Integration of environmental management control in companies (EMC): Case of companies in the western region of algeria

دمج الرقابة الإدارية البيئية في المؤسسات: دراسة حالة لمؤسسات من المنطقة الغربية في الجزائر

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Abstract

This study analyzes environmental management control (EMC) as a strategic lever for competitiveness and sustainability among Algerian companies. It aims to assess the extent to which firms integrate environmental control practices within their managerial and decision-making systems, focusing particularly on industrial waste management. Based on a survey conducted among 50 companies in the Oran region, the results reveal that environmental management culture remains limited, especially within small and medium-sized enterprises (SMEs). Environmental practices are mainly reactive and compliance-oriented, driven by regulatory obligations rather than proactive sustainability strategies. The absence of clearly defined environmental indicators and dedicated environmental budgets constrains the effectiveness of EMC. The study concludes that weak institutional and regulatory frameworks, combined with limited managerial awareness, hinder the integration of environmental control into corporate management. Recommendations highlight the need for training, performance indicators, and supportive legislation to promote sustainable management practices in Algeria.

Keywords: Environmental Management Control, Sustainability, Regulation, Performance Indicators, Algeria.

Jel Classification Codes : **Q56, M41, Q58**

الملخص

تتناول هذه الدراسة التحكم في الإدارة البيئية (EMC) بوصفه رافعة إستراتيجية لتعزيز القدرة التنافسية والاستدامة لدى الشركات الجزائرية. وتهدف إلى تقييم مدى دمج المؤسسات للممارسات البيئية ضمن أنظمتها الإدارية واتخاذ القرار، مع التركيز بشكل خاص على إدارة النفايات الصناعية. استنادًا إلى استبيان أُجري على عينة من خمسين (50) شركة في منطقة وهران، أظهرت النتائج أن ثقافة الإدارة البيئية ما زالت محدودة، خصوصًا لدى المؤسسات الصغيرة والمتوسطة. كما تبين أن الممارسات البيئية تتسم بالطابع التفاعلي والامتثالي أكثر من كونها ناتجة عن استراتيجيات استباقية تسعى إلى تحقيق الاستدامة، حيث تُفرض أساسًا بفعل الالتزامات التنظيمية. إن غياب مؤشرات بيئية واضحة وميزانيات مخصصة للبيئة يحدّ من فعالية نظام التحكم في الإدارة البيئية. وتخلص الدراسة إلى أن ضعف الأطر المؤسسية والتنظيمية، إلى جانب انخفاض الوعي الإداري، يعيقان إدماج التحكم البيئي ضمن إدارة المؤسسات. كما توصي بضرورة تطوير الكفاءات، ووضع مؤشرات للأداء، وسَنّ تشريعات داعمة لتعزيز ممارسات الإدارة المستدامة في الجزائر.

الكلمات المفتاحية: التحكم في الإدارة البيئية، الاستدامة، التنظيم، مؤشرات الأداء، الجزائر.

تصنيف JEL: Q56, M41, Q58

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Introduction

The seminal works on traditional management control (Anthony, 1965, 1988) and organizational control (Simons, 2005) are often regarded as essential references. However, these contributions do not address the integration of tools specifically designed to tackle environmental issues, which have emerged and expanded over the past two decades. In this context, a new form of control has appeared: environmental management control, also referred to as eco-control by Henri and Journeault (2010). This mechanism enables firms to monitor their environmental performance while being accountable to their stakeholders. The rise of this type of control is closely linked to institutional pressures originating from the State, international organizations such as the United Nations (through the Global Compact), ISO (with the ISO 14001 standard), the Global Reporting Initiative (GRI), as well as professional associations.

Recent literature has focused on studying this emerging form of control by analyzing how it is applied within organizations. These studies highlight a diversity of practices, shaped by several factors: the nature of the company's strategy (Marquet-Pondeville, 2003), the degree of ambiguity in the objectives set (Essid, 2009), the type of learning sought or observed (Dohou-Renaud, 2009), the articulation between strategy and operationalization (Acquier, 2007), and the ability to translate objectives into management tools while integrating environmental control mechanisms with existing control systems (Moquet & Pezet, 2006; Sautereau-Moquet, 2008). According to Angèle Renaud (2015), Canadian researcher Hoffbeck (as cited in Renaud, 2015) was a pioneer in this field, with a 1993 article entitled "Environmental Management Control: Concepts, Systems, and Tools," which emphasized the instruments of such control, particularly environmental accounting, environmental management accounting, and information systems dedicated to environmental management.

Within this framework, our article seeks to address the following research question:

To what extent and to what degree do Algerian companies integrate environmental management control practices into their managerial and decision-making systems?

Based on this central question, we propose the following hypotheses:

- H1: The level of managerial maturity in environmental management significantly influences the effectiveness of environmental management control systems in Algerian companies.
- H2: The effectiveness of environmental management control in Algerian companies is primarily driven by regulatory compliance rather than by proactive sustainability strategies.;

To answer this question, we employed an empirical methodology. Our study is structured into two main parts: a theoretical section, devoted to the foundations and tools of environmental management control, and an empirical section, focusing on the analysis of a practical case.

Moreover, this article holds particular significance in the Algerian context, where environmental management control remains an emerging field. It highlights the institutional and managerial weaknesses that hinder its adoption, while emphasizing the need for tools adapted to local realities. By analyzing the practices of companies in Western Algeria, this study helps fill an empirical gap and promotes a sustainable management culture based on relevant environmental performance indicators.

1. The basic approach to environmental management control

To approach management control in a simplified manner, Françoise Giroud et al. (2004) outline four essential points, as follows.

1.1 Clarifying the object of control

The first step is to clarify what is being controlled. To define management control, it is necessary to determine the meaning of the term control. As noted by P. Drucker (as cited in Starbuck, 2017), often considered one of the founding figures of management control, "the word control is ambiguous. It means the ability to direct oneself and one's work. It can also mean the domination of one person by another." It is therefore useful to specify both the general purpose of the approach and its object, namely what is to be controlled.

In this perspective, control is fundamentally assessed in terms of the effects of actions or events, that is, the results obtained. Management control consists in steering the achievement of results, usually expressed in economic terms such as profit, financial balance, or value creation for shareholders. Its primary role is not to monitor employees in an authoritarian manner, but rather to guide the achievement of organizational performance objectives, which inherently involves risks. The more adverse the external factors, the more complex control becomes. In this sense, performance is understood as achieving results despite unfavorable external influences and managing risks accordingly. Managing performance thus requires specifying the type of performance sought, since performance can take different forms depending on the context.

Doonan et al. (2005) show that top management's commitment to environmental management, evaluation, and control has a positive impact on environmental performance. This finding is also validated in the Algerian context (Daoudi & Mendli, 2025). Henri and Giasson's (2006) model highlights four dimensions: product and process improvement, stakeholder relations, regulatory compliance and financial impacts, and environmental impacts and corporate image. More specifically, environmental performance includes the management of natural resources, waste reduction, energy use optimization, and the adoption of sustainable production processes. Generally, steering environmental performance aims to:

- Reduce costs by optimizing resource use and minimizing waste.
- Comply with environmental standards and regulations such as ISO 14001.
- Improve corporate image among consumers and investors.
- Attract and retain employees concerned with ecological and social issues.

1.2 Modes of guiding behavior

Managing performance involves striving to achieve objectives within a progressive, time-bound process, hence the notion of control as a process. The basic dynamic of management control encompasses two major phases.

- **Planning phase:** The primary role of planning is to set objectives, benchmarks against which results will be evaluated. Designing a management control system must be based on objectives derived from a thorough analysis of desired performance, with periodic reassessment of their relevance. Strategic planning corresponds to reflection on the company's mission and long-term goals, while operational planning anticipates the resources needed to achieve them. Planning therefore also involves choosing action plans and anticipating related resource needs. A coherent system of objectives and plans must be established ex ante during the planning stage.

- **Results analysis phase**: This phase assesses the degree of success of actions undertaken and guides future actions. Forecasting aims to anticipate difficulties by choosing realistic objectives and coherent plans. However, actual performance may differ from expectations, either due to improper execution of action plans or unforeseen circumstances.

With respect to environmental management control, O'Riordan (1991) distinguishes three conceptual frameworks for performance objectives:

- **Dry green:** Alignment of internal corporate behavior with sustainable development objectives, ensuring compliance with ISO 9000 and ISO 14000 standards.
- **Shallow green:** A control mode oriented toward economic value creation for the company, introducing environmental considerations into corporate strategy. In other words, the use of EMC tools to steer the company while accounting for both economic and environmental constraints.
- **Deep green:** A control mode "for the environment," focusing on the real evaluation and measurement of the company's contribution to sustainable development goals related to environmental protection and human well-being.

Continuous monitoring of actual results and regular comparison with objectives are therefore necessary. Methods of results analysis include:

- Measuring deviations between expected and actual outcomes, in order to determine whether corrective action is required.
- Identifying the causes of deviations, in order to guide corrective measures.
- The dynamic of management control therefore comprises two complementary processes:
- An implementation process, which consists in executing predefined action plans and corresponds to the regulation loop.
- A diagnostic process, which consists in regularly questioning the relevance of both objectives and action plans, and corresponds to the learning loop.

1.3 The central role of measurement

Managers often define management control in terms of "profitability measurement," "performance measurement," "production and analysis of management information," or "results measurement." These expressions highlight the centrality of measurement. This is encapsulated in the American expression: "What gets measured gets managed!" Measurement is essential to the control process because it provides rhythm and allows organizations to record results at regular intervals, assess the level of interim performance, quantify performance precisely, and trigger managerial action when necessary.

The main challenge lies upstream of the control process: defining the type of performance toward which managerial decisions should be oriented. Translating performance criteria into measurable indicators allows organizations to provide clear, objective, and reliable information on the goals pursued, in a systematic and consistent manner.

According to Bollecker (2007), various tasks may be assigned to the management controller: supervising, advising, coordinating both horizontally and vertically, adjusting, and disseminating information. Renaud (2014) identifies four main missions for the environmental management controller:

- **CO_2 auditor:** Responsible for assessing greenhouse gas emissions generated by each activity, using carbon accounting to quantify emissions and establish a carbon budget.

- **Business partner:** Playing an advisory role to decision-makers by contributing to budget creation and monitoring implementation. This role also involves encouraging managers to consider the environmental impact of their choices and requires the development of an environmental information system.
- **Euro-carbon translator:** Measuring reductions in GHG emissions from company activities and translating them into monetary or financial values. However, this estimation remains complex and inherently imprecise.
- **Change agent:** Ensuring compliance with environmental objectives and embedding sustainability within corporate action plans, thereby contributing to cultural change within the organization.

1.4 The necessary distinction between the control approach and the controller's function

The control approach, as described by specialists, goes far beyond the responsibilities traditionally assigned to the management controller. It represents a collaborative management process shared between managers (management controllers and operational staff). Within this "duo," some argue that the role of the management controller is to provide information, while that of the operational manager is to make decisions. However, this distinction requires nuance, as the mode of communication can significantly influence the type of decisions that follow.

For instance, if the management controller confines the information system to the assessment of production costs, managerial decisions will tend to focus on improving manufacturing processes. Yet this perspective neglects potential overheads generated by support services (such as marketing, R&D, etc.) and overlooks the more qualitative dimensions of performance.

Thus, the roles are far more intertwined, making it difficult to draw a clear line between the functions of the operational manager and the management controller, as these depend heavily on the organizational context. In environments with a strong operational management culture, operational managers typically handle a large part of the control process. Conversely, when management culture is less developed, management controllers play a more significant role in raising awareness and educating operational staff about control practices.

2. Tools of environmental management control

2.1. Sustainable accounting

According to Gray (1994), the implementation of environmental management accounting is based on three main approaches: sustainable costs, natural capital inventory accounting, and input-output analysis.

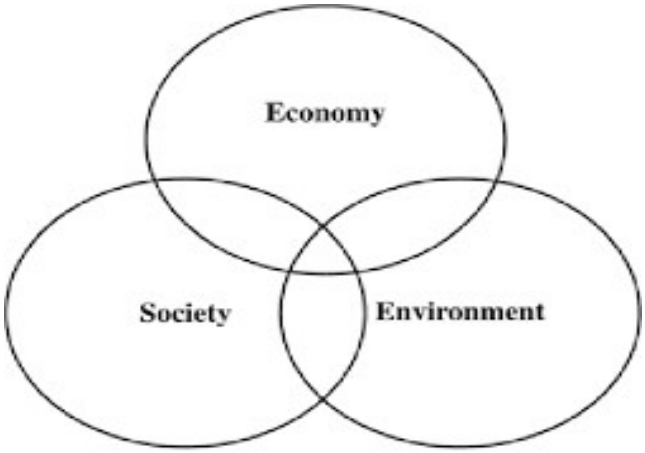
- **Sustainable costs:** These represent an amount of money that an organization should theoretically pay at the end of an accounting period to restore the biosphere to its initial state at the beginning of the period (Taïbi, Antheaume, & Gibassier, 2020). Lamberton (2005) characterized these costs as hypothetical deductions from company profits, meant to protect the rights of future generations regarding non-renewable resources. They represent the counterpart of restoring the environment to its initial state prior to the company's activities. However, the estimation of such costs is far from accurate. Several difficulties may arise when calculating, determining, or applying sustainable costs (Bebbington & Gray, 2001).
- **Natural capital inventory accounting:** According to Lamberton (2005), this approach consists in determining the quantity of natural capital used or consumed and the amount

remaining. Natural capital may be critical (such as the ozone layer), non-renewable (substitutable, such as energy, or non-substitutable, such as petroleum products), or renewable energy sources such as solar energy.

- **Input-output analysis:** This economic technique presents the inputs and outputs of a process in a tabular format. In the context of sustainable development, this method incorporates not only monetary indicators but also physical environmental indicators such as energy, water, and other natural resources consumed as process inputs, along with greenhouse gas emissions and other outputs from the production process.

In addition to these three approaches, Lamberton (2005) reported from Elkington (1999) *the Triple Bottom Line (TBL)* approach. This involves integrating environmental, social, and economic objectives (the three pillars of sustainable development) into the results expected from the company.

Fig.1. Triple Bottom Line of J. Elkington



Source : Reprinted from Hasanova & Romanovs (2020).

2.2. Environmental analysis tools

Environmental analysis tools enable companies to systematically assess the impact of their activities on the natural environment and to define relevant indicators for sustainable performance management. These tools constitute essential strategic instruments that help organizations make informed decisions, monitor the implementation of environmental initiatives, and ensure compliance with both national and international standards. Beyond compliance, they also play a central role in enhancing corporate reputation, improving resource efficiency, and promoting a culture of continuous environmental improvement.

Among the most widely used instruments are Life Cycle Assessment (LCA), the carbon footprint, and complementary approaches such as environmental audits and ecological risk assessments. Each of these tools provides a specific lens through which environmental performance can be evaluated and optimized.

Life Cycle Assessment (LCA) examines the environmental effects of a product or process throughout its entire life cycle, from the extraction of raw materials, manufacturing, and distribution to its use, recycling, and final disposal. By quantifying impacts at every stage, LCA allows organizations to identify critical phases with the greatest environmental burden and to compare alternative production or consumption scenarios. It is a decision-support method that

encourages eco-design, responsible sourcing, and the selection of more sustainable materials and technologies.

The carbon footprint analysis, meanwhile, measures the total volume of greenhouse gas (GHG) emissions generated directly and indirectly by an organization's activities. This tool provides a global diagnosis of emission sources, whether from energy consumption, transportation, supply chains, or waste management, and helps companies set realistic reduction targets aligned with international frameworks such as the Paris Agreement or ISO 14064 standards. Increasingly, carbon footprinting is integrated into corporate sustainability reporting and used to communicate transparency and accountability to stakeholders.

In addition, the environmental audit serves as a systematic, periodic, and objective evaluation of both regulatory compliance and internal environmental performance. It helps identify gaps between existing practices and environmental management objectives, thus contributing to the continuous improvement of the company's environmental management system. Similarly, the ecological risk assessment focuses on anticipating potential adverse effects of industrial or economic activities on ecosystems, biodiversity, and natural resources. It supports preventive management by highlighting vulnerabilities and helping to establish mitigation measures before damage occurs.

All these analytical tools rely on an efficient Environmental Information System (EIS),a structured data platform designed to collect, store, and analyze environmental information from multiple operational sources such as production processes, logistics, energy consumption, or waste treatment. The EIS ensures data consistency, traceability, and accessibility, facilitating real-time monitoring of environmental indicators and supporting integrated environmental reporting. By enabling cross-departmental data sharing and continuous updates, the system reinforces the credibility and accuracy of sustainability metrics.

The combination of these instruments, supported by a robust information system, allows organizations to adopt a proactive, measurable, and evidence-based approach to managing their environmental impacts. Such an integrated framework not only improves operational efficiency but also strengthens corporate social responsibility (CSR) strategies and helps align environmental objectives with broader sustainable development goals (SDGs). Ultimately, the use of environmental analysis tools transforms environmental management from a compliance-oriented task into a strategic process that creates long-term value for both the organization and society as a whole.

2.3. Performance management tools

- **The green dashboard**

The balanced scorecard was introduced by Kaplan and Norton (1992) as a strategic tool for implementing and measuring strategy. Its purpose is to balance financial and non-financial, short-term and long-term, quantitative and qualitative performance indicators.

According to Hansen & Schaltegger (2016), the sustainable scorecard explicitly considers all dimensions of sustainability, not only environmental ones. When only the environmental dimension is added to the traditional scorecard, it becomes an environmental or green scorecard. Since performance indicators are central to traditional scorecards, sustainable scorecards must also incorporate environmental performance indicators (EPIs). According to ISO 14031, these are grouped into two categories:

- *Management performance indicators (MPIs)*, which provide information on efforts made by management to influence the environmental performance of company operations.

- *Operational performance indicators (OPIs)*, which provide information on the environmental performance of company operations.

The second category consists of environmental condition indicators (ECIs), which provide information on the local, regional, national, or global state of the environment. They show the relationship between environmental conditions and company activities, helping firms account for the real or potential impact of their operations. ECIs are typically developed by government agencies, NGOs, and research institutes, and serve in environmental regulations, standards, and public reporting.

EPIs, by contrast, offer quantitative measures of the environmental impacts of business activities. They provide concise, precise information on environmentally relevant aspects of operations and help express best practices through numerical data. They are thus both a management and communication tool.

- **Environmental budgets**

To control environmental performance, companies may establish specific budgets for energy consumption to determine costs accurately, rather than treating them as undifferentiated overheads.

According to Renaud (2015), corporate environmental or sustainability action plans should be economically quantified in the form of *green budgets* or environmental budgets. A specific version of these is the *carbon budget*, which defines GHG emission limits not to be exceeded, with the objective of mitigating climate change.

The preparation of green budgets requires calculating environmental costs. Environmental expenditures are defined by Seguret (2008) as expenses incurred to prevent (prevention costs), reduce, or repair damage caused or potentially caused by corporate activities (degradation costs). According to Benabdellah & Ouguenoune (2022), such costs may relate to:

- Waste elimination and reduction efforts.
- Soil and water pollution control.
- Air quality and climate protection.
- Noise reduction.
- Biodiversity and landscape preservation.

3. Review of previous research

Recent research on Environmental Management Control Systems (EMCS) highlights their vital role in aligning corporate strategy, environmental responsibility, and organizational performance. Pondeville, Swaen, and De Rongé (2013) demonstrate that EMCS development is influenced by contextual and strategic factors such as ecological uncertainty, stakeholder pressure, and environmental proactivity. Firms facing higher environmental uncertainty tend to adopt less proactive strategies, while stakeholder influence, especially from markets and communities, drives the establishment of EMCS and environmental information systems.

Building on this, Albertini (2018) shows that management control systems contribute to environmental capabilities through Simons' (1995) "levers of control." The joint use of belief, boundary, diagnostic, and interactive control systems enhances stakeholder integration, shared vision, organizational learning, and continuous innovation. EMCS thus appear not only as monitoring mechanisms but also as dynamic tools fostering strategic learning and environmental innovation.

Awewomom et al. (2024) adopt a global perspective emphasizing preventive environmental management (PEM) and environmental policies (EP) as key levers to combat pollution. Their synthesis stresses that robust policy frameworks and proactive management approaches are

essential for sustainable development, requiring anticipation, prevention, and multi-stakeholder collaboration.

Einhorn, Fietz, Guenther, and Guenther (2023) examine the link between organizational culture and EMCS, revealing that different cultural profiles shape control emphasis. Bureaucratic cultures favor results and action controls, while clan cultures emphasize personnel and cultural controls. This suggests that EMCS design must be adapted to organizational culture to ensure effectiveness.

From an integration perspective, Alastal et al. (2024) analyze the convergence of Management Control Systems (MCS) and EMCS as a means to achieve sustainable performance. Evidence from Jordan indicates that integration improves operational efficiency, ethical behavior, and alignment with sustainability goals, despite difficulties in real-world application.

Similarly, Agyemang et al. (2023) provide empirical evidence from China showing that environmental accounting information disclosure and environmental performance indices positively influence profitability, especially in high-impact sectors. These findings confirm the financial relevance of transparent and structured environmental control systems.

Overall, the literature agrees that integrating EMCS into corporate management frameworks is both a strategic necessity and an organizational challenge. Contextual factors, cultural dynamics, and institutional frameworks jointly determine how environmental controls are designed and transformed into sustainable performance outcomes.

In the Algerian context, academic research on environmental management is relatively abundant but rarely addresses environmental management control as a distinct field of study. With the exception of a few recent studies that mention it only superficially (Daoudi & Senouci, 2025; Daoudi, 2024), most research remains general in scope, focusing on managerial practices that incorporate environmental concerns without delving into the instrumental and performance-control dimensions. This gap highlights the need for empirical investigations into how Algerian firms integrate environmental control mechanisms into their management systems, within a context characterized by evolving regulations and growing stakeholder expectations for sustainability.

4. Results of the empirical study

4.1. Survey methodology

Our case analysis focused on assessing the extent to which theoretical knowledge is interpreted and applied within commercial reality. To this end, we designed a questionnaire targeting polluting companies, generally classified as small and medium-sized enterprises (SMEs). The questionnaire was distributed to 70 companies, of which only 50 provided responses, while the remaining 20 did not participate. It comprised 10 questions, three of which addressed general characteristics such as company size (small or medium), the educational background of the manager, and their level of understanding of environmental management.

The scope of this study was limited to the Oran region, encompassing a sample of companies located in various industrial zones within the wilaya of Oran (Algeria).

The survey was conducted during the first two quarters of 2025.

With regard to the data collection procedure, the questionnaires were distributed and collected directly on-site to ensure a higher response rate and to guarantee the reliability of the information obtained.

Finally, it is important to note that the surveyed population consisted primarily of top executives and senior managers within the companies studied.

4.2. Survey results

The findings reveal that 70% of managers hold a university degree and possess awareness of environmental management practices. Among them, 20% are certified under ISO 9001 and ISO 14001. In contrast, the remaining 30% lack higher education qualifications.

Regarding compliance with legislative procedures related to industrial waste management, the results are illustrated in Figure 2.

Fig.2. Distribution of Waste Types

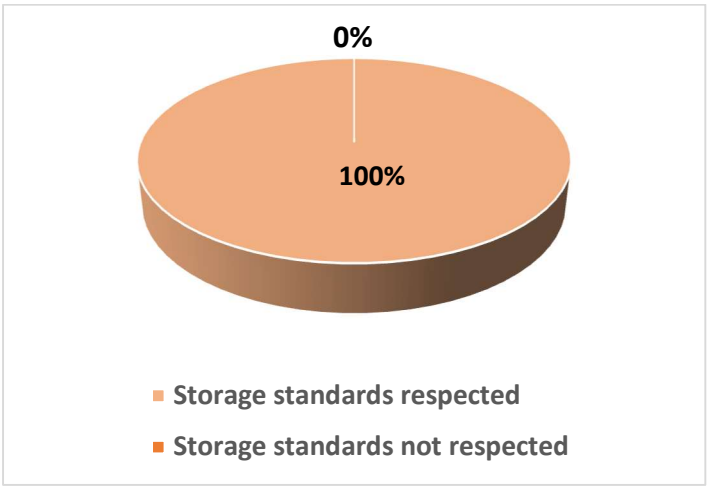


The responses indicated that 80% of companies identify their pollutants as special hazardous waste, requiring specific management measures in terms of confinement and transportation. The remaining 20% are classified as special waste, whose treatment demands fewer specific measures compared to the former, although still necessary to avoid risks that could result in significant financial costs for the company.

In this regard, reference is made to Law No. 01-19 of 27 Ramadhan 1422 (corresponding to December 12, 2001), which regulates the management, control, and elimination of waste in Algeria. Within this regulatory framework, particular emphasis is placed on compliance with the organization and maintenance of areas dedicated to waste confinement.

All surveyed companies expressed a positive assessment regarding adherence to the regulatory and technical standards governing the storage and management of both special hazardous waste and other types of waste. Figure 3 illustrates the position of the surveyed companies with respect to their compliance with regulatory requirements for waste management.

Fig.3. Compliance with waste storage standards

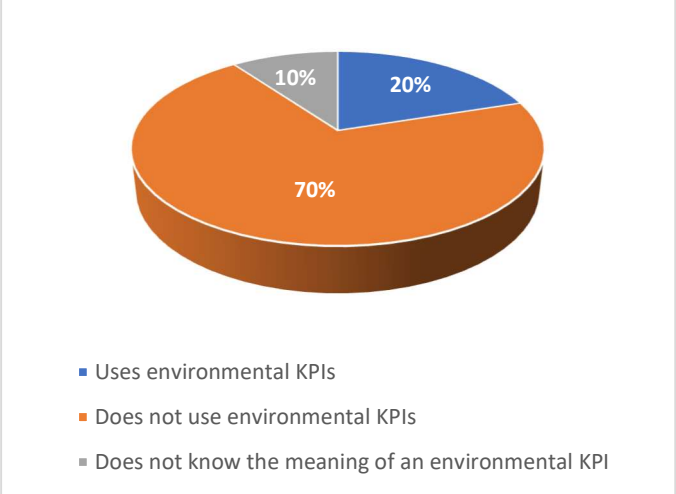


Given that the management of industrial waste stocks generates considerable costs, our approach was to assess whether companies had implemented an environmental management

accounting system. Such a system would provide firms with a clearer perspective on their environmental initiatives. However, all responses proved negative. This was either because environmental expenditures were combined with the company's capital assets or because they were treated as operating expenses. Furthermore, these costs were not incorporated into management accounting when evaluating the firm's operational costs, generally due to a lack of resources and the absence of specialized staff in this field.

In order to highlight the company's efforts with respect to environmental issues, we sought to identify the key indicators of its environmental performance. Figure 4 presents the extent to which environmental performance indicators are employed in managing pollutants, according to the nature of the waste generated.

Fig.4. Utilization of environmental KPIs

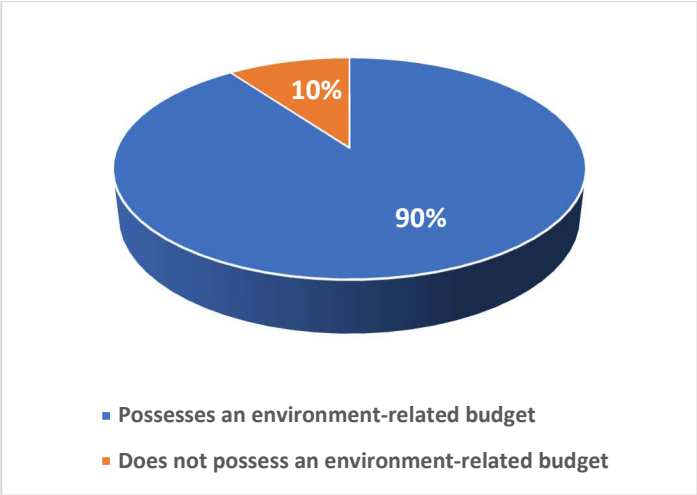


According to the responses, 20% of the companies certified under ISO 9001 and ISO 14001 confirmed that the national environmental policy does not establish the environmental performance parameters they use to develop relevant indicators. Nevertheless, these companies rely on international standards to enhance their corporate reputation among stakeholders, particularly foreign clients. Among the remaining firms, 70% reported that the national environmental policy does not provide indicators related to the management of greenhouse gas emissions, the production of hazardous waste, or the reuse of pollutants in the value-creation process. The final 10% acknowledged a lack of knowledge regarding environmental performance indicators, largely due to the absence of specialized expertise in environmental management.

Given the expenses incurred by companies in complying with regulatory requirements on best practices for the storage, transport, and treatment of special waste, the primary objective is to improve stakeholder perceptions. To this end, we examined whether companies had established a specific budget to ensure the systematic management of such expenditures, with the dual aim of optimizing environmental costs and promoting good sustainable development practices within the organization.

Figure 5 illustrates the managerial culture of company leaders in the surveyed firms, highlighting those that establish an environmental budget in order to facilitate the monitoring of operational management and ensure alignment with the objectives defined by strategic management.

Fig.5. Budgeting of environmental management



According to 90% of the surveyed companies, their environmental budget consists exclusively of the environmental tax, which is calculated based on the volume produced during the financial year. Respondents indicated that historical costs include expenditures on infrastructure and equipment dedicated to environmental protection. However, this practice appears to reflect a lack of expertise in environmental accounting and environmental management accounting. Such competencies would allow firms to distinguish operating costs from environmental expenditures, thereby facilitating environmental financial quantification. This, in turn, would enable the assessment of environmental financial performance and the evaluation of the impact of ecological initiatives on overall corporate performance.

Furthermore, 20% of the certified companies stated that national environmental policy does not encourage investment in managerial innovation, nor does it promote the mobilization of human and material resources to examine the costs associated with environmental initiatives. They emphasized that the company's mission regarding environmental preservation does not alter the calculation mechanism of the ecological tax, which remains unaffected by the absence of comprehensive environmental performance indicators that could serve as strategic benchmarks and operational objectives.

As for the remaining 10% of companies, the education and training levels of their managers revealed a lack of knowledge concerning environmental budgeting, and more specifically, environmental management practices.

Finally, in response to the last question, nearly all surveyed firms confirmed the absence of an established management control system, given the challenges posed by environmental policy and managerial culture.

Conclusion

The objective of this research was to analyze environmental management control as a lever for competitiveness and sustainability among Algerian firms, within the broader context of an evolving competitive and regulatory environment. More specifically, the study sought to understand how companies adapt to environmental regulations governing industrial waste management and to assess their managerial maturity in handling environmental costs and evaluating ecological performance.

The findings reveal that the culture of environmental management remains limited, particularly among small and medium-sized enterprises, due to insufficient training and awareness among managers. Corporate environmental actions are largely reactive and regulation-driven, focusing on compliance and image preservation rather than on proactive strategies that embed

sustainability into overall management systems. Even ISO-certified firms tend to align their environmental commitments primarily with external stakeholder expectations.

Furthermore, the absence of clearly defined environmental indicators prevents companies from setting measurable objectives and developing a coherent environmental budget, thereby constraining the effectiveness of environmental management control. This indicates that current practices are still driven more by regulatory compliance than by a structured managerial approach to sustainability.

Finally, the implementation of environmental management control in Algerian SMEs is hindered by an insufficient institutional and legal framework. The lack of mandatory social or environmental reporting standards limits firms' ability to identify, measure, and monitor environmental costs. Establishing such legislation would be a crucial step toward fostering a culture of environmental control and ensuring its effective integration into managerial practices across Algerian enterprises.

Limitations and directions for future research

Although this research provides valuable insights into environmental management control (EMC) practices within Algerian companies, certain limitations restrict the generalizability of its findings. The relatively small sample size, limited to 50 companies in the Oran region, reduces national representativeness. Moreover, the limited number of questions in the survey, designed to prevent respondent fatigue, may not have fully captured the complexity of managerial practices related to EMC. The reliance on self-reported data may also introduce perception or desirability biases, while the cross-sectional design does not allow for the observation of changes over time.

These findings open several avenues for improvement. Future studies should expand the scope to include additional regions and sectors, adopt a mixed-method approach combining quantitative and qualitative analyses, and develop more comprehensive questionnaires integrating environmental accounting and performance indicators. Finally, longitudinal research would make it possible to assess the gradual integration of EMC into managerial practices in response to regulatory and cultural developments.

Recommendations and research perspectives

This study highlights the need to strengthen the institutional and managerial foundations of environmental management control (EMC) in Algeria. Companies should integrate environmental objectives into their strategic planning, supported by clear regulatory frameworks, defined performance indicators, and mandatory sustainability reporting. Training programs in environmental accounting and cost management are essential to overcome the shortage of qualified professionals. Firms are also encouraged to adopt ISO 14001 certification and implement environmental information systems to improve data traceability and decision-making.

Future research should examine the sectoral and regional determinants of EMC adoption, evaluate the effectiveness of specific tools such as environmental budgeting and dashboards, and explore how organizational culture and governance influence implementation. Strengthening both institutional mechanisms and managerial competencies will enable Algerian firms to transition from regulatory compliance to proactive environmental performance management.

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