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## Working Party on Global and Structural Policies

# DEVELOPMENT, INVESTMENT AND ENVIRONMENT: IN SEARCH OF SYNERGIES

# ANNEX: MULTINATIONAL ENTERPRISES AND GLOBAL POLLUTANTS: A REVIEW AND ANALYSIS OF THE OECD FACILITY-LEVEL DATA BASE

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**ACKNOWLEDGEMENTS**

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# MULTINATIONAL ENTERPRISES AND GLOBAL POLLUTANTS: A REVIEW AND ANALYSIS OF THE OECD FACILITY-LEVEL DATABASE

## Introduction

### *Overview and methodology*

This report described the results of analysis on the relationship between environmental management and performance and structural characteristics of facilities which are typically associated with multinational enterprises (MNEs). An overview of the bivariate relationship between these two sets of variables tends to confirm the hypothesis that MNEs (or facilities associated with MNEs) are more likely to have better environmental performance than non-MNEs. However, more formal multivariate analysis focusing on global pollutants does not confirm these findings, indicating that the 'better' environmental performance of MNE facilities is not a consequence of these characteristics in and of themselves, but rather of other correlated factors (such as sector, policy framework, etc…).

The survey upon which this report draws was undertaken by a consortium of seven research centres lead by OECD Environment Directorate in the Spring of 2003. The database includes over 4,000 observations from facilities with more than 50 employees in all manufacturing sectors. Seven OECD countries participated in the survey: Germany, Canada, France, United States, Hungary, Norway and Japan. A summary of the respondents by sector and firm-size is presented in Table 1. For details on the project and the sampling procedure please see ENV/EPOC/WPNEP(2003)13.

**Survey respondents by sector and by country**

| | Canada | France | Germany | Hungary | Japan | Norway | USA | Total |
|---|---|---|---|---|---|---|---|---|
| Food, beverage and tobacco | 23 | 44 | 77 | 68 | 138 | 33 | 36 | 419 |
| Textiles, leather and footwear | 8 | 13 | 40 | 50 | 72 | 10 | 12 | 205 |
| Pulp, paper, publishing & printing | 21 | 5 | 10 | 13 | 12 | 29 | 12 | 102 |
| Chemical, rubber, plastics and fuel | 22 | 17 | 92 | 21 | 129 | 25 | 24 | 330 |
| Other non-metallic mineral products | 39 | 48 | 149 | 54 | 195 | 24 | 123 | 632 |
| Basic metal and fab'd products | 13 | 13 | 35 | 21 | 34 | 14 | 19 | 149 |
| Machinery and equipment | 42 | 54 | 211 | 52 | 286 | 54 | 126 | 825 |
| Transport equipment | 50 | 47 | 227 | 119 | 439 | 55 | 59 | 996 |
| Manufacturing n.e.c. and recycling | 23 | 19 | 32 | 22 | 113 | 44 | 36 | 289 |
| Other | 11 | 7 | 26 | 17 | 30 | 21 | 21 | 133 |
| Total | 252 | 267 | 899 | 437 | 1448 | 309 | 468 | 4080 |

***Scope of the analysis***

This report focuses on facilities associated with firms which have characteristics that are often prevalent in multinational enterprises (MNEs). It focuses, more particularly, on their environmental management practices and environmental performance as compared to facilities from non-MNEs.

The main themes addressed in this section concern:

- the prevalence of management systems and tools in place in the facility (environment-related or not);
- the institutional location of environmental responsibility organisation within the firm (if any);
- the potential environmental impacts of the facility, the measures undertaken to reduce such impacts, and their consequences;
- the influence of stakeholders and motivations on environmental practices;
- and, other interesting structural and economic characteristics of MNEs relative to the facilities of non-MNEs.

***Definition of an MNE***

For the purposes of this study a facility belonging to an MNE has been initially defined as having the following characteristics:

- employ more than 500 full-time employees;
- be listed on a stock exchange;
- have an international market scope (regional or global); and,
- have the head office located in a foreign country.

However, only a few facilities in our sample present simultaneously those four characteristics (number of observations: 60). Therefore, the definition of a facility belonging to a MNE has been relaxed and the most troublesome variable – "have the head office located in a foreign country" – has been dropped because of the large number of missing observations. With a more flexible definition of an MNE, we obtain 175 valid responses, which is a quite reasonable and realistic figure relative to the size of the total sample. This sub-sample, though relatively small, will allow us to compare MNE facilities with non-MNE facilities, concerning the aforementioned aspects of environmental management practices and environmental performance in a statistically reliable manner.

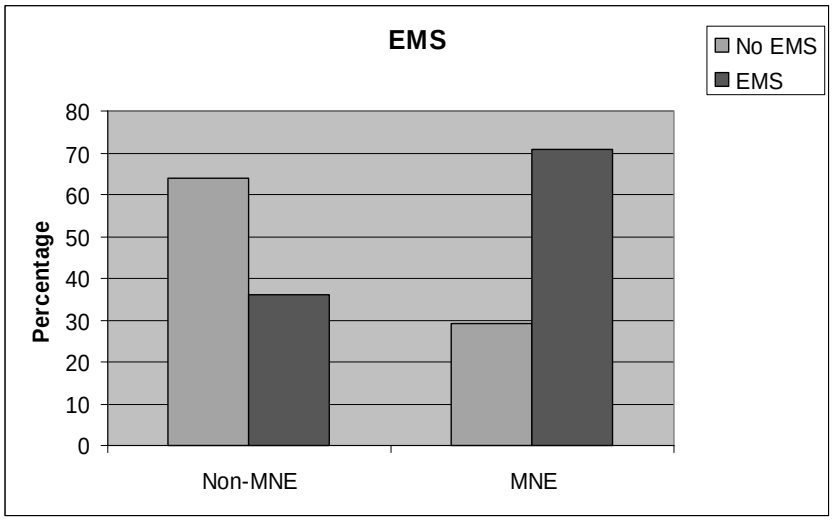
Such a definition can be subject to criticism. Most significantly, the data is collected at the level of the facility and this can be problematic. For instance, there is no *a priori* reason to expect that an individual facility which is part of a large multi-facility MNE is more likely to have a large number of employees. However, the data was not collected to examine MNE issues in particular, and the reader of this review which follows should bear precise definition applied in mind.

## Overview of results

### *Environmental management*

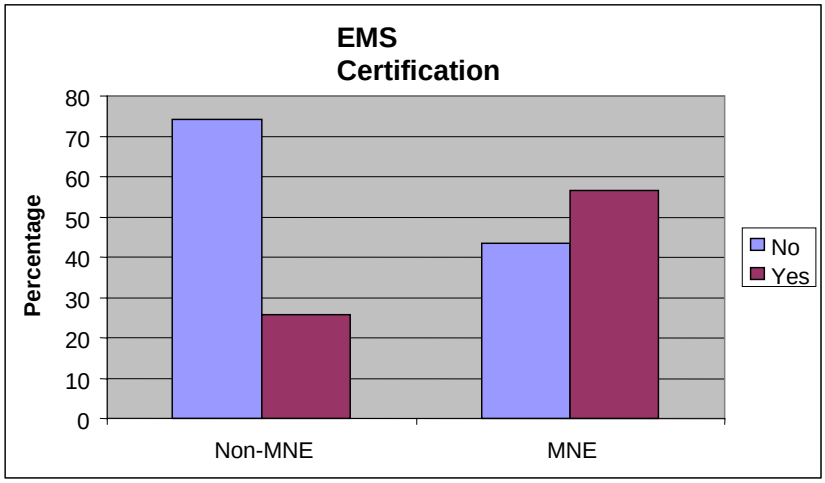
*MNEs with Environmental Management System in place*

One indicator of the quality of environmental management decisions is reflected in the binary response to the question: "has your facility actually implemented an environmental management system?" (Question 1.6). Respondents were also requested to indicate the year in which an EMS was first implemented, and whether or not it is certified, and if so under which scheme.




The percentage of MNE facilities reporting that they had environmental management systems is 71%, while only 36% of non-MNE facilities reported having an EMS. This is not really surprising since, as expected, the relationship between facility size and the probability of having an EMS is increasing, meaning that smaller facilities are less likely to have environmental management systems in place. For the largest class of facility (>500 employees) over 60% of facilities have an EMS, while for the smallest class (<100 employees) the figure is less than 20%.

Over 1,100 facilities reported having some form of certification for their EMS, whether EMAS or ISO 14001. Among those, 57% of MNEs have a certified EMS, while only 26% of non-MNEs possess a certified EMS.

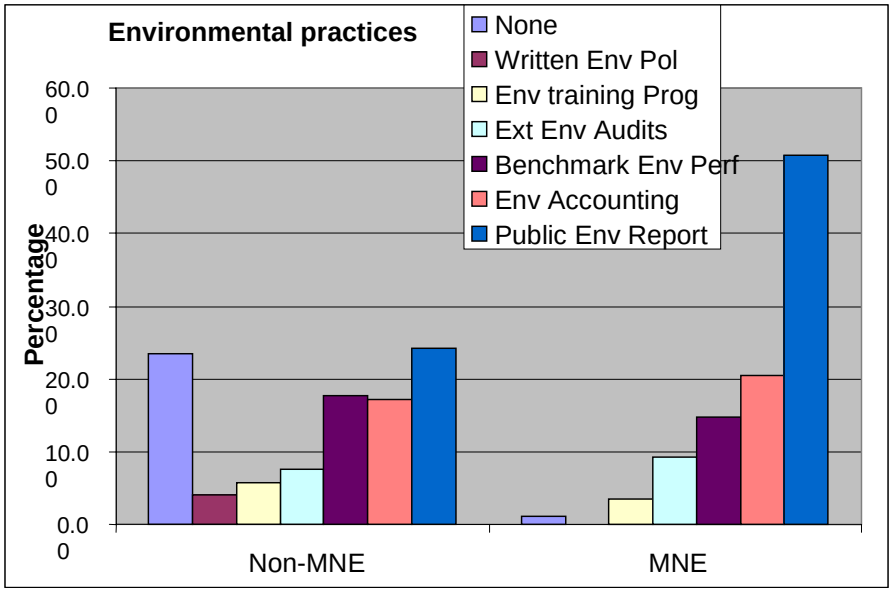



When distinguishing between certification schemes, MNEs and non-MNEs show similar results: 79% of MNEs who have a certified EMS possess a ISO 14001 certification (the figure for non-MNEs with certified EMS being 81%) while only 8% of those MNEs have an EMAS certification (respectively for non-MNEs with certified EMS: 12%). Given that most of the MNEs in our sample are located outside Europe, in the US, Canada and Japan (see below), they tend more to have a ISO 14001 certification rather than a EMAS certification, the latter being proper to European countries.

*Environmental management tools*

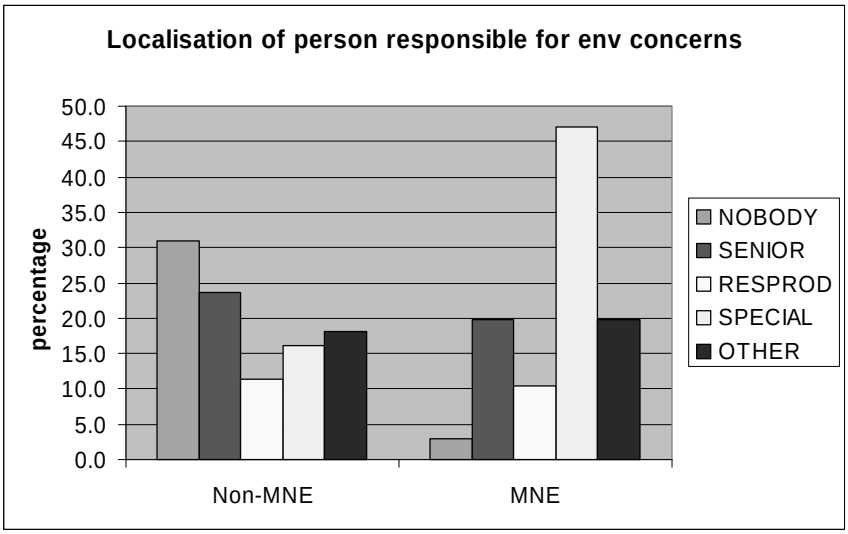
Questions were also asked about specific environmental management tools (e.g. environmental accounting, environmental reporting), and it is particularly interesting to note some important differences across MNEs and non-MNEs.

The figure below shows that MNEs are more likely to use public environmental reporting, twice more than non-MNEs. They also easily adopt environmental accounting and benchmark environmental performance to promote environmental management, in a more important manner than non-MNEs do. The figure also shows that almost all MNEs (99%) have established practices to implement environmental management, whereas 24% of non-MNEs have not.




*Environmental responsibility organisation within the firm*

97% of MNEs reported having at least one person with explicit responsibility for environmental matters, as compared to 69 % of non-MNEs. Among MNEs, this person is most likely to work in a "specialised environmental department", followed by "senior management" and "other department".




***Environmental actions and performance***

Respondents were requested to report on whether in the last three years they had:

- significant potential environmental "impacts" associated with their facility (scale from 1 (no negative impacts) to 3 (very negative impacts)),
- undertaken significant concrete actions to reduce environmental "impacts" (binary response),

- reported changes in environmental impacts per unit of output, the scale being from 1 (significant decrease) to 5 (significant increase).

These questions have been posed for a number of different environmental impact areas (*e.g.*, solid waste generation, waste water effluent, air pollution, soil contamination, risk of severe incidents). Environmental performance is reflected in terms of both inputs ("concrete actions") and results ("changes in impacts"). Responses to these two performance variables are not equivalent. Over one-third of facilities declared having undertaken actions to reduce global pollutants. Concerning results, solid waste generation and wastewater effluent are the two areas in which the most progress had been made. Global air pollutants (and to a lesser extent soil contamination) were the areas with the least improvement (See Tables below).

**Concrete actions undertaken in the last three years**

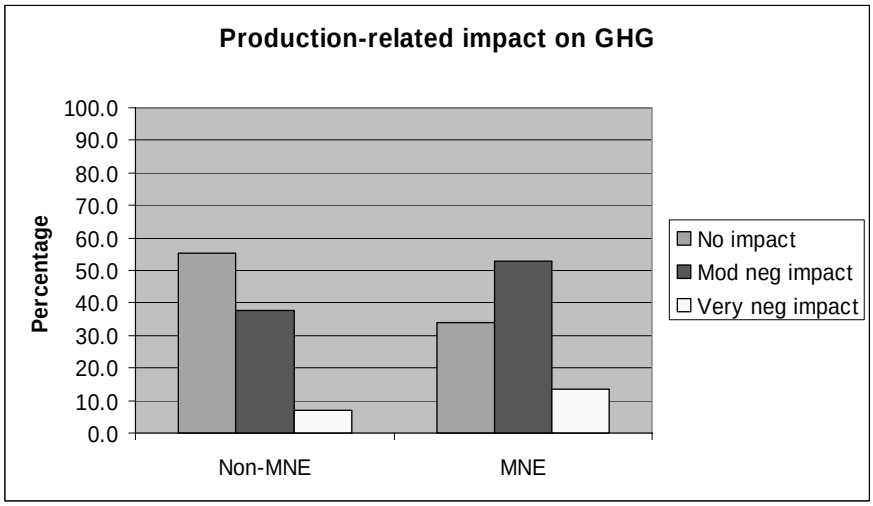
| | Use of natural resources | Solid waste generation | Waste water effluent | Local/ regional air pollution | Global pollutants | Aesthetic effects | Soil contamin-ation | Risk of severe accidents |
|---|---|---|---|---|---|---|---|---|
| No | 899 | 699 | 891 | 1177 | 1695 | 1136 | 1352 | 961 |
| Yes | 2893 | 3135 | 2577 | 1958 | 1042 | 2187 | 1338 | 2166 |
| Not applicable | 336 | 300 | 672 | 982 | 1365 | 799 | 1426 | 955 |

**Changes in environmental impacts in the last three years**

| | Use of natural resources | Solid waste generation | Waste water effluent | Local or regional air pollution | Global pollution | Aesthetic effects | Soil contamin-ation | Risk of severe accidents |
|---|---|---|---|---|---|---|---|---|
| Significant decrease | 270 | 319 | 272 | 220 | 129 | 151 | 150 | 215 |
| Decrease | 1643 | 1727 | 1144 | 1002 | 649 | 1083 | 445 | 1059 |
| No change | 1418 | 1350 | 1695 | 1539 | 1451 | 1752 | 1557 | 1466 |
| Increase | 269 | 253 | 162 | 83 | 73 | 67 | 6 | 36 |
| Significant increase | 19 | 16 | 10 | 4 | 1 | 5 | 3 | 7 |
| Not applicable | 359 | 327 | 704 | 1118 | 1639 | 910 | 1800 | 1148 |

In this report we focus on global pollutants, such as greenhouse gases. In this specific context, over 3400 facilities recognised the potential negative environmental impacts from their products and production processes in terms of the emissions of global pollutants; 2670 facilities have undertaken actions to reduce global pollutants in the last three years; and, 2245 facilities reported changes (decrease, increase or no change) in environmental impacts with respect to global pollutants in the last three years. A further analysis is provided below.

*Negative Environmental Impacts*



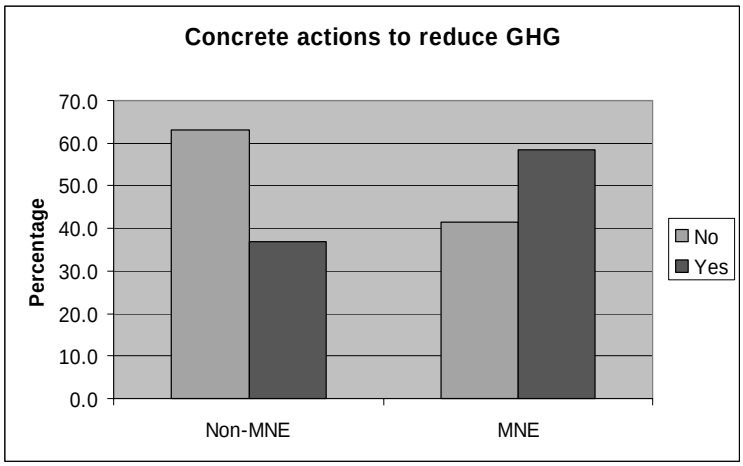

The chart shows that MNEs tend to report the existence of greater potential impacts from the generation of global pollutants than non-MNEs. This result is probably largely associated with the sectoral distribution of MNEs, since MNEs are more present in the transport equipment and machinery equipment sectors and the other non-metallic mineral products sector, as we will see below. However, as MNEs recognize they may have a negative impact on the environment because of their pollution emissions, it would be interesting to examine in more detail their responses to questions related to actions undertaken to reduce negative environmental impacts, the types of measures undertaken, and the results arising from these actions.

*Concrete actions undertaken in the last three years*

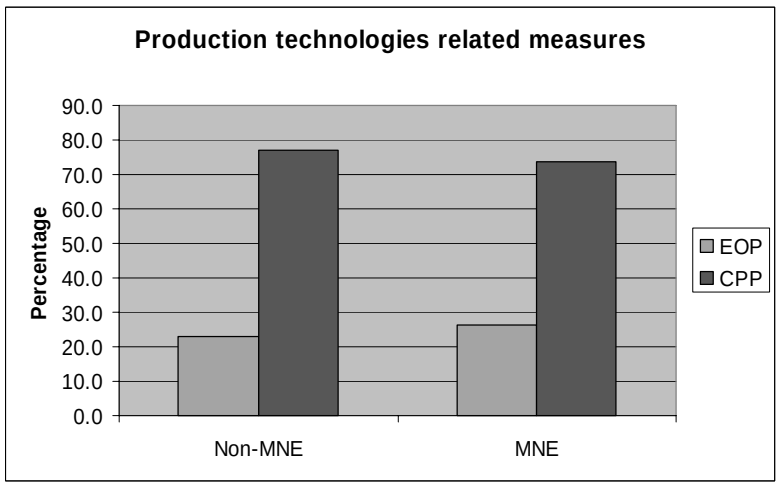
59% of MNE facilities have undertaken concrete actions to reduce global pollutants in the last three years, while only 37% of non-MNEs have undertaken similar action.

**Concrete actions to reduce global pollutants undertaken in the last three years**

| | Non-MNE | MNE | Total |
|---|---|---|---|
| No action undertaken | 1594 | 61 | 1655 |
| Actions undertaken | 929 | 86 | 1015 |
| Total | 2523 | 147 | 2670 |




A related and interesting result could be derived from the question distinguishing types of measure related to production technologies, and particularly the distinction between investment in end-of-pipe technologies and changes in production processes. In our sample, 74% of MNE facilities reported having undertaken changes in production processes which reduce pollution emissions and/or resource use, and 76% of non-MNE facilities have undertaken similar measures. Thus, 26% of MNEs have used end-of-pipe technologies which reduce pollution emissions or allow for resource recovery, while only 24% of non-MNEs have undertaken similar actions.




Though the figures are quite close, a slight difference between MNEs and non-MNEs between the types of measure adopted in the production technologies in order to reduce emissions of pollutants is discernible. More specifically, MNEs are more likely to undertake significant concrete actions related to end-of-pipe technologies to reduce pollution emissions than non-MNEs which are more likely to adopt changes in production processes.

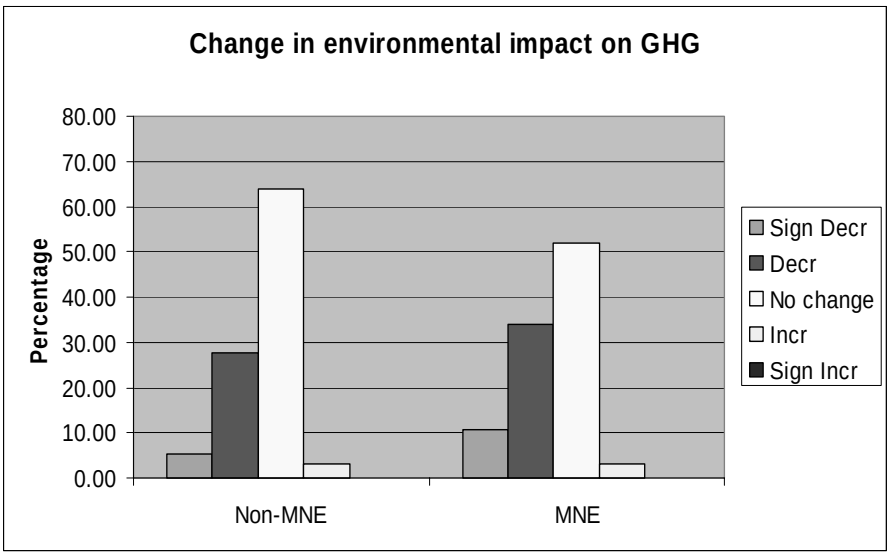
*Change in environmental impacts*

34% percent of the facilities in our sample have experienced some decreases (significant or other) in the environmental impacts of their products or production processes in the last three years with respect to global pollutants. This represents 45% of MNEs against 33% of non-MNEs. If this variable is interpreted as a proxy to environmental performance with respect to global pollutants, this suggests that MNEs have

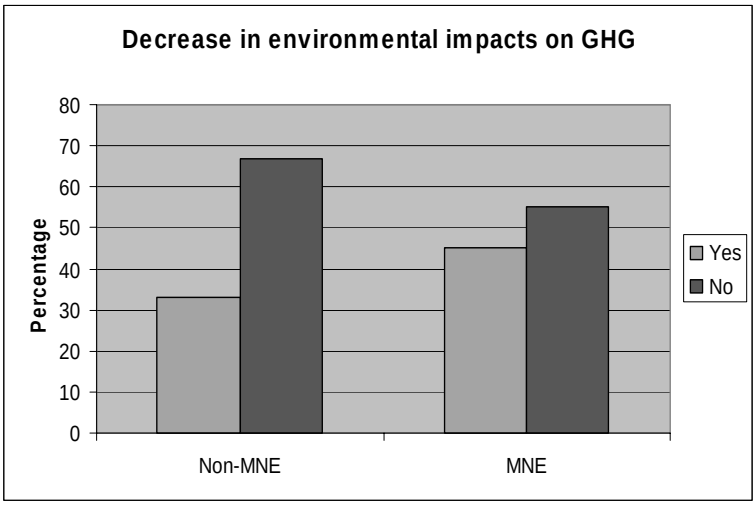
improved their environmental performance with respect to GHG to a larger extent than non-MNEs. In other words, MNEs are more environmental efficient than non-MNEs.

**Changes in environmental impacts with respect to global pollutants in the last three years**

| | Non-MNE | MNE | Total |
|---|---|---|---|
| Significant Decrease in global pollutants | 111 | 14 | 125 |
| Decrease in global pollutants | 585 | 44 | 629 |
| No change in global pollutants | 1352 | 67 | 1419 |
| Increase in global pollutants | 67 | 4 | 71 |
| Sign Increase in global pollutants | 1 | 0 | 1 |
| Total | 2116 | 129 | 2245 |



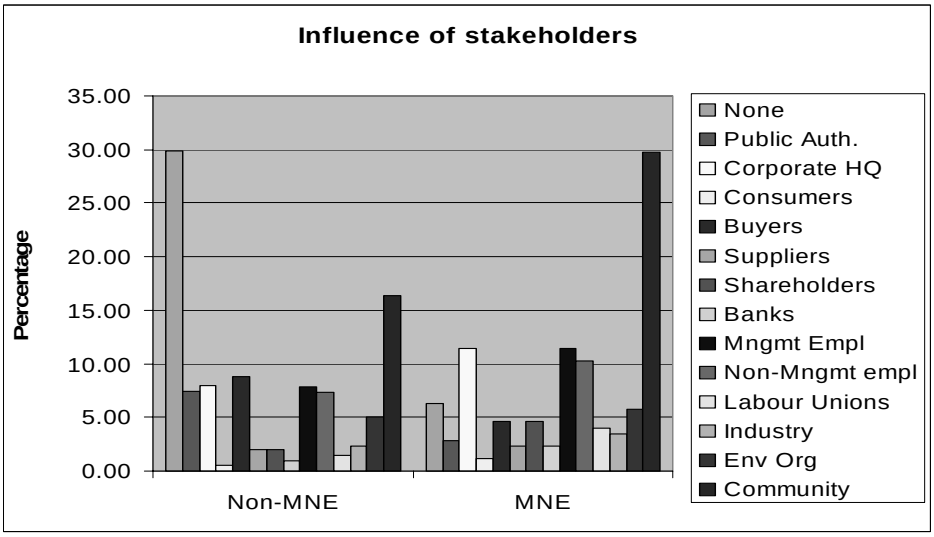

The chart clearly shows that MNE facilities have reduced generation of global pollutants emissions, and in a more important way than non-MNEs have. As we assume that answers to this question could be interpreted as "performance", the results may conclude that MNEs reported improvements in environmental performance that were more significant and more important than those reported by non-MNEs.




A greater percentage of MNE facilities report having experienced a decrease (significant or not) in their emissions of global pollutants than non-MNEs. The econometric analysis of the performance data will help to better understand the determinants of the environmental performance, and will constitute the purpose of the next section.

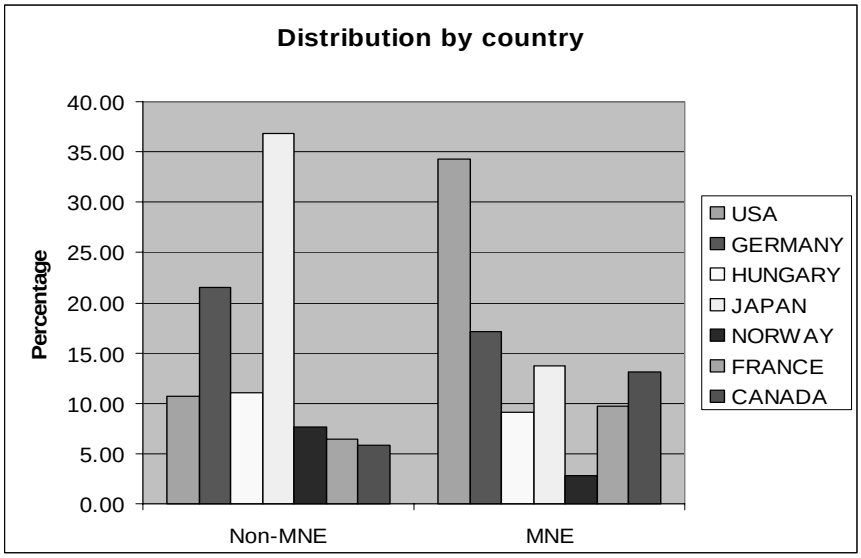
***Influence of stakeholders on the environmental practices***

When looking at the groups or organisations that are reported as influencing the environmental practices of the facility, the distinction between MNEs and non-MNEs is clear. The chart shows that MNEs consider community/neighbourhood groups and organisations as the most influential actors on their environmental practices. Corporate headquarters, management employees and non-management employees follow, but are of lesser importance. The results are very different for non-MNEs. First, 30% of non-MNEs do not think that any group or organisation has influence on their environmental practices. Community groups are reported as having a certain influence, but of a lesser importance. Buyers, corporate headquarters and management employees are even less influential. For both classes of facility, consumers, banks and other lenders, and suppliers are the least influential groups.



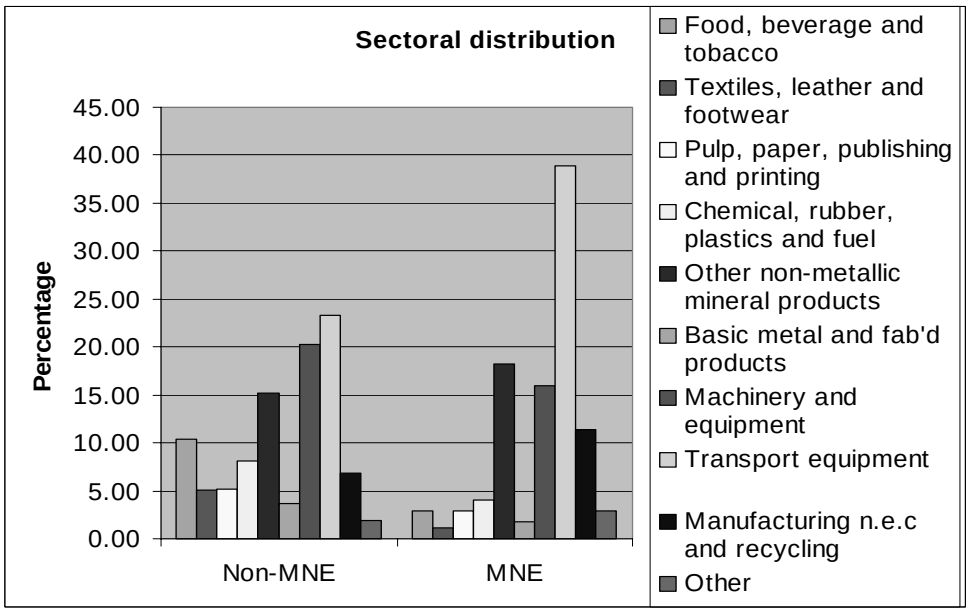
***Other characteristics of MNEs***

*Distribution by country*




A high proportion (35%) of the MNEs in our sample are located in the US, and only 11% of non-MNEs are located there. Canada and France also exhibit a proportionately greater number of MNEs than non-MNEs. On the contrary, Japan and Germany concentrate more non-MNEs than MNEs.

*Sectoral distribution*

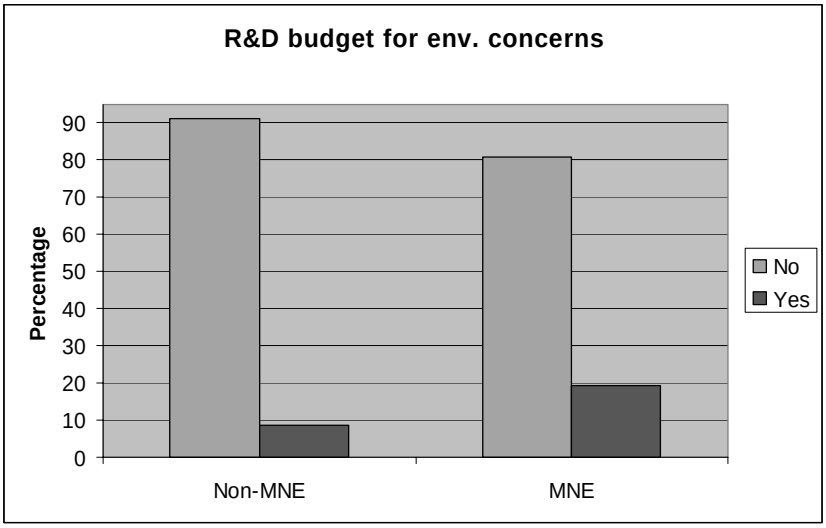



The analysis of the sectoral distribution of manufactures contributes to a better understanding of the behavioural and strategic differences between sectors. However, in this survey, no large disparity is highlighted between MNEs and non-MNEs. Almost 40 % of MNEs are located in the transport equipment sector. The other important sectors for MNEs are the sectors of other non-metallic mineral products and

machinery equipment. The sectors with few MNEs are the textile, basic metals and fabricated products, food/beverage and pulp/paper sectors.

*Research and development budget for environmental concerns*

MNEs tend to allocate more financial resources for research and development specifically related to environmental matters than non-MNEs: almost 20% of MNEs have a specific R&D budget for environmental matters, while less than 10% of non-MNEs have such a budget. It is also interesting to note that most firms in our sample do not have a specific budget for environmental concerns, whether they are MNEs or not.




**Conclusions**

A survey relating to environmental policy tools and firm-level management and practices implemented in seven countries allows analysing the environment-related behaviour of facilities which are part of MNEs as compared to those of non-MNEs (as defined in this study). Though the sample of MNEs is quite small (175 observations), some interesting conclusions can be drawn.

- MNEs are more likely to have an EMS in place than non-MNEs, and the discrepancy increases if certification is taken into account.

- MNEs are more likely to have at least one person with explicit responsibility for environmental matters, and this person is in general working in a specialised environmental department or in senior management. Non-MNE facilities often (31%) do not have such a person.

- Concerning the potential negative impact of production on global pollutants emissions, on the one hand, a greater number of MNEs than non-MNEs (respectively 66% vs. 45%) reported generating such impacts. On the other hand, MNEs are more likely to undertaken concrete actions to reduce GHG emissions than non-MNEs (respectively 59% vs. 37%). As a consequence, 45% MNEs have experienced an important decrease of their global pollutants emissions while only 35% of non-MNEs have. As this variable is used as a proxy of environmental performance, this could suggest that improvements in environmental

performance are more significant and important in MNEs than in non-MNEs. This latter result is particularly interesting and of considerable policy relevance.

A further analysis of the determinants of environmental performance would provide valuable inputs on the behaviour of MNEs relative to other facilities. This analysis is proposed in the Appendix.

## Appendix

***Econometric analysis***

While interesting, a simple review of the bivariate relationships between various indicators of environmental management and performance and facilities which are part of MNE's and non-MNE's (as defined above), is not entirely satisfactory. Due to the close relationship between many of the variables it is important to examine this issue using multivariate statistical methods. As such, in this section, we examine the determinants of environmental performance in order to identify potential disparities between facilities which are part of MNEs and non-MNEs. As previously mentioned, environmental performance is reflected through "changes in impact" (Question 2.6 of the questionnaire – see Annex 1).

Let's assume that performance can be represented by the following equation:

$$Performance = f(EMS, Policy, MNE, C, S, \varepsilon_1) \qquad \text{Equation (1)}$$

where Performance is the performance level, EMS is the variable describing the facility's level of environmental management, Policy is a vector of different policy variables (policy stringency and inspection frequency), MNE are variables representing facility's structural characteristics which are often associated with MNE's, such as facility size, stock market listing, etc., C are country-specific dummy variables and S are sector-specific dummy variables. ε1 is a random variable with zero mean, which captures unobserved heterogeneity.

In this context, the vector MNE gathers distinct explanatory variables (See Questionnaire in Annex 1), including:

- Facility's size (Question 5.6)
- Market scope (Question 5.2)
- Nature of market competition (Question 5.3)
- Firm listed on a stock exchange (Question 6.1)
- Location of firm's headquarters in a foreign country (Question 6.2)

In order to capture heterogeneity due to the international nature of the survey (7 countries were involved), dummy variables reflecting country specificities and industrial sectors are included in the models. The estimations will be used to address the following questions:

- What factors determine a facility's decision to improve its environmental performance, with a particular focus on the role of public policies.
- Do MNEs have a greater level of environmental performance than non-MNEs? And if so, what can explain this difference between MNEs and non-MNEs?

In order to address these questions, as well as for computational ease, it was decided to estimate a logit model using the maximum likelihood method.

The first estimation consists in estimating Equation (1) with a limited set of variables contained in vector X. The results of the estimation are produced in the table below.

**Results of estimation**

| Explanatory variables | Coefficient | Standard Error | t-ratio |
|---|---|---|---|
| Constant term | 0.461 | 0.279 | 1.652 |
| Having an EMS | -0.330*** | 0.079 | -4.177 |
| Policy framework | | | |
| Policy stringency | 0.015 | 0.104 | 0.143 |
| Inspections frequency | -0.018*** | 0.007 | -2.666 |
| Firm characteristics | | | |
| 100-250 employees | -0.136 | 0.086 | -1.590 |
| 250-500 employees | -0.325*** | 0.106 | -3.075 |
| More than 500 employees | -0.489*** | 0.115 | -4.269 |
| Global or international market | -0.149* | 0.086 | -1.732 |
| Headquarters in a foreign country | -0.156 | 0.118 | -1.323 |
| Listed on a stock exchange | -0.170 | 0.109 | -1.564 |
| Countries | | | |
| USA | -0.184 | 0.185 | -0.994 |
| Germany | 0.831*** | 0.161 | 5.175 |
| Hungary | 0.389** | 0.174 | 2.235 |
| Japan | -0.299* | 0.163 | -1.837 |
| France | 0.499** | 0.203 | 2.462 |
| Norway | 0.185 | 0.187 | 0.988 |
| Industrial sectors | | | |
| Food & beverage | -0.448* | 0.256 | -1.752 |
| Textiles & leather | -0.114 | 0.276 | -0.415 |
| Pulp, paper & printing | -0.183 | 0.282 | -0.650 |
| Chemical, rubber & plastics | -0.426 | 0.262 | -1.623 |
| Other non-metallic mineral products | -0.440* | 0.247 | -1.782 |
| Basic metals | -0.833*** | 0.297 | -2.802 |
| Machinery & equipment | -0.306 | 0.243 | -1.262 |
| Transport equipment | -0.062 | 0.240 | -0.259 |
| Manufacturing n.e.c and recycling | -0.021 | 0.264 | -0.079 |
| Models measures of fit and statistics | | | |
| Number of observations: 3530 | | | |
| Log likelihood function value: -2300.171 | | | |
| Chi-squared statistic: 276.1206 | | | |
| Degrees of freedom: 24 | | | |
| Significance level: ***:1% level, **: 5% level, *: 10% level | | | |

The variable having the most important impact on environmental performance is the size of the firm. However, as the sign is negative, this means that bigger firms are not likely to be more effective than small firms. This is also true of market scope. Facilities which sell into international markets are less likely to have responded that they had improved their environmental performance in the last three years. Other characteristics assumed to be associated with MNEs are statistically insignificant (whether the head office

is located overseas and whether it is listed on a stock exchange). This is interesting since, while descriptive statistics show MNEs have improved their performance more than non-MNEs (See Section 1), this is not the case in the multivariate analysis.

Two major reasons could explain this result. First, it is reasonable to think that MNEs characteristics are correlated with other variables included in the model which have a positive effect on environmental performance. For instance, this could be the case for policy framework. The policy stringency variable exhibits a positive sign (although it is not significant). Moreover, the inspections frequency variable is negatively significant. This might be explained by the Harrington thesis, which argues that policymakers may use compliance records and other factors to determine inspection frequency – i.e. worse performers are inspected more frequently, suggesting that those facilities for whom environmental performance is unsatisfactory are more likely to be targeted.

However, since MNE facilities – due to their size, visibility, etc. – are often inspected frequently, this may explain the negative or insignificant results for the MNE characteristics. Moreover, since country and sectoral dummies are included in the model and many of these are highly significant these may also capture difference in the environmental policy framework. Potential correlation between these policy and policy-related variables and the MNEs characteristics could explain why the former do not show up in the multivariate analysis in the manner expected from the review of the bivariate relationships.

The second plausible explanation is directly associated with the nature of the data. Firms have been asked to provide data on a 3-year basis. As such, it may be reasonable to observe non-MNEs having better performance than MNEs in recent years, since MNEs may have undertaken many investments earlier, with 'returns' being correspondingly less. In effect the results may indicate that non-MNEs are "catching-up". Given the nature of the data, it is not possible to address this issue empirically.

A final interesting result is the negative and significant sign on the EMS variable. This result is difficult to explain. However, other work undertaken on this project indicates that the performance and EMS variables are endogenous – i.e. the two decisions are often taken simultaneously and for similar reasons. As such, more sophisticated econometric techniques need to be applied in order to assess the true effect of the EMS variable on environmental performance, and this work is being undertaken presently.

In the models above, we consider environmental performance expressed in terms of global pollutants. In order to draw comparisons and to better understand the relationship between environmental performance and MNEs more generally, we have estimated similar models with the same statistical techniques (i.e. logit models), but with a different dependent variable: environmental performance is considered in what follows as "changes with respect to local or regional pollutants". The results of the estimation are presented in the Table below.

**Results of the estimation**

| Explanatory variables | Coefficient | Standard Error | t-ratio |
|---|---|---|---|
| Constant term | 0.444 | 0.291 | 1.525 |
| Having an EMS | -0.429*** | 0.084 | -5.118 |
| Policy framework | | | |
| Policy stringency | -0.045 | 0.113 | -0.397 |
| Inspections frequency | -0.031*** | 0.008 | -3.658 |
| Firm characteristics | | | |
| 100-250 employees | -0.244*** | 0.088 | -2.782 |
| 250-500 employees | -0.492*** | 0.115 | -4.281 |
| More than 500 employees | -0.519*** | 0.125 | -4.161 |
| Global or international market | -0.197** | 0.090 | -2.189 |
| Headquarters in a foreign country | 0.070 | 0.127 | 0.550 |
| Listed on a stock exchange | -0.194* | 0.119 | -1.639 |
| Country | | | |
| USA | -0.388** | 0.199 | -1.950 |
| Germany | 0.478*** | 0.164 | 2.914 |
| Hungary | -0.797*** | 0.192 | -4.158 |
| Japan | -0.224 | 0.168 | -1.331 |
| France | 0.331 | 0.208 | 1.593 |
| Norway | -0.271 | 0.196 | -1.386 |
| Industrial sectors | | | |
| Food & beverage | -0.442* | 0.268 | -1.650 |
| Textiles & leather | -0.245 | 0.288 | -0.850 |
| Pulp, paper & printing | -0.455 | 0.297 | -1.535 |
| Chemical, rubber & plastics | -0.218 | 0.273 | -0.799 |
| Other non-metallic mineral products | -0.581** | 0.261 | -2.231 |
| Basic metals | -0.743** | 0.314 | -2.363 |
| Machinery & equipment | -0.382 | 0.254 | -1.502 |
| Transport equipment | -0.064 | 0.251 | -0.255 |
| Manufacturing n.e.c and recycling | -0.359 | 0.279 | -1.286 |
| Model measures of fit and statistics | | | |
| Number of observations: 3530 | | | |
| Log likelihood function value: -2154.371 | | | |
| Chi-squared statistic: 302.3142 | | | |
| Degrees of freedom: 24<br>Significance level: ***:1% level, **: 5% level, *: 10% level | | | |

Generally speaking the results are consistent with those for global pollutants. The only significant difference is the negative result for facilities which are part of firms quoted on the stock exchange.

***Conclusions***

While the bivariate analysis of the data tend to show that facilities with characteristics associated with MNEs have a greater level of environmental performance than non-MNEs, a thorough analysis of the determinants of environmental performance, with a particular focus on global pollutants, has not confirmed this finding. This suggests that the characteristics of a MNE are not sufficient to ensure a greater level of performance than that of non-MNEs, even if the bivariate analysis indicates a strong relationship.

These results could be explained by the greater pressure imposed by public authorities on facilities with the characteristics associated with MNEs. This argument is highlighted by the positive sign and the coefficient of the policy stringency variable, variable which is almost significant, the negative sign on the inspections frequency variable, and the role of sectoral and country dummies. Since these are all correlated with the MNE characteristics, this could explain the disparity between the bivariate and multivariate results.

This may suggest that current public policies exert an important pressure on MNEs, which make them perform better than non-MNEs. However, the structural characteristics of a MNE in and of themselves do not explain the differences in terms of environmental performance that exist between MNEs and non-MNEs. Not surprisingly, the policy context in which firms operate has a large impact on their environmental performance, including in the area of global pollutants.

Given the results presented in this report it is clear that at least three areas require further in-depth analysis:

- A more focused analysis of the effects of the policy framework (including instrument choice – for which the database is exceptionally rich);

- An improved understanding of the complex links between environmental management (systems and other tools), innovation and performance; and,

- Comparative studies of the differences between environmental management and performance for different types of environmental impacts.

In all of these areas the database provides the means by which to gain new and original insights.