International Journal of Business and Management; Vol. 10, No. 11; 2015
ISSN 1833-3850 E-ISSN 1833-8119
Published by Canadian Center of Science and Education

# Environmental Management System: Environmental Impacts and Productivity

Mohamed Marouen Amiri[1], Hédi Noubbigh[1], Kamel Naoui[1] & Nouha Choura[1]

[1] Risk Management and Research in Accounting and Finance, Tunisia

Correspondence: Mohamed Marouen Amiri, Risk Management and Research in Accounting and Finance, Tunisia. E-mail: marouen.amiri@gmail.com

Received: July 27, 2015 Accepted: October 8, 2015 Online Published: October 28, 2015

doi:10.5539/ijbm.v10n11p107 URL: http://dx.doi.org/10.5539/ijbm.v10n11p107

**Abstract**

Nowadays, the environmental dimension is an important factor in the managerial decisions of polluting firms. These firms are subject to regulations which are characterized by the adoption of norms and standards to ensure a minimally non-polluted environment. These norms have incited firms to adopt environmental management systems. In line with these ideas, our study aims to analyze whether the adoption of an environmental management system would improve the productivity of firms operating in the manufacturing sector. With a sample composed of French companies listed in the SBF 120, we measured productivity by specifying and estimating a Cobb-Douglas production function and then used panel data to test the impact of the adoption of an environmental management system on the productivity of manufacturing firms. We found a positive and significant relation between the implementation of an EMS and productivity.

**Keywords:** EMS, polluting firms

## 1. Introduction

Recently, due to the emergence of various environmental crises caused by industrial disasters (Bhopal, Erika, Exxon-valdés..), we began to wonder "about the purpose of economic activities, their effects on the geophysical configuration of the planet, their long-term consequences for future generations. It is therefore to companies, main agents of these activities, as all eyes turn to hold them accountable not only on their economic performance but also on their attitudes towards individuals, human societies and the natural environment" (Quairel & Capron, 2010). As suggested by this citation, companies have seen the scope of their responsibility expand. Thus, looking more and more to notions of environmental responsibility is a must for the companies' success. According to Martinet and Reynaud (2004), dealing with environmental issues is "a matter of policy and decisive strategies for the future of societies and the planet, but also for the legitimacy, effectiveness and efficiency of enterprises".

According to Porter (1995), environmental pressures and green investments contribute to improving the competitiveness of firms. Therefore, a big number of companies carry out environmental actions because of the growing awareness of social actors towards the protection of the environment. Preserving the environment is no longer regarded as a source of expenditure and external stress that companies must meet, but rather as an instrument of competitiveness and a way to control the environmental costs, permitting the company to ensure its legitimacy. Recognizing the role of the environmental dimension in preserving the social legitimacy of their activities, firms engage in more voluntary approaches to integrate ecological concerns in their daily practices. On the corporate level, this awareness is reflected by the implementation of an environmental management system (EMS), which is the ISO 14001 standard as reference model.

For the last decade, environmental compliance through the ISO 14001 certification appears to be one of the most significant events from the set of initiatives on environmental protection and sustainable development. Firms that aim to acquire the ISO 14001 standard are asked to settle an EMS in order to improve their environmental performance. Reverdy (2005) points out that "a system of this kind enables an organization to develop an environmental policy, establish objectives, processes to meet its commitments and take necessary actions to improve its performance."

Boiral (2006) argues that the environmental management systems' objectives are twofold: first, "to provide structured guidelines which promote the integration of environmental concerns, from the top of the organization

to operational activities" and second "to promote the recognition of ecological actions of the organization with stakeholders, particularly, clients, citizens and public authorities." Whether there is a connection between the environmental performance and corporate performance is an issue of debate. Nash and Eferfled (2001), Morrow and Rondinelli (2002), Rondinelli and Berry (2000), Melnyk et al. (2003) and Janicot (2007), among others, investigated also the eventual impact the environmental management system may have in improving the corporate environmental performance.

In line with the aforementioned studies, our research focuses on studying the relationship between the implementation of environmental management system and firms' performance. This study aims to verify whether environmental performance achieved through the implementation of an environmental management system is positively associated with the economic performance of the firm. Thus, this research seeks to answer the following research question: to what extent the implementation of an EMS influences the reduction of environmental impacts and improves productivity. To answer this question, the paper will be organized as follows: the first section will be devoted to literature review, the second to variables definition and measures, the third to sample and the procedure of data collection, the fourth to the empirical design, the fifth to the empirical results and the final on to the conclusion.

## 2. Literature Review

According to the International Institute for Sustainable Development, ISO 14001 certified EMS assists companies with lowering their environmental impact, improving their responsibility, reinforcing the operational efficiency by eliminating waste from production and distribution processes, enhancing employees' awareness of the environmental effects of operations, and building a strong image of corporate social responsibility. In the environmental management literature, it has been documented that the implementation of EMSs can be coherent with different approaches. Indeed, some works argue that EMSs adoption may be realized through the well-known management procedures such as total quality management (TQM) which may incentivize executive managers to engage in an integrated system of environmental management.

As environment is gaining a lot of interest, so far, more than 130 000 organizations have validated their environmental management systems according to ISO requirements. As stated by Khanna and Anton (2002), adopting EMSs consists on adhering to a set of environmental management practices (EPSs) such as: setting an environmental policy, training and remunerating workers to seek for possibilities to avoid pollution, performing internal environmental audits and using total quality management in environmental management. According to Nash et al. (2001), by EMSs it is meant the processes by which a firm establishes a set of organizational adjustments by defining formal environmental policies, goals, strategies and administrative procedures that promotes firms' performance.

Zutshi and Sohal (2004) documented through a survey related to the motives for adopting EMSs on 286 organizations certified ISO 14001 in Australia and New Zealand that 'improving corporate image' and 'compliance with regulation' were the two main principal motives for implementing an EMS, while 'compliance to legislation' and 'lowering organizational risks' such as those related to safety, health and environment were the principal gains the organizations obtained. The authors reported that the most important benefits obtained through the adoption of EMS once employees got involved are: 'morale building within the organization' and 'achieving the customers' expectations'. Moreover, they documented that EMSs permitted the companies to 'reduce waste' and to 'gain market and competitive advantages'.

In a different context, Pan (2003) investigated the reasons underlying the implementation of EMSs through ISO 14001 certification in four Asian countries namely Japan, Taiwan, Korea and Hong Kong. They found that the most important motives are: improving the corporate image, environmental improvement, gaining marketing advantage and improving relations with countries. In the same way, Poksinska et al. (2003) investigating the drivers of the ISO 14001 certification in Swedish companies, found that the motives may be either internal or external. These motives may be summarized as: enhancing the corporate image, gaining marketing advantage, customer pressure/demand, relations with communities and authorities, environmental improvements, capturing workers' knowledge, cost reductions, following competitors already certified and avoidance of exporting barriers.

The advocates of environmentally oriented management system suggest that EMSs may be effective tools to increase the firm's environmental performance and business efficiency. Indeed, Chavan (2005) documented that the implementation of EMSs through the certification ISO 14001 helps firms achieve the following results: lowering their environmental impact, optimizing the efficient use of resources, lowering waste, building a good corporate image, raising the awareness of the environment and augmenting the corporate profit through more

efficient operations. Da Silva and de Medeiros (2004) found that environmental management permits the company to better its environmental performance, lower its costs, improve its image with the public, regulators and investors; restrain pollution, save resources and find new customers and new markets.

In a more recent study, Evangelos et al. (2011) conducted a study through survey methodology to determine what are the benefits, difficulties and motives associated with the implementation of ISO 14001 in the Greek context. They found that the reasons that push Greek firms to adopt ISO 14001 are internal and external. These motives can be summarized in obtaining competitive advantage and social pressure. These reasons led the companies to upgrade the market position, move from conventional to sustainable systems and improve their relation with stakeholders.

As suggested by Kirkpatrick and Pouliot (1996), an integrated program of pollution reduction leads companies to improve their efficiency by lowering the costs of energy and materials and thereby strengthening investor confidence in the company and providing it with international advantage. Clark (1999) reported that many multinational companies are following EMS to meet with the customers' pressure and to insure that the suppliers are environmentally and socially driven. As more stakeholders get involved in environmental issues, this incentivizes firms to get EMS certifications. Cascio (1994) asserts that ISO 14001 as an international standard aids companies to establish a more environmentally driven, coherent scheme. Donaldson (1996) claims that international standard makes it easier for firms to set intentional EMSs, which aids shareholders, government regulatory agencies, insurance companies and financial institutions to evaluate the company's adherence to ameliorate environmental performance and reducing risk. As opposed to regulation, Rondinelli and Vastag (1996) point out that the deliberate ISO 14001 approach provides the company with the adaptability to create EMSs that are coherent with their operations, characteristics and levels of risk.

Despite the fact that at the first glances the performance of environmental management systems lead to enhance corporate performance; the debate of whether the two variables are positively related to each other is still raised. The debate has been addressed at the theoretical (Walley & Whitehead, 1994; Hart, 1995; Porter & Van der Linde, 1995) and the empirical (Ullman, 1985; Margolis & Walsh, 2003) sides. Friedman (1970) suggests that environmental expenditures that aren't in line the regulatory compliance aren't the interest of shareholders since they lead to the deterioration of value and firms' performance. In line with these thoughts, Corbett and Klassen (2006) reported that this view hasn't been confirmed by empirical evidence.

Dowell et al. (2000) documented that firms that adhere to environmental standards obtain better financial performance as measured by Tobin's q comparatively to firms that don't use environmental standards. In a more recent study, King and Lenox (2001) investigated the relationship between firms' environmental performance and firms' financial performance based on a sample of 652 publicly traded U.S. manufacturing firms during the period 1987-1996. Based on Tobin's q as a measure of financial performance, they used least-squares regression analysis and found that environmental performance is consistent with financial performance.

According to Rosewicz (1990), the financial performance of the firm is affected by a strong environmental performance by the combined effect of market (revenue) and cost lines. On the revenue viewpoint, customers exhibit an inclination towards environmentally driven companies. Manufacturers, who show an inclination towards preserving the environment through the reduction of waste, lowering the impact of products and processes on the environment or adopting environmental management systems, are more inclined to expand their markets and gain competitive advantages. Moreover, obtaining environmental certifications such as Green Cross in the U.S. or EcoLogo in the European community, present a new basis of differentiation for the consumer. On the cost viewpoint, enterprises that invest massively in environmental management systems are likely to prevent crises and liabilities which lead to lowering materials waste and strengthening inefficient processes. Using event study methodology on a sample of 96 publicly traded firms, Klassen and McLaughlin (1996) investigated the linkage of social responsibility to firm performance and documented a positively significant relation between strong environmental performance and the market valuation of the firm.

In a more recent study, Lee et al. (2012) investigated the relationship between environmental practices and firms' financial performance over the period 1994-2008 using event methodology based on a sample of 61 publicly-listed fashion or textiles related manufacturing firms in the U.S. that got the ISO 14000 certification. Measuring financial performance by return-on-asset (ROA), return-on-sales (ROS) and sales-on-assets (SOA), they documented that: more than 60.5% of the sample firms documented a mean cumulative change of 2.3% of ROA, 69.7% of the firms revealed a mean cumulative change of 11.7% and 60.5% of the firms showed a mean cumulative change of 6.9%.

Investigating the relationship between eco-efficiency which expresses the environmental governance of the firm

which surpasses elementary environmental compliance and pollution control policies and financial performance, Derwall et al. (2005) constructed two equity portfolio of stocks based on eco-efficiency scores and reported that the most eco-efficient firms on the period 1995-2003 earn on average higher return equal to 6% per annum in comparison to the least eco-efficient firms. In the same way, Guenster et al. (2011) investigated the eco-efficiency and financial performance nexus over the period 1997-2004. Measuring financial performance using ROA and Tobin's q, they concluded that there is a positive relation between eco-efficiency and firm performance as measured by return-on-assets and Tobin's q.

Based on a sample of 300 Japanese manufacturing firms over the period 1997-2003, Nakao et al. (2007) investigated the relationship between environmental performance and financial performance using a set of different financial variables. They relied on a set of profitability variables such as: return on assets (ROA), return on equity (ROE), sales, rate of increase of revenues, advertising expenses/sales, R&D expenses/sales, financial leverage and sales/total assets; and market valuation related variables such as Tobin's q and earnings per share, they reported that the hypothesis which states that environmental performance leads to financial performance is confirmed.

Wagner (2005) tested the long-term relationship between environmental and economic performance using multivariate regression analysis namely fixed and random effects models. Using a sample of 37 European industrial firms operating in the sector of pulp and paper and variables such as return on sales (ROS), return on owner's capital employed (ROCE) and return on equity (ROE) as measures of financial performance, they documented that the relation between ROS, ROE and environmental performance is positive and statistically insignificant while ROCE and environmental performance are positive and statistically related to each other.

Because empirical evidence is controversial, there is a strand of empirical literature which suggests a negative relationship between environmental management systems and firms' performance. These studies argue that the latter may be explained by the fact that companies that seek for improving the environmental performance must handle large implementation costs that are detrimental for the corporate performance. Lee et al. (2008) reported that profit margin, sales growth, return-on-equity, and earning per share of Taiwan manufacturing firms decreased after obtaining the EMS certification. Montabon et al. (2000) found using 1510 surveys related to supply chain and purchasing managers, that EMSs negatively impact strategic companies' performance such as: lead-time, costs and quality and that they don't strengthen their competitive advantage. Consistent with this idea, Watson et al. (2004) reported using financial performance indicators such as: price-to-earnings ratio (PER), market-to-book (M/B), return on invested capital (ROIC), return-on-assets (ROA), profit margin, operating margin and beta, based on the Wilcoxon signed-rank test that there is no significant difference between EMS adopters and non-adopters.

## 3. Variables Definition and Measures

To investigate the relationship between environmental and financial performance, we chose the following variables: productivity, pollution emissions, environmental management system, debt-to-equity ratio and stock proportion held by foreign investors. As suggested by the literature, some variables may hinder the relationship between environmental and financial performance. Therefore, control variables were included to the specification.

These variables include: research and development (R&D) expenditure ratio, logarithm of firm size, logarithm of firm age.

### *3.1 Productivity*

To measure firms' productivity, we relied on the total factor productivity. This proxy is defined as a measure of the efficiency by which the inputs are combined to produce an output. According to Liu and Wang (2003), an increase in the quantity of production reflects an increase in TFP, representing a technological advance. We will measure TFP by specifying and estimating a Cobb-Douglas function. Thus, for each firm i, the Cobb-Douglas function based on labor, capital and material inputs is specified as:

$$X = AL^{\alpha}K^{\beta}M^{\gamma} \quad (1)$$

With:

- X: production;
- A: TFP;
- L: labor;
- K: capital;

- M: materials;

$0 < \alpha < 1$, $0 < \beta < 1$, and $0 < \gamma < 1$.

Taking natural logarithm to the both sides of equation (1) yields:

$$lnX = lnA + \alpha LnL + \beta lnK + \gamma LnM = lnA^* + \alpha LnL + \beta lnK + \gamma LnM + \mathcal{E} \quad (2)$$

Where $\ln A^*$ is a constant that represents the mean value of the logarithm of the TFP, and $\mathcal{E}$ is the residual, which is the relative deviation from $\ln A^*$.

According to Liu and Wang (2003), the level of TFP is empirically measured by a residual; thus, the TFP is measured as the residual of equation (2):

$$\mathcal{E} = lnX - lnA^* - \alpha lnL - \beta LnK - \gamma lnM \quad (3)$$

lnL, lnK and for lnM are, respectively, the logarithm of wage, the logarithm of the book value of tangible fixed assets and the logarithm of raw materials expenses.

*3.2 Pollution Emissions*

We use pollution emissions divided by total assets to proxy environmental impact. The data on polluting emissions are retrieved from PRTR (Pollutant Release and Transfer Register). PRTR is a system that requires companies handling potentially hazardous chemicals to the environment to communicate the data to their local governments to estimate the amounts of chemicals released and transferred in waste. National governments then aggregate the data presented and make public the results. Moreover, companies that have more than 20 employees and use one of the chemicals included on a list of 354 substances (462 substances since 2010) provided by law, must report annually to the government regarding the quantities released and transferred (Hibiki & Managi, 2010).

*3.3 Implementation of an EMS*

To proxy the implementation of an EMS, especially in accordance with the adoption of ISO 14001, we use a dummy variable that takes the value 1 if a firm has adopted ISO 14001 for more than 4 years, and is 0 otherwise (EMS dummy). Following Nakamura et al. (2001) and Nishitani (2010), we define a firm that has at least one facility with ISO 14001 certification as a certified firm, and we designate the year in which the first facility of the firm adopted this as the certification year.

*3.4 Debt-to-Equity Ratio*

The debt-to-equity ratio (DTE) is defined as debt divided by equity. This ratio is used to determine how much debt the company uses to finance its assets. Because debt restricts a firm's financial flexibility, it is difficult for firms facing severe debt-payment to invest simultaneously in activities that aim to improve the environment and to enhance productivity. Typically, the higher is DTE, the less inclination the firm will have towards implementing environmental practices.

*3.5 Proportion of Shares Held by Foreign Investors*

The proportion of shares held by foreign investors is defined as the number of shares held by foreign investors, divided by the total number of shares. Foreign investors are often considered as institutional investors who are perceived in the financial literature as representative of market discipline which is imposed to mangers in order to adopt effective management activities that increase the corporate's value.

*3.6 Proportion of Shares Held by Individual Investors*

The proportion of shares held by individual investors is defined as the number of shares held by individual investors, divided by the total number of shares. We use this variable as a proxy for the discipline imposed to individual investors.

*3.7 Control Variables*

3.7.1 Research and Development (R&D) Expenditure Ratio

It is defined as R&D divided by total sales. The ratio of R&D measures the degree of technical innovation in the production process (Anton et al., 2004).

3.7.2 Logarithm of Firm size

This variable is measured by calculating the logarithm of the number of employees.

3.7.3 Logarithm of Firm Age

This variable is measured by calculating the logarithm of the number of years since the creation of the company.

The description and the labels of the dependent and independent variables are summarized in Table 1.

Table 1. Variables description

| | Variables | Label |
|---|---|---|
| Dependent Variable | Total factor productivity | TFP |
| | Pollution emissions | POLL |
| | Environmental management system | EMS |
| | Debt-to-equity ratio | DTE |
| | Proportion of shares held by foreign investors | INVE |
| Independent | Proportion of shares held by individual investors | INVI |
| Variables | R&D expenditure | RD |
| | Size | S |
| | Age | A |

## 4. Data and Sample Selection

Our sample consists of 43 French companies listed on the French stock exchange. The companies are selected based on the Pollutant Release and Transfer Register (PRTR). The PRTR represents an environmental database which performs a national or regional inventory of chemical substances and/or potentially dangerous pollutants released into the air, water and soil, and transferred off-site for treatment or disposal. In France, the general direction of risk prevention Ministry of Ecology, Sustainable Development and Energy identifies key industrial emissions in a specific register. These data are available to the general public. The major industrial sectors that are concerned by the PRTR include: energy (oil, gas, and electricity), construction (cement and lime) and steel. The information used to measure our variables and perform this study is retrieved from the SBF 120 from 2007 to 2011.

*4.1 Empirical Design*

To test the hypotheses of this study, we present, first of all, the econometric models used for this type of data (in our case of study, the data is a pooled cross sectional time series or generally known as panel data).Typically, in panel data regressions, two specifications may be used:

- A specification named fixed effect model known also as covariance model. This model is generally applied for homogeneous samples.
- A specification called random effect (composite error model) is often applied to incorporate the heterogeneity of the individuals that form the sample. It is assumed that, in a random effects model, the residuals are expressed as:

$$\mathcal{E}_{it} = \mu_i + V_{it} \quad (4)$$

Where $\mu_i$ is a term specific for each individual i and $V_{it}$ is a random term which accounts for the heterogeneity of the sample.

Typically, panel data requires testing if the constant term is the same for the entire group. The latter is verified through the Chow test which tests the two following hypotheses:

$$H_0: SCR_0 = \sum_{i=1}^{N} SCR_i$$

$$H_0: SCR_0 \neq \sum_{i=1}^{N} SCR_i$$

where the calculated Fisher equals to:

$$F_C = \frac{(SCR_0 - \sum_{i=1}^{N} SCR_i/(N-1)K}{\sum_{i=1}^{N} SCR_i/N(T-K)}$$

- $SCR_0$ is the sum of squared residuals from the combined data;
- $SCR_i$ is the sum of squared of the group I;

- N the number of groups;
- T is the number of observations;
- K is the number of parameters.

If $F_C < F_{table}$ we accept $H_0$ i.e. the groups are homogenous, otherwise we accept $H_1$.

The choice between the fixed effects model and the random effects model is carried out through the Hausman test. Empirically, the test verifies whether:

$$H_0: \text{cov}(x_{it}, \mu_i)=0$$

$$H_1: \text{cov}(x_{it}, \mu_i)\neq 0$$

If there is no correlation between $\mu_i$ and the explanatory variable i.e. $\text{cov}(x_{it}, \mu_i)=0$, the random effects model is chosen. Otherwise, we choose the fixed effects model. To test the hypothesis stating that the companies that implement an EMS may simultaneously reduce their environmental impact and improve their productivity, we estimated the two following models:

$$\textbf{\textit{Model (1)}}: \text{Poll}_{it} = \beta_0 + \beta_1 \text{EMS}_{it} + \varepsilon_{it} \quad (5)$$

$$\textbf{\textit{Model (2)}}: \text{TFP}_{it} = \beta_0 + \beta_1 \text{EMS}_{it} + \varepsilon_{it} \quad (6)$$

The second hypothesis of our research reports that companies that reduce their impact on the environment are more likely to improve productivity. To this end, we will test the following model:

$$\textbf{\textit{Model (3)}}: \text{TFP}_{it} = \beta_0 + \beta_1 \text{Poll}_{it} + \varepsilon_{it} \quad (7)$$

The third assumption is related to the fact that if a company is implementing an EMS, it is more likely to simultaneously reduce its impact on the environment and improve its productivity. As indicated earlier, some variables are described in the financial literature to have an impact on the corporate economic performance. To this end, we estimate the two following models:

$$\textbf{\textit{Model (4)}}: \text{Poll}_{it} = \beta_0 + \beta_1 \text{EMS}_{it} + + \beta_2 \text{DTE}_{it} + \beta_3 \text{INVE}_{it} + \beta_4 \text{INVI}_{it} + \beta_5 \text{RD}_{it} + \beta_6 \text{S}_{it} + \beta_7 \text{A}_{it} + \varepsilon_{it} \quad (8)$$

$$\textbf{\textit{Model (5)}}: \text{TFP}_{it} = \beta_0 + \beta_1 \text{EMS}_{it} + + \beta_2 \text{DTE}_{it} + \beta_3 \text{INVE}_{it} + \beta_4 \text{INVI}_{it} + \beta_5 \text{RD}_{it} + \beta_6 \text{S}_{it} + \beta_7 \text{A}_{it} + \varepsilon_{it} \quad (9)$$

*4.2 Empirical Results*

**a. Descriptive statistics**

Table 2 provides the following descriptive statistics of the dependent and independent variables.

Table 2. Descriptive statistics

| Variable | Average | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Poll | 6.756266 | 3.961805 | 0.4608375 | 17.74361 |
| TFP | 1.676255 | 43.43492 | -148.0443 | 142.034 |
| EMS | 0.7906977 | 0.40776 | 0 | 1 |
| DTE | 0.6120479 | 0.9708175 | -0.7758 | 6.5522 |
| INVE | 0.158934 | 0.1587301 | 0.0245 | 0.88 |
| INVI | 0.6269549 | 0.2306172 | 0.08 | 0.9531 |
| RD | 0.0298053 | 0.0214906 | 0.00151 | 0.12 |
| S | 4.520631 | 0.5626801 | 2.880814 | 5.32051 |
| A | 1.710985 | 0.5312611 | 0 | 2.539076 |

The table shows that all the variables studied have a positive average. It is noteworthy that the variables productivity (TFP) and debt-to-equity ratio have a high standard deviation which means that the variable presents volatility pattern. The summary statistics indicate also that 79.07% of the polluting firms surveyed have implemented an environmental management system for at least three years.

**b. Correlation matrix**

We present in the table below the correlation matrix based on Pearson's coefficient.

Table 3. Correlation matrix (Pearson)

| Var | poll | TFP | EMS | DTE | INVE | INVI | RD | S | A |
|---|---|---|---|---|---|---|---|---|---|
| Poll | 1 | | | | | | | | |
| TFP | -0.037 | 1 | | | | | | | |
| EMS | 0.027 | -0.104 | 1 | | | | | | |
| DTE | 0.028 | -0.009 | -0.01 | 1 | | | | | |
| INVE | 0.107 | 0.049 | 0.04 | 0.096 | 1 | | | | |
| INVI | -0.078 | -0.072 | 0.011 | -0.095 | 0.095 | 1 | | | |
| RD | -0.222** | 0.008 | 0.07 | 0.029 | -0.124 | 0.148 | 1 | | |
| T | 0.02 | 0.534** | -0.27 | -0.022 | -0.133 | 0.016 | 0.064 | 1 | |
| A | -0.02 | -0.065 | 0.094 | -0.123 | 0.11 | -0.019 | -0.012 | -0.053 | 1 |

** Significance at the 1% level.

We note that the dependent variable TFP is significantly and positively correlated with the explanatory variable "size" but not significantly correlated with other variables. Examining the correlation between "pollution" variable with all the remaining variables indicates that the most critical pollution variable is the variable research and development ( $\rho$ = -0.222).

**c. Estimation results**

To investigate the relationship between firms' performance and environmental practices, we estimate the two following models:

$$\textbf{\textit{Model (1)}}: \ Poll_{it} = \beta_0 + \beta_1 \ EMS_{it} + \varepsilon_{it} \quad (10)$$

$$\textbf{\textit{Model (2)}}: \ TFP_{it} = \beta_0 + \beta_1 \ EMS_{it} + \varepsilon_{it} \quad (11)$$

In the first step, we run the test of homogeneity of the constants which demonstrated that the firms are heterogeneous ($H_0$ is rejected in all models as all p-values are less than 5%). In a second step, we perform the Hausman test in order to choose between the fixed effects and random effects models. The fixed effects model is retained if there is no correlation between the explanatory variables and the constant term specific for each firm i, [$H_0$: cov ($x_{it}$, $\mu_i$) = 0)], otherwise the random effects model is chosen i.e. (cov($x_{it}$, $\mu_i$) ≠ 0). The results of the Haussman test for models 1 and 2 are summarized in table 4.

Table 4. Results for the Hausman test for models (1) and (2)

| Model | Chi 2 (1) | p-values > $\chi^2_{0.05}$ | Retained model |
|---|---|---|---|
| Model (1) | 7.61 | 0.0058 < 0.05 | Fixed effects model |
| Model (2) | 0.73 | 0.3932> 0.05 | Random effects model |

Based on the Hausman test, the fixed effects model is chosen for model (1) while the random effects is retained for model (2).

Table 5 provides the following estimate results of models (1) and (2):

Table 5. Estimation results

| Model | $\beta_1$ (EMS) | $R^2$ | F (42, 171) | Wald $\chi^2_{(1)}$ |
|---|---|---|---|---|
| Model (1) | -2.28452** | 0.1211 | 21.69** | - |
| | (-4.85) | | | |
| Model (2) | -3.428601 | 0.0020 | - | 0.27 |
| | (-0.520) | | | |

** Significance at the 1% level.

The estimations of respectively models 1 and 2 gave that the coefficient is statistically significant at the 1% level only for model 1. Moreover, the coefficient is negative for both the models with an $R^2$ respectively equal to 0.1211 and 0.0020. These results are consistent with the idea that the establishment of an environmental management system reduces emissions and therefore firms' environmental impacts. This suggests that the ISO 14001 certified institutions focus their efforts on actions to reduce their negative impact on the environment. This result corroborates the findings of Anton et al. (2004) who documented that EMS leads to lower toxic emissions per unit of output. Similarly, Fresner and Englhardt (2004), Newbold (2006) and Radonjic and Tomnic (2007) reported that the implementation of EMSs through ISO 14001 and Eco-Management and Audit Scheme (EMAS) contributes to the realization of environmental performances. In another study, King et al. (2005) found ample evidence that EMS implementation improved the environmental performance as measured by the logarithm of the toxicity-weighted sum of all Toxic Release Inventory. Furthermore, Iraldo et al. (2009) using survey methodology concluded that EMS adoption is positively associated with environmental performance.

The insignificant coefficient $\beta_1$ found for model 2 confirms the idea that perceives environmental tasks as economic and social hardship. This result corroborates the findings of Denison (1978), Christainsen and Haveman (1981); Gollop and Roberts (1983) and Dufour et al. (1995). It is also consistent with the findings of Gomez and Rodriguez (2011) who found insignificant relationship between the implementation of an environmental management system and the reduction of emissions. The result is in line also with the findings of Corbett and Kirsch (1999) who established that ISO 14001 isn't consistent with the improvement of environmental performance. Our study corroborates also the results of the study conducted by Barla (2007) who established in the paper industry that facilities that are certified ISO 14001 didn't experience a reduction in their emissions.

As a summary, we can conclude that polluting French companies have successfully reduced emissions by implementing an EMS. However, they have failed to reduce their costs of production factors and therefore their productivity decreased. Therefore, we can conclude that our first hypothesis is partially confirmed since the implementation of an EMS wasn't accompanied by an increase in productivity.

To investigate the relationship between the firm's productivity and its level of pollution, we estimate the following specification:

$$Model\ (3):\ TFP_{it} = \beta_0 + \beta_1\ Poll_{it} + \varepsilon_{it} \quad (12)$$

To choose between the random effects model and the fixed effects model, the Hausman test gave the following results which are summarized in table 6.

Table 6. Results of Hausman test for model (3)

| Model | Chi 2 (1) | p-values > $\chi^2_{0.05}$ | Retained model |
|---|---|---|---|
| Model (3) | 0.01 | 0.9120 >0.05 | Random effects model |

The results of the Hausman test led to retain the random effects model for the model (3). The results of the random effects model for model 3 are summarized in Table 7.

Table 7. Estimation results of model (3)

| Model | $\beta_1$ (Poll) | $R^2$ | Wald $\chi^2_{(1)}$ |
|---|---|---|---|
| Model (3) | -0.5106501 | 0.0070 | 0.33 |
| | (-0.58) | | |

( ) t statistic

The estimates show the absence of a relationship between the dependent variable "productivity" and the explanatory variable "pollution." Indeed, the coefficient $\beta_1$ is negative and statistically insignificant (t-statistic = -0.58) and the explanatory power of the model as captured by the $R^2$ is very low equaling 0.7%. Regardless of the robustness of the model which is almost zero, we can deduce that the two variables vary in opposite directions as explained by the negative sign of $\beta_1$. Hence, companies that reduce their environmental impacts are more likely to improve productivity. Nevertheless, the result cannot be confirmed since the estimates of the model are statistically weak. Therefore, we can conclude that our hypothesis is rejected which means that the

productivity of French companies does not depend on the level of pollution generated and therefore the certification ISO 14001 presents a formal alignment with the requirements set by the government.

The third hypothesis of this study supposes that if a firm adopts an environmental management system, it is susceptible to simultaneously improve its economic and environmental performances. This hypothesis is tested by the two following models:

***Model (4)***: $Poll_{it} = \beta_0 + \beta_1 EMS_{it} + + \beta_2 DTE_{it} + \beta_3 INVE_{it} + \beta_4 INVI_{it} + \beta_5 RD_{it} + \beta_6 S_{it} + \beta_7 A_{it} + \varepsilon_{it}$ (13)

***Model (5)***: $TFP_{it} = \beta_0 + \beta_1 EMS_{it} + + \beta_2 DTE_{it} + \beta_3 INVE_{it} + \beta_4 INVI_{it} + \beta_5 RD_{it} + \beta_6 S_{it} + \beta_7 A_{it} + \varepsilon_{it}$ (14)

The two models have the same exogenous variables namely, SME, debt ratio, the proportion of shares held by foreign investors, the proportion of shares held by individual investors, the ratio of expenditure on research and development, the company's size and age. Model (4) is specified to estimate the determinants of reducing environmental impacts while the model (5) is to estimate how the productivity of French firms varies taking into consideration the environmental aspect and the firm's various activities.

The results of the Hausman test are summarized in Table 8:

Table 8. Results of Hausman test for models (4) and (5)

| Model | Chi 2 (7) | p-values > $\chi^2_{0.05}$ | Retained model |
|---|---|---|---|
| Model (4) | 33.64 | 0.0000 < 0.05 | Fixed effects model |
| Model (5) | 19.58 | 0.0066 < 0.05 | Random effects model |

The results of the Hausman test indicates that models (4) and (5) are respectively fixed effects and random effects models which the results of their estimation are summarized in Table 9.

Table 9. Estimation results of models (4) and (5)

| Model | Model (4) | Model (5) |
|---|---|---|
| $\beta_1$ (EMS) | -1.955546** | -0.8497802 |
| | (-4.17) | (-0.13) |
| $\beta_2$ (DTE) | 0.4826994* | -3.299597 |
| | (2.23) | (-1.13) |
| $\beta_3$ (INVE) | 0.0256758 | -0.5369701* |
| | 0.02) | (-2.92) |
| $\beta_4$ (INVI) | 0.0092749 | 0.0447824 |
| | (0.41) | (0.15) |
| $\beta_5$ (RD) | -1.3009918 | -5.616607* |
| | (-0.65) | (-2.07) |
| $\beta_6$ (S) | -1.279812 | 0.6630942** |
| | (-1.69) | (6.51) |
| $\beta_7$ (A) | -4.48237* | 0.3579441 |
| | (-2.13) | (0.01) |
| $R^2$ | 0.1942 | 25.83 |
| F (42, 165) | 21.23** | 8.58** |

** Significant at the 1% level;

* Significant at the 5% level.

The results of these regressions are in concordance with those found on models (1) and (2). Moreover, model 4 gave the following results: the introduction of the variables of control didn't affect the significance of the variable EMS since the coefficient is statistically significant at the 1% level.

Moreover, the estimation of model 4 reported that the ratio of debt and the age of the company are the only two variables that influence the dependent variable EMS since they are statistically significant at the 5% level. These results are in line with the idea that the companies with the highest debt ratios are the most polluting companies since the variable EMS moves in the same direction as the variable DTE. The more leveraged is the company, the more it will have negative influence on the environment. Moreover, it is noted that the older firms are, the

less polluting they might be. This result may be explained by the fact that the two variables move in two opposite directions (the coefficient related to the variable "age" is negative).

As a summary, based on the estimates of model 4, we can conclude that the dependent variable, environmental emissions, is significantly related to three variables namely EMS, the ratio of debt and the age of the company. This empirical study showed that emissions isn't significantly associated with the proportion of shares held by foreign investors, the proportion of shares held by individual investors, the ratio of expenditure on research and development and size of the business.

Based on the empirical studies related to the topic, we point out that the results are similar to the findings of Khanna and Anton (2002), Melnyk et al. (2003), Babakri et al. (2004), Potoski and Parkash (2005a), King et al. (2005), Ann et al. (2006), Turk (2009) and Comoglio and Botta (2012) who found that EMS leads to improved environmental performance. The findings corroborate also the results of Testa et al. (2014) who concluded that the environmental management and auditing scheme (EMAS) and ISO 14001 lowered the carbonic anhydride emissions of 229 energy intensive plants in Italy. Similar results were established in a follow-up study performed by Nguyen and Hens (2015) who compared the environmental performance of certified and non-certified plants in Vietnam operating in the cement industry. Retrieving data through questionnaires, they demonstrated through the Wilcoxon rank-sum test that there is a significant difference between certified and non-certified firms in terms of environmental performance (dust, $SO_2$, $NO_2$, noise emissions).

Based on model (5) specification, the variable EMS has no influence on productivity as the associated coefficient is statistically insignificant at the 1% and 5% levels respectively, while the proportion of shares held by foreign investors, the ratio of research and development and the size of the company are statistically significant. This means that productivity increases gradually as the proportion of shares held by foreign investors' decreases. This result corroborates the findings of Hahn et al. (2010) who documented no linear relationship between environmental and economic performances. The authors explain the result that the costs of implementing an EMS outweigh by a large amount the benefits obtained which means that environment performance isn't a synonym of economic performance.

Moreover, productivity also increases gradually as the ratio of R&D decreases. This can be explained by the fact that polluting companies invest extensively in research and development to reduce their emissions. Therefore these types of investments will decrease their productivity. The results of the estimation of model (5) which has a total explanatory power of 25.83%, show that productivity depends significantly on the size of the company (t-statistic = 6.51) i.e. the more sized is the company, the higher is its productivity.

Based on model 5 estimation, we conclude that the results of this empirical study, conducted in the French context, show that EMS is significantly impacted by the proportion of shares owned by foreign investors, the ratio of expenditure on research and development and size of the firm. These finding are related to the fact that productivity varies independently of the EMS, the debt ratio, the proportion of shares held by individual investors and the age of the company.

## 5. Conclusion

The debate of whether EMSs lead to improved environmental and economic performances in the business setting has been an issue of interest. Therefore, based on a sample of 43 French polluting firms, we investigated whether EMS leads to environmental and economic performance. First, we found that an EMS improves the environmental performance by lowering emissions. This finding is consistent with the idea that ISO 14001 certification may be a valuable tool for developing EMSs and thus improving the economic performance of the firm. Based on the empirical results, we argue that the paper offers theoretical and practical answers on the debate that stipulates whether is-it worthy to be "green"? Second, similarly to extant studies, we documented an inconclusive relationship between EMS and corporates' economic performance. As suggested by Testa et al. (2014), these results may be attributed to the use of diverse methods and methodologies to evaluate environmental performance and to test the different forms that lead EMSs to improve business performance. As a conclusion, the findings of our paper are inconsistent with the resource-based view of the firm which indicates that EMSs are valuable resources that lead firms to gain competitive advantages and economic performance.

## References

Andrew, K., & Lenox, M. (2001). Does It Really Pay to Be Green? *Journal of Industrial Ecology*, *5*(1), 105-116. http://dx.doi.org/10.1162/108819801753358526

Anton, W. R. Q., Deltas, G., & Khanna, M. (2004). Incentives for environmental self-regulation and implications for environmental performance. *Journal of Environmental Economics and Management*, *48*(1), 632-654.

http://dx.doi.org/10.1016/j.jeem.2003.06.003

Babakri, K. A., Bennett, R. A., Rao, S., & Franchetti, M. (2004). Recycling performance of firms before and after adoption of the ISO 14001 standard. *Journal of Cleaner Production*, *12*(6), 633-637. http://dx.doi.org/10.1016/S0959-6526(03)00118-5

Barla, P. (2007). ISO 14001 certification and environmental performance in Quebec's pulp and paper industry. *Journal of Environmental Economics and Management*, *53*(3), 291-306. http://dx.doi.org/10.1016/j.jeem.2006.10.004

Boiral, O. (2006). La certification ISO 14 001: Une perspective néo-institutionnelle. *Management International*, *10*(3), 67.

Cascio, J. (1994, May). International environmental management standards (ISO 9000's less tractable siblings). In *Electronics and the Environment, 1994. ISEE 1994. Proceedings, 1994 IEEE International Symposium on* (pp. 27-28). IEEE. http://dx.doi.org/10.1109/ISEE.1994.337277

Chavan, M. (2005). An appraisal of environment management systems: A competitive advantage for small businesses. *Management of Environmental Quality, 16*(5), 444-463. http://dx.doi.org/10.1108/14777830510614321

Christainsen, G. B., & Haveman, R. H. (1981). Public regulations and the slowdown in productivity growth. *The American Economic Review*, 320-325.

Clark, D. (1999). What drives companies to seek ISO 14000 certification. *Pollution Engineering International*, *31*(7), 14-15.

Comoglio, C., & Botta, S. (2012). The use of indicators and the role of environmental management systems for environmental performances improvement: A survey on ISO 14001 certified companies in the automotive sector. *Journal of Cleaner Production*, *20*(1), 92-102. http://dx.doi.org/10.1016/j.jclepro.2011.08.022

Corbett, C. J., & Klassen, R. D. (2006). Extending the horizons: environmental excellence as key to improving operations. *Manufacturing & Service Operations Management*, *8*(1), 5-22.

Denison, E. F. (1978). Effects of selected changes in the institutional and human environment upon output per unit of input.

Derwall, J., Guenster, N., Bauer, R., & Koedijk, K. (2005). The eco-efficiency premium puzzle. *Financial Analysts Journal*, *61*(2), 51-63.

Donaldson, J. (1996). US companies gear up for ISO 14001 certification. *InTech*, *43*(5).

Dowell, G., Hart, S., & Yeung, B. (2000). Do corporate global environmental standards create or destroy market value? *Management science*, *46*(8), 1059-1074.

Dufour, C., Lanoie, P., Patry, M., & Cirano. (1995). Regulation and productivity in the Quebec manufacturing sector.

Eng Ann, G., Zailani, S., & Abd Wahid, N. (2006). A study on the impact of environmental management system (EMS) certification towards firms' performance in Malaysia. *Management of Environmental Quality*, *17*(1), 73-93. http://dx.doi.org/10.1108/14777830610639459

Fresner, J., & Engelhardt, G. (2004). Experiences with integrated management systems for two small companies in Austria. *Journal of Cleaner Production, 12*(6), 623-631. http://dx.doi.org/10.1016/j.jclepro.2003.09.013

Friedman, M. (2007). *The social responsibility of business is to increase its profits* (pp. 173-178). Springer berlin heidelberg. http://dx.doi.org/10.1007/978-3-540-70818-6_14

Gollop, F. M., & Roberts, M. J. (1983). Environmental regulations and productivity growth: The case of fossil-fueled electric power generation. *The Journal of Political Economy*, 654-674.

Gomez, A., & Rodriguez, M. A. (2011). The effect of ISO 14001 certification on toxic emissions: an analysis of industrial facilities in the north of Spain. *Journal of Cleaner Production*, *19*(9), 1091-1095. http://dx.doi.org/10.1016/j.jclepro.2011.01.012

Guenster, N., Bauer, R., Derwall, J., & Koedijk, K. (2011). The economic value of corporate eco-efficiency. *European Financial Management*, *17*(4), 679-704. http://dx.doi.org/10.1111/j.1468-036X.2009.00532.x

Hahn, T., Figge, F., Pinkse, J., & Preuss, L. (2010). Trade-offs in corporate sustainability: You can't have your cake and eat it. *Business Strategy and the Environment*, *19*(4), 217-229. http://dx.doi.org/10.1002/bse.674

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review*, *20*(4), 986-1014. http://dx.doi.org/10.5465/AMR.1995.9512280033

Hibiki, A., & Managi, S. (2010). Environmental information provision, market valuation, and firm incentives: An empirical study of the Japanese PRTR system. *Land Economics*, *86*(2), 382-393. http://dx.doi.org/10.3368/le.86.2.382

International Institute for Sustainable Development. (1996). *Global Green Standards: ISO 14000 and Sustainable Development*. IISD, Winnipeg, Canada.

Iraldo, F., Testa, F., & Frey, M. (2009). Is an environmental management system able to influence environmental and competitive performance? The case of the eco-management and audit scheme (EMAS) in the European Union. *Journal of Cleaner Production*, *17*(16), 1444-1452. http://dx.doi.org/10.1016/j.jclepro.2009.05.013

Janicot, L. (2007). Les systèmes d'indicateurs de performance environnementale (IPE), entre communication et contrôle. *Comptabilité-Contrôle-Audit, 13*(1), 47-67. http://dx.doi.org/10.3917/cca.131.0047

Khanna, M., & Anton, W. R. Q. (2002). Corporate environmental management: Regulatory and market-based incentives. *Land economics*, *78*(4), 539-558. http://dx.doi.org/10.2307/3146852

King, A. A., Lenox, M. J., & Terlaak, A. (2005). The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. *Academy of Management Journal*, *48*(6), 1091-1106. http://dx.doi.org/10.5465/AMJ.2005.19573111

Kirkpatrick, D., & Pouliot, C. (1996). Environmental Management, ISO 14000 offer multiple rewards. *Pollution Engineering*, *28*(6), 62-65.

Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science*, *42*(8), 1199-1214.

Liu, X., & Wang, C. (2003). Does foreign direct investment facilitate technological progress? Evidence from Chinese industries. *Research Policy*, *32*(6), 945-953. http://dx.doi.org/10.1016/S0048-7333(02)00094-X

Margolis, J. D., & Walsh, J. P. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, *48*(2), 268-305. http://dx.doi.org/10.2307/3556659

Martinet, A. C., & Reynaud, E. (2004). Stratégies d'entreprise et écologie. *Economica*.

Melnyk, S. A., Sroufe, R. P., & Calantone, R. (2003). Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management*, *21*(3), 329-351. http://dx.doi.org/10.1016/S0272-6963(02)00109-2

Montabon, F., Melnyk, S. A., Sroufe, R., & Calantone, R. J. (2000). ISO 14000: Assessing its perceived impact on corporate performance. *Journal of Supply Chain Management*, *36*(1), 4-16. http://dx.doi.org/10.1111/j.1745-493X.2000.tb00073.x

Morrow, D., & Rondinelli, D. (2002). Adopting corporate environmental management systems: Motivations and results of ISO 14001 and EMAS certification. *European Management Journal*, *20*(2), 159-171. http://dx.doi.org/10.1016/S0263-2373(02)00026-9

Nakamura, M., Takahashi, T., & Vertinsky, I. (2001). Why Japanese firms choose to certify: A study of managerial responses to environmental issues. *Journal of Environmental Economics and Management*, *42*(1), 23-52. http://dx.doi.org/10.1006/jeem.2000.1148

Nash, J., & Ehrenfeld, J. R. (2001). Factors that shape EMS outcomes in firms. In C. Coglianese, J. Nash (Eds.), *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals? Resources for the Future*. Washington, DC.

Newbold, J. (2006). Chile's environmental momentum: ISO 14001 and the large-scale mining industry–case studies from the state and private sector. *Journal of Cleaner Production*, *14*(3), 248-261. http://dx.doi.org/10.1016/j.jclepro.2004.05.010

Nguyen, Q. A., & Hens, L. (2013). Environmental performance of the cement industry in Vietnam: the influence of ISO 14001 certification. *Journal of Cleaner Production*. http://dx.doi.org/10.1016/j.jclepro.2013.09.032

Nishitani, K., Kaneko, S., Fujii, H., & Komatsu, S. (2011). Effects of the reduction of pollution emissions on the economic performance of firms: An empirical analysis focusing on demand and productivity. *Journal of Cleaner Production*, *19*(17), 1956-1964. http://dx.doi.org/10.1016/j.jclepro.2011.06.021

Nishitani, K., Kaneko, S., Fujii, H., & Komatsu, S. (2012). Are firms' voluntary environmental management

activities beneficial for the environment and business? An empirical study focusing on Japanese manufacturing firms. *Journal of environmental management*, *105*, 121-130. http://dx.doi.org/10.1016/j.jenvman.2012.03.054

Pan, J. N. (2003). A comparative study on motivation for and experience with ISO 9000 and ISO 14000 certification among Far Eastern countries. *Industrial Management & Data Systems*, *103*(8), 564-578.

Pesqueux, Y., & Damak-Ayadi, S. (2003). La théorie des parties prenantes en perspective.

Poksinska, B., Jörn Dahlgaard, J., & Eklund, J. A. (2003). Implementing ISO 14000 in Sweden: Motives, benefits and comparisons with ISO 9000. *International Journal of Quality & Reliability Management*, *20*(5), 585-606.

Porter, M. E., & Van der Linde, C. (1995). Green and competitive: Ending the stalemate. *Harvard Business Review*, *73*(5), 120-134.

Potoski, M., & Prakash, A. (2005). Covenants with weak swords: ISO 14001 and facilities' environmental performance. *Journal of Policy Analysis and Management, 24*(4), 745-769.

Psomas, E. L., Fotopoulos, C. V., & Kafetzopoulos, D. P. (2011). Motives, difficulties and benefits in implementing the ISO 14001 Environmental Management System. *Management of Environmental Quality: An International Journal*, *22*(4), 502-521.

Quairel-Lanoizelée, F., & Capron, M. (2010). La responsabilité sociale d'entreprise. *La découverte.*

Radonjič, G., & Tominc, P. (2007). The role of environmental management system on introduction of new technologies in the metal and chemical/paper/plastics industries. *Journal of Cleaner Production*, *15*(15), 1482-1493. http://dx.doi.org/10.1016/j.jclepro.2006.03.010

Reverdy, T. (2005). Management environnemental et dynamique d'apprentissage.

Rondinelli, D. A., & Berry, M. A. (2000). Environmental citizenship in multinational corporations: Social responsibility and sustainable development. *European Management Journal*, *18*(1), 70-84. http://dx.doi.org/10.1016/S0263-2373(99)00070-5

Rondinelli, D. A., & Vastag, G. (1996). International environmental standards and corporate policies: an integrative framework. *California Management Review*, *39*(1), 106.

Rondinelli, D., & Berry, M. (2000). Multimodal transportation, logistics, and the environment: managing interactions in a global economy. *European Management Journal*, *18*(4), 398-410. http://dx.doi.org/10.1016/S0263-2373(00)00029-3

Rosewicz, B. (1990). Americans are willing to sacrifice to reduce pollution, they say. *Wall Street Journal*, *20*.

Sena da Silva, G. C., & Dumke de Medeiros, D. (2004). Environmental management in Brazilian companies. *Management of Environmental Quality: An International Journal*, *15*(4), 380-388.

Testa, F., Rizzi, F., Daddi, T., Gusmerotti, N. M., Frey, M., & Iraldo, F. (2014). EMAS and ISO 14001: the differences in effectively improving environmental performance. *Journal of Cleaner Production*, *68*, 165-173. http://dx.doi.org/10.1016/j.jclepro.2013.12.061

Turk, A. M. (2009). The benefits associated with ISO 14001 certification for construction firms: Turkish case. *Journal of Cleaner Production*, *17*(5), 559-569. http://dx.doi.org/10.1016/j.jclepro.2008.11.001

Ullmann, A. A. (1985). Data in search of a theory: A critical examination of the relationships among social performance, social disclosure, and economic performance of US firms. *Academy of management review*, *10*(3), 540-557. http://dx.doi.org/0.5465/AMR.1985.4278989

Wagner, M. (2005). How to reconcile environmental and economic performance to improve corporate sustainability: Corporate environmental strategies in the European paper industry. *Journal of Environmental Management*, *76*(2), 105-118. http://dx.doi.org/10.1016/j.jenvman.2004.11.021

Walley, N., & Whitehead, B. (1994). It's not easy being green. *Reader in Business and the Environment*, *36*, 81.

Watson, K., Klingenberg, B., Polito, T., & Geurts, T. G. (2004). Impact of environmental management system implementation on financial performance: A comparison of two corporate strategies. *Management of Environmental Quality: An International Journal*, *15*(6), 622-628.

Zutshi, A., & Sohal, A. (2004). A study of the environmental management system (EMS) adoption process within Australasian organisations—2. Role of stakeholders. *Technovation*, *24*(5), 371-386.

http://dx.doi.org/10.1016/S0166-4972(02)00115-3