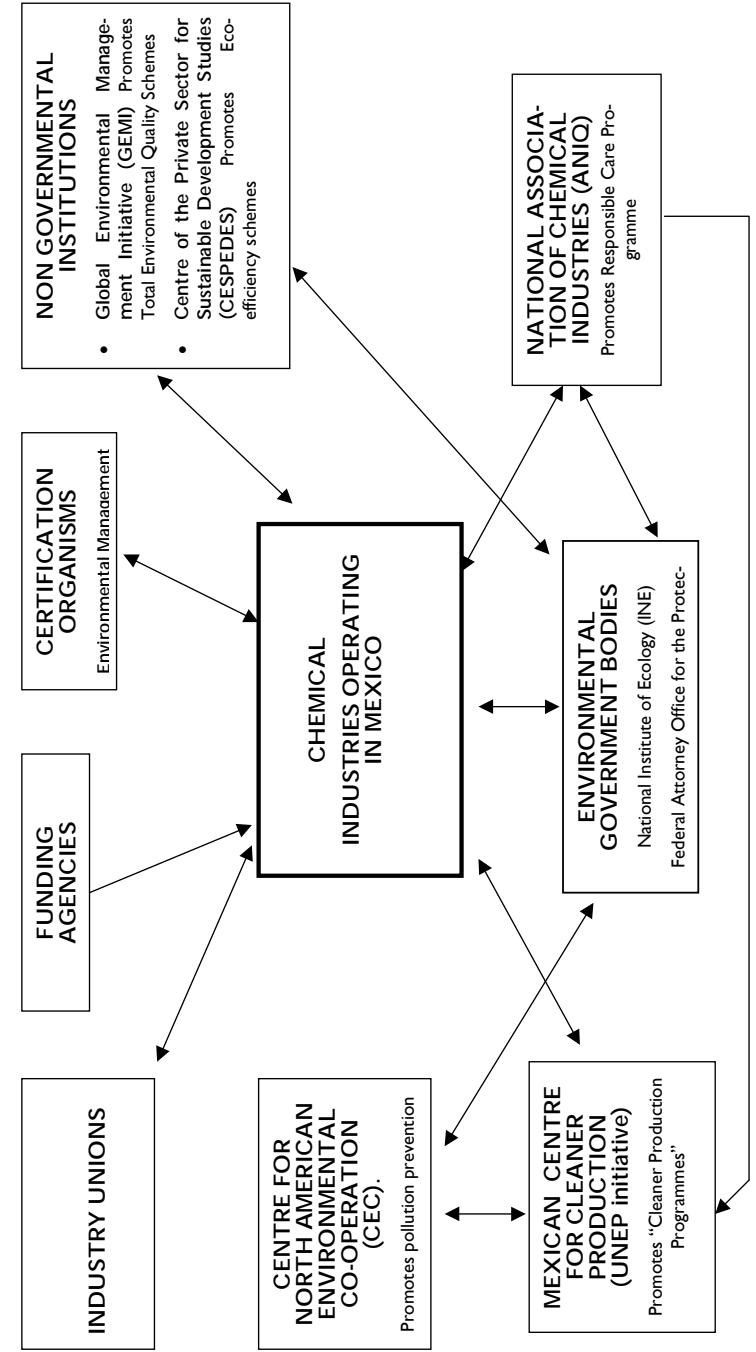
chambers (e.g. National Chamber of Transformation Industries). At the end of this phase, it was possible to identify a quite complex net of links among the relevant stakeholders involved in the process of promotion and implementation of voluntary environmental management initiatives. These are shown in Figure 1. The analysis of these links generated a number of interesting issues that served as a basis from which the particular research questions were developed. They are indicated in Box 1 below.

Box 1

Summary of Particular Research Questions

- Which are the main drivers (i.e. motivations) for chemical industries to implement voluntary programmes to improve their environmental management and ideally performance?
- What have been the benefits gained from the implementation of voluntary environmental programmes?
- What are the barriers that chemical industries have to overcome in order to adopt and implement voluntary environmental programmes?
- What has been the role of industrial environmental regulation policies and instruments on the improvement of environmental management in chemical companies?
- What is the role of Mexican governmental agencies in promoting the adoption and implementation of voluntary environmental initiatives?
- What is the role played by identified key stake-holders (i.e. governmental agencies, industry associations, communities, other organisations) on the adoption and implementation of voluntary environmental initiatives by chemical companies?
- Relationship between voluntary initiatives and formal industrial environmental regulation. Are they mutually exclusive or can they be complementary?
- What are the advantages and disadvantages of voluntary environmental initiatives from the experiences and results gained in this research?

Figure 1
Links identified among key stakeholders involved in the process of adoption and implementation of environmental voluntary initiatives in chemical companies operating in Mexico



b) Main field work

This phase was undertaken from January to September 2000 when 58 interviews were conducted. The persons in charge of environmental management matters of 17 chemical companies were interviewed. The chemical sector was chosen because: a) it is traditionally considered to be highly polluting and with significant social impacts; b) it is a sector which plays an important role in the external market, and historically has been facing pressures regarding the conditions of product quality, and environmental and social effects of production and management of chemicals; and c) there are indications that this industry has been changing in terms of technology and management, including the adoption of voluntary environmental management systems, voluntary codes of practice (like the Responsible Care Programme) and other certification schemes.

The selection of companies willing to participate was based on the following criteria: i) firms in the chemical sector⁴, ii) operating in Mexico City or the State of Mexico⁵, iii) seek for a mix of multinational and Mexican owned companies, and if possible of different sizes (large, medium, small) in order to establish a comparison between the different types of firms.

Additionally a series of elite interviews were carried out, they included representatives from governmental agencies, industrial associations and chambers, and other non-governmental institutions (many of them previously contacted during the exploratory fieldwork). All interviews were tape recorded and carried out employing a semi-structured approach, using an interview guide that could be referred to as the interview develops. This helped to ensure consistency and that all relevant topics were covered. However, in terms of conducting the interview another essential requirement was to allow flexibility considering interesting points that arose in the course of interviews. Transcriptions of interviews were not done word by word, but instead the main points related to the research questions were written down and only the most significant comments were transcribed fully. Listening, typewriting and translating the tapes (from Spanish to English) was a very valuable opportunity to obtain insights, make initial interpretations of the tapes' contents and to analyse their message.

Regarding the analysis of qualitative data generated, it was fundamentally an analytical procedure that involved examination of the facts and the meaning of respondents' words and actions (Mason, 1998). This process required to systematically synthesise and structure qualitative data (the interview transcripts) to be able to carry out analysis of relevant information and establish comparisons.

During the main field work it was also possible to attend several conferences and meetings relevant to this research project. Participant observation provided insights into the active interrelationships of relevant stakeholders, and presented a valuable opportunity to observe, record and cross reference data obtained from other sources. In addition, attending these events was very helpful in providing feedback on the position of companies, governmental agencies, and industry associations towards voluntary environmental management initiatives.

For this study, documentary analysis was employed throughout the research process. A considerable number of documents and publications were obtained from governmental institutions and from their web sites (especially of INE and PROFEPA). Other relevant documents were given by other institutions (e.g. GEMI, CEC, MCCP). Relevant information about the chemical sector and the Responsible Care programme was obtained from ANIQ. Companies

⁴ From exploratory field work it was already acknowledged that access to industries would be quite difficult, so there was not an intention to select a particular sub-sections within the chemical sector. Any firm belonging to this sector and willing to participate will be taken into account.

⁵ The State of Mexico and Mexico City have a strong significance in the number of chemical plants in the country. State of Mexico with 126 (first place in the country) and Mexico City 74 plants (third place in the country). Therefore, their contribution to environmental effects is very relevant.

provided general documents with their environmental policy, characteristics of environmental management programmes implemented including their objectives and targets.

Qualitative research poses a number of challenges with regard of issues of validity and reliability. That is, is the interviewee really saying the truth or his/her version of reality?; is the researcher obtaining reliable data? For instance, Hammersley (1992), indicates that an account is valid or true if it represents accurately those features of the phenomena that it is intended to describe and understood. Thus, different strategies were followed in this research to ensure validity and reliability. Firstly, information obtained during the interviews was cross-checked against other sources, such as other interviewees, analysing the minutes of meetings or other documents. This is what Kvale (1996) refers to as triangulation, which is the use of multiple data or combined techniques of gathering data and use of other comparable studies. Secondly, I followed other suggestions also indicated by Kvale (1996) that are the following: looking for negative evidence; checking possible false reports from subjects; getting feedback from informants; verifying rival explanations and theories; and making sure informants are representative.

Finally, it is significant to mention that this type of research implies overcoming several challenges, the most important was getting access to chemical firms. From this process (i.e. getting in contact and obtaining access to chemical companies), there were important lessons learnt. Firstly, was not an easy task and in order to be successful a lot of patience and perseverance is required. Secondly, it was necessary to employ many strategies to achieve contact and access to firms. More importantly, it was essential to have the support from a recognised and well-known organisation by industries in order to be accepted and admitted within companies.

4. Findings

There were 17 chemical companies studied 9 multinational companies (1 large company, 2 medium, 5 small and 1 micro company); and 8 Mexican firms (5 medium and 3 small)⁶. Regarding the types of voluntary environmental management initiatives Table 2 indicates the programme implemented in each of the firms studied. It can be noted that the programmes adopted and implemented were: specific environmental management systems (EMS) developed by the company or its corporation, the Responsible Care Programme, and the Environmental Audit Programme promoted by PROFEPA.

However, the most common voluntary environmental management initiative adopted and implemented by chemical firms is the Responsible Care (RC) programme. Multinational companies have a higher degree of implementation when compared to Mexican companies. The multinational companies are medium to large companies. The small multinational companies with high degree of implementation tend to belong to large powerful foreign corporations, and all these companies are export orientated. On the other end of the spectrum, companies with lower degree of RC implementation tend to be smaller domestic companies that are not export orientated.

⁶The classification of firms was according to the number of employees considering the Mexico's SECOFI (Secretariat of Commerce and Industrial Promotion): 0-30=micro-company; 31-100=small company; 101-500=medium company; 501 and plus = large company

Of the 17 companies studied, more multinational firms (66.7%) than Mexican firms (25%) had the necessary elements of environmental management. These were environmental department with specific budget, organisational structure with environmental responsibilities, environmental training, environmental evaluation and monitoring, and internal environmental reports. In this respect, it was clear that implementation of voluntary environmental management programmes is conditional on the administrative structure of the organisation. This structure includes capacity for improvement, level of efficiency, and it incorporates the environmental component within the general administration of the firm, for instance, by establishing a department to deal with environmental issues and allocating specific budget for it.

Name	Ownership	Number employees	Export Activities?	Type of EMS	ISO Certification?	PROFEPA Environmental Audit
Arteva Specialites	Multinational	781	Yes	Responsible Care(RC) Integrated in Corporation EMS	ISO 9000 (interested in applying ISO 14001 system)	Yes with Clean Industry Certificate
Clariant Productos Quimicos de Mexico	Multinational	450	Yes	Responsible Care integrated into the Clariant Environmental Protection Programme	No, however, it incorporates some aspects of ISO 14001	Yes with Clean Industry Certificate (already re-certified)
Reichhold Quimica de Mexico	Multinational	250	Yes	Responsible Care	ISO 9000	No
Schenectady Mexico	Multinational	95	Yes	Responsible Care integrating also corporation guidelines	in process of obtaining ISO 9000	No
Nalco de Mexico	Multinational	88	Yes	Responsible Care Integrated in Corporation EMS	ISO 9000 Interested in ISO 14001	In the process of Environmental Audit
Klüber Lubricacion Mexicana	Multinational	78	Yes	Responsible Care	ISO 9000 in process of obtaining ISO 14001	No
Quimica Hercules	Multinational	70	Yes	Responsible Care	NO	Not yet but it is interested in participating. In the process of negotiations with gov.
Dow Agrosociencias de Mexico	Multinational	50	Yes	Responsible Care integrated into Dow's Environment, Health and Safety Programme	ISO 9,000	Yes with Clean Industry Certificate (already re-certified)
Bostik Mexicana	Multinational	24	Yes	Just starting Responsible Care (very low progress)	Working to obtain ISO 9000	No
El Oso	Mexican	350	No	NONE	ISO 9 000	NO
Comercial Roshfrans	Mexican	280	No	Restarted the Responsible Care programme in 1997. In the process of development its own EMS	ISO 9,000(interested in the future obtaining ISO 14001)	NO
Qumir	Mexican	250	Yes	Corporation EMS: Integrated Management System for Environmental Control, Security and Hygiene (integrates RC aspects); Cleaner Production Programme	ISO 9,000(interested in the future obtaining ISO 14001)	Yes with Clean Industry Certificate

Productos de Consumo Resistol	Mexican	170	No	Corporation EMS: Integrated Management System for Environmental Control, Security and Hygiene (integrates RC aspects)	ISO 9,000	Yes with Clean Industry Certificate (already re-certified)
QB Quimicos de Mexico	Mexican	115	No	NO EMS (the company is trying to develop its EMS). At the moment just complying with regulations	In the process of obtaining ISO 9000	NO
Christiansson	Mexican	80	Yes	Responsible Care	NO	In the process of obtaining the Clean Industry Certificate
Resinas y Materiales	Mexican	70	Yes	Responsible Care Cleaner Production Programme	ISO 9,000(interested in the future obtaining ISO 14001)	NO
Distribuidora Quimica Mexicana	Mexican	50	No	Responsible Care (low progress)	NO	NO

Table 2: Voluntary environmental management initiatives implemented

A number of drivers were found to have influenced the adoption and implementation of environmental management initiatives in Mexican and multinational chemical companies. They are presented in Table 3 and are ranked in order of importance.

Multinational chemical companies	Mexican chemical companies
<ol style="list-style-type: none"> 1. Improvement of image (to governmental authorities, consumers, communities) 2. Economical reasons (related to savings from eco-efficiency practices) 3. Environmental compliance and anticipate fast change of regulations 4. Corporation's head-quarter guidelines and pressures 5. Improvement of environmental compliance 6. Care for the community 7. More demands from clients including environmental aspects 	<ol style="list-style-type: none"> 1. Comply with environmental regulations and improve relationship with authorities 2. Economical reasons (related to savings from eco-efficiency practices) 3. Improvement of image (to governmental authorities, consumers, communities) 4. More demands from clients including environmental aspects 5. Maintain position of leadership in the market 6. Fulfil commitments with ANIQ 7. Obtain a better organisation within the company 8. Interest to innovate

Table 3: Drivers

Similarly, a number of obstacles were found to have hindered the implementation of environmental management initiatives in Mexican and multinational chemical companies. These are presented in Table 4 and similarly ranked in order of importance.

Multinational chemical companies	Mexican chemical companies
1. Employees' resistance to change (i.e. hard to incorporate new operation systems and transmit environmental culture)	1. Employees' resistance to change (i.e. hard to incorporate new operation systems and transmit environmental culture)
2. Difficult economic situation (e.g. lack of specific budget for environmental issues and economic crisis in Mexico)	2. Lack of enough economic resources
3. Barriers from environmental authorities (i.e. too much bureaucracy)	3. Not enough support from high directors and/or head-quarter corporations
4. Too much rotation of personnel in the area of Environment, Health and Safety department	4. Problems to find appropriate technology
5. Responsible Care codes of practise not well adapted for Mexico	5. Responsible Care codes of practise not well adapted for Mexico
	6. Change of ownership (i.e. from a multinational corporation to a Mexican "family type "owner")

Table 4: Obstacles

It was indicated by interviewees in the chemical companies studied that the benefits obtained from the implementation of voluntary environmental management initiatives were:

- Improvement of image
- Better organisation of environmental actions
- Saving of resources (e.g. water and energy) and consequently gaining economic benefits
- Improvement of environmental and security culture of personnel; and operational and cleanliness in the plant
- Being in total environmental compliance.
- Reductions in emissions (to air, soil, and water).

Concerning the role of relevant stakeholders (i.e. governmental agencies, industrial associations and chambers, and other non-governmental institutions) in the adoption of environmental voluntary initiatives, it was noticed that in Mexico there is a growing interest to build up 'links' and eventually form partnerships among them. These 'links' among these are getting firmer and more complex as well. This is because it was observed that there has been an increasing effort to open communication channels, and develop collaboration programmes between stakeholders involved. These jointed schemes play an important role in the adoption of voluntary environmental initiatives in chemical companies (and in Mexican industry in general), because they aim to promote their potential benefits and assist firms on their adoption and implementation. Moreover, there has been also an improvement in the relationship among these stakeholders and they are more cordial and trustworthy. However, it was observed that collaboration and communication between these actors was not effective. It is necessary to develop more efficient and stronger collaboration and communication mechanisms between these actors. The perception was that sometimes there are not really working together, and in some cases they are duplicating efforts.

Tri-sector partnerships between business, government and civil society are incipient in Mexico. The reasons behind this situation include the lack of policies, instruments and institutional behaviour (both in private companies and governmental agencies) concerning the disclosure of environmental performance data of industrial facilities. Considering that Mexico's General Law for Ecological Equilibrium and Environmental Protection (LEEPEPA) included the 'right to know' principle as one of its major reforms in 1996, this is a very striking situation. Without any effective implementation of the 'right to now' legal,

environmental reporting with disclosure of performance data, is still an under-developed procedure within companies, exclusively dependent upon a firms' goodwill.

In relation to the position of relevant stakeholders on voluntary environmental management initiatives, this research indicates that in general all of them are increasingly supportive of these schemes. They recognise their potential benefits as not supplementary, but potentially complementary to state regulation.

Accordingly, it was found that there is a strong preference for environmental compliance through voluntarism. The companies with high progress on their environmental management have reported to be in full environmental compliance and some of them claimed to be even in a beyond compliance status. Most of these companies are medium to large companies. In the case of small firms, the common pattern is that they all belong to well structured and institutionalised corporations. On the other hand, the companies that face difficulties in achieving full environmental compliance have a low degree of voluntary environmental management implementation (these firms are small Mexican companies with a family type ownership).

Lastly, concerning the challenges in moving towards sustainability through voluntary environmental management initiatives, this research suggests that while corporations (usually larger) have made significant progress on the implementation of sound environmental management programmes, they have not been very active in social accountability issues. The evaluation of impacts and improvements on nearby communities through voluntary environmental initiatives was not studied deeply in this research. Nonetheless, it was possible to note that programmes and activities linked to communities near the visited companies, are still very rudimentary and in most cases non-existent.

5. Discussion and conclusions

The fact that Responsible Care programme is the most common voluntary environmental programme implemented by chemical companies indicates that it is almost obligatory for them, as this is a very powerfully required (but not demanded) environmental management strategy within the sector. It is also a recognised programme outside Mexico, so it is in a way an expected requirement for those companies willing to trade with other chemical companies outside Mexico.

As explained before, multinational companies have a higher degree of implementation progress of such programme when compared to Mexican companies. These multinational companies are medium to large companies; in the case of small multinational companies with high degree of implementation the common pattern is that they belong to large powerful foreign corporations, and all of them are export orientated. On the other extreme of the spectrum, companies with lower degree of RC implementation are smaller domestic companies which are not export orientated.

These results correspond to findings by Mercado (2002), which point out that environmental problems occupy a second place in most of Mexican companies, especially among small and medium sized firms. The financial and profitability issues, are more important in smaller companies. Additionally, these findings correspond with the results of two research projects: firstly, Chudnovksi et.al. (1998) whose findings indicated that export-oriented and foreign owned firms had more advanced environmental management when compared with domestic companies, and small and medium sized firms presented strong deficiencies in environmental areas. Secondly, with the survey carried out by Dasgupta et. al. (1997) which indicates that about 70%-80% of large Mexican and multinational companies operating in Mexico had key environmental management elements in place, as opposed to about 20% of the surveyed small and medium enterprises. The existence of these key environmental management elements is one of the best predictors of better environmental performance.

Correspondingly, ANIQ's directives recognised that its associates have not achieved the same level of Responsible Care implementation. At present, one of ANIQ's challenges is to increase promotion and assistance for further implementation of the programme among customers and providers within the chemical production chain (that are usually medium to small enterprises).

Regarding the drivers that have influenced the implementation the difference among multinational and Mexican companies is evident. For multinational firms the most important driver is the improvement of image. This 'image' factor implies improvement of image towards consumers, governmental authorities and communities (i.e. improvement of reputation). Interestingly, companies that regarded it as a significant driver are large companies that have a high public profile and tend to rely heavily on their corporate image. This is because results of poor environmental records are more visible in larger companies, and consequently they are more prone to receive pressures and attacks from regulators and non governmental organisations. In addition, image in larger firms could be also important to improve their sales, and reduce insurance costs. In contrast for Mexican companies, the most important driver was to comply with regulations and in this way improve relationship with governmental authorities.

In relation to the 'economic driver' mentioned (in second place) by both types of companies, it was observed that is more related to economic gains obtained from savings from efficient use of energy, water, raw materials, and reduction and efficient management of wastes (i.e. eco-efficient practises), than to increment of market share.

In relation to the obstacles that have hindered the adoption and further implementation of voluntary environmental management initiatives, Mexican and multinational chemical firms indicated that the most important was workers resistance to change. That is, firms have faced difficulties in educating workers and transmit to them an 'environmental culture'. In many occasions changes in plants' operations to be applied by workers were viewed only as extra responsibilities. Thus, this research agrees with Halme's (1997) argument which explains that changing from a paradigm of traditional management culture to one which includes environmental issues, requires unlearning old assumptions and traditions that exclude such issues from business decision making and general practises in the plant. It is also necessary to learn new assumptions and practises that include environmental considerations. At the beginning of this process, there is resistance and rejection to environmental demands, until the new understanding regarding the business-environment relationship becomes acceptable and incorporated into general practises of the firm.

The second most important obstacle mentioned by multinational and Mexican companies was a difficult economic situation (produced for example by Mexican economic crisis). These firms explained that due to lack of enough economic resources it was impossible to have a specific budget for environmental issues. Interestingly, all firms that pointed out this obstacle are small in size. Hence, it can be argued that environmental improvements cannot always go hand in hand with cost reductions, this is particularly the case for many small and medium sized enterprises that often find difficult to justify certain improvements in environmental management systems (if they possess them at all). Frequently if they introduce innovations is simply to stay in the market, rather than to gain any additional advantage. Indeed, financial factors do constrain environmental efforts, and many firms assume that environmental efforts impose at least a short-term net cost on the firm.

Concerning the relationship between these initiatives and state industrial environmental regulation in Mexico, firstly it is important to consider that both have advantages and weaknesses. Mexican environmental regulation has taken important steps to improve industrial environmental regulation but still faces many limitations. The most important is lack of efficient monitoring and enforcement activities to foster and verify companies' environmental compliance. Within this context, voluntary environmental management initiatives have a role to play to enhance environmental protection.

On the other hand, such initiatives present several advantages such as: being efficient tools for achieving environmental compliance, lead to long-term cultural changes in environmental management shifting from reactionary to more proactive practises, and have potential to improve environmental performance. However, they also have limitations such as: in some cases lack of external verification and monitoring (e.g. Responsible Care programme); a noticeable difference in the degree of implementation between large and smaller companies; and have not been developed considering specific circumstances and needs of smaller firms.

Therefore, these two modes of influencing firms behaviour are closely linked, that is, it is not really an either/or situation. This investigation agrees with and stresses the point of view of Hillary and Thorsen (1999): opportunities exist for the integrated employment of regulation and voluntary environmental management initiatives. Effective co-ordination of these two paradigms will bring about more ambitious environmental improvements in industrial plants that eventually contribute more forcefully to sustainable development.

Lastly, this investigation makes the point that nowadays the task for 'voluntarism' to better contribute to sustainability, is to not only achieve improvements in the environmental and economical fronts but also design and implement them in terms of social responsibility and accountability.

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