

# ASSESSING THE EFFECTIVENESS OF ISO 14001 IN MANAGING AND EVALUATING ENVIRONMENTAL IMPACTS: A CASE STUDY OF A LOGISTICS COMPANY

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**Abstract:** The logistics sector is a major contributor to environmental degradation, particularly in emerging economies where regulatory oversight is weak. This study investigates the effectiveness of ISO 14001:2015 implementation at Condor Logistics, a leading Algerian transport and distribution company. Using a qualitative single-case study design combining document analysis, direct observation, and external validation, we applied a severity–frequency criticality matrix to evaluate environmental aspects. Results indicate that the Environmental Management System (EMS) effectively addresses internal operational risks (e.g., diesel spills, oily wastewater), enabling low-cost, practical improvements. However, it fails to manage external environmental pressures, notably toxic gas emissions from a neighboring facility, despite their high criticality (C = 12). This gap reveals a systemic limitation in operationalizing Clause 6.1.2 on "influenceable aspects." To our knowledge, this is the first study that addresses this gap by applying a rigorous quantitative assessment of environmental aspects and critically analyzing externality management within an Algerian logistics context. We argue that ISO 14001's strategic potential in complex industrial ecosystems depends on strengthening collaborative governance mechanisms for cross-boundary risks. The findings contribute to the growing literature on EMS effectiveness in resource-constrained settings and offer actionable insights for practitioners and policymakers in emerging economies.

**Keywords:** EMS, logistics sustainability, environmental externalities, emerging economies, criticality assessment.

## INTRODUCTION

Environmental degradation has emerged as one of the most pressing challenges of the 21st century, particularly in emerging economies where rapid industrial expansion often outpaces regulatory enforcement and institutional capacity. Despite increasing global awareness, many organizations continue to face difficulties in integrating environmental considerations into their core operational and strategic practices.

In response to these challenges, Environmental Management Systems (EMS), especially ISO 14001, have been widely adopted as structured frameworks for managing environmental impacts. Based on the principle of continuous improvement and the Plan–Do–Check–Act (PDCA) cycle, ISO 14001 enables organizations to systematically identify environmental aspects, ensure regulatory compliance, and enhance environmental performance over time. Its global diffusion reflects its dual role as both a compliance mechanism and a strategic management tool.

However, the actual effectiveness of ISO 14001 remains contested, particularly in emerging economies. While a substantial body of literature has explored the drivers and barriers to EMS adoption, relatively limited attention has been paid to its operational effectiveness—namely, how environmental aspects are concretely identified, evaluated, and managed within organizations. This gap is especially significant in the logistics sector, which is characterized by complex operations, high energy consumption, and multiple sources of environmental impact across supply chains.

Indeed, logistics activities generate substantial environmental pressures, including greenhouse gas emissions, resource depletion, and waste production. Although ISO 14001 offers a structured approach to mitigate these impacts, its capacity to address both internal operational risks and external environmental influences remains insufficiently understood.

This study addresses this gap by examining the implementation of ISO 14001 within Condor Logistics, a major Algerian transport and distribution company. It focuses specifically on the Environmental Aspect Evaluation (EAE) process, analyzing how environmental aspects are identified, prioritized, and managed using a severity–frequency (G × F) criticality matrix.

The contribution of this study is twofold. First, it provides an empirical and methodologically structured assessment of EMS effectiveness in a logistics context within an emerging economy. Second, it highlights a critical limitation of ISO 14001 in managing external environmental pressures, emphasizing the need to strengthen collaborative governance mechanisms for addressing cross-boundary environmental risks.

## Theoretical Background and Literature Review Function of the Environmental Management System

The Plan-Do-Check-Act (PDCA) cycle is a continuous, iterative process that enables an organization to establish, implement, maintain, and continually improve its environmental management system (EMS) in alignment with its environmental

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policy and objectives. By following this systematic approach, organizations can enhance their environmental performance and ensure long-term sustainability.

#### a) Plan – Planning for Environmental Improvement

In the planning phase, the organization defines the key elements for developing and implementing an effective Environmental Management System (EMS). This starts with understanding its internal and external context, identifying interested parties and their needs, and setting the system's scope. Leadership is reinforced through top management commitment and the establishment of a clear environmental policy aligned with sustainability goals. Roles and responsibilities are clearly assigned, while environmental aspects and their impacts are identified. The organization also addresses legal and other compliance obligations, evaluates environmental risks and opportunities, and establishes measures to manage them. Finally, measurable environmental objectives with performance indicators are set, supported by action plans to ensure continual improvement in environmental performance.

### **Do - Implementation of the EMS**

In the implementation phase, the organization carries out the plans to establish and operate an effective Environmental Management System (EMS). This involves providing the necessary resources, ensuring staff competence through training and awareness, and setting up clear communication channels internally and externally. Documented information is managed to keep records accurate and controlled. Operational controls are applied to manage activities in line with EMS requirements, including outsourced work. Lastly, emergency preparedness and response procedures are developed to address potential environmental emergencies effectively.

### **Check - Monitoring and Evaluation**

The checking phase ensures the EMS is effective, compliant, and aligned with organizational goals. It includes ongoing monitoring, measurement, and evaluation of environmental performance, as well as assessing compliance with legal and other obligations. Internal audits are performed to verify effectiveness and conformity, and management reviews are conducted periodically to confirm the system's suitability and support for environmental objectives.

### **Act - Action for Improvement**

In the action phase, the focus shifts toward continual improvement of the EMS based on the findings from the previous stages. When nonconformities are identified, the organization takes corrective actions to address these issues and prevent their recurrence. This phase emphasizes the need for ongoing enhancement of the EMS by improving its suitability, adequacy, and effectiveness. By doing so, the organization can enhance its overall environmental performance, adapt to changing conditions, and better meet stakeholder expectations.

### **Understanding ISO 14001**

ISO 14001 is an international environmental management standard developed in 1996 by the International Organization for Standardization (ISO). It is a process-oriented standard that does not specify particular environmental goals to be achieved (Herás-Saizarbitoria & Boiral, 2013 ; Aragon-Correa et al., 2020). Instead, it assists organizations in designing and implementing systems to manage their environmental impacts. Its adoption is voluntary, meaning no central authority provides rewards for compliance or imposes sanctions for non-adoption (Ingram & Silverman, 2002). Compliance with ISO 14001 can be certified by independent third-party auditors accredited by national accreditation bodies, typically at the facility level.

With increasing interest among organizations—regardless of size or type—in respecting and continuously improving environmental quality, greater attention is being paid to the potential environmental impacts of their activities, products, and services. Interested parties, both internal and external, increasingly consider environmental performance as a priority. Achieving strong environmental performance requires the entire organization to adopt a systematic approach alongside a commitment to the continuous improvement of the EMS.

The ISO 14001 standard primarily aims to assist organizations seeking to implement or improve an environmental management system, thereby enhancing their environmental performance. This international standard aligns with the concept of sustainable development and is compatible with various cultural, social, and organizational frameworks, as well as other management systems. Organizations of all types, sizes, and maturity levels across all sectors and regions can apply this standard. Furthermore, the standard addresses the specific needs of small and medium-sized enterprises (SMEs), encouraging them to adopt an environmental management system tailored to their operational nature and requirements. ISO 14001 is part of the series of environmental management standards developed by the ISO/TC 207 technical committee.

### **Environmental Management Systems in Emerging Economies**

Recent scholarship emphasizes the contextual challenges of EMS implementation in emerging economies. Institutional weaknesses, lack of regulatory enforcement, and limited managerial capacity often constrain the effectiveness of formal systems like ISO 14001 (Boiral et al., 2022). However, when properly adapted, EMS can serve as a catalyst for organizational learning and stakeholder engagement, even in low-resource settings (Aragon-Correa et al., 2020).

### **ISO 14001 in the Logistics Sector**

The logistics sector presents unique environmental challenges due to its reliance on fossil fuels, extensive land use, and complex supply chains. Recent studies confirm that ISO 14001 can help logistics firms reduce emissions, optimize resource use, and comply with tightening environmental regulations, but only if implementation moves beyond symbolic compliance

toward genuine operational integration (Govindan & Hasanagic, 2022; Horry et al., 2023).

### Strategic Environmental Decision-Making

Corporate-level environmental decisions are increasingly shaped by global stakeholder pressures, ESG (Environmental, Social, Governance) reporting demands, and supply chain sustainability requirements (Herás-Saizarbitoria et al., 2020). In emerging markets, however, decision-making is often reactive rather than strategic, due to short-term financial pressures and weak institutional support (Testa et al., 2021).

### RESEARCH METHODOLOGY

This study adopts a qualitative single-case study design (Yin, 2018), chosen for its ability to explore complex phenomena within their real-life context. The case site is Condor Logistics, a company managing a large fleet for national and cross-border transportation, warehousing, and distribution. The research is grounded in the Environmental Aspect Evaluation (EAE) process as defined by ISO 14001, which systematically identifies, assesses, and prioritizes environmental aspects according to their potential impacts. This framework guided the entire process of data collection and analysis, ensuring consistency with organizational environmental management practices.

Data were collected through two main sources:

**Document analysis:** Review of EMS procedures, environmental aspect registers, management programs, and EAE records.

**Direct observation:** Field visits to operational sites, including transport operations, vehicle washing areas, maintenance workshops, and storage facilities, in order to validate reported practices and detect unrecorded aspects.

Data analysis followed the ISO 14001 PDCA cycle (Plan–Do–Check–Act), with emphasis on the "Plan" and "Do" phases:

In the Plan phase, environmental aspects were identified and evaluated using EAE criteria such as frequency, scale, severity, regulatory compliance, and stakeholder concern.

In the Do phase, the corresponding management programs and control measures were implemented based on EAE outcomes.

This methodology ensured a rigorous, structured, and context-sensitive assessment of how Condor Logistics translated environmental aspect identification into operational practice, thereby validating the effectiveness of its EAE process within the EMS.

To ensure deep contextual understanding, the primary investigator leveraged prior professional experience as the former QHSE Manager at Condor Logistics. To mitigate potential observer bias and ensure objectivity, data triangulation was strictly enforced: findings from internal documents were cross-validated against direct field observations and

independently reviewed by an external ISO auditor not affiliated with the company's management. This position provided privileged access to the organization's operational context, decision-making processes, and complete EMS documentation. To ensure objectivity and reduce potential bias, the analysis was explicitly grounded in ISO 14001 requirements, and findings from document analysis were systematically cross-validated with direct field observations.

### Environmental Analysis of the Site

In order to establish an effective Environmental Management System (EMS), Condor Logistics must develop a comprehensive understanding of how it interacts with the environment, including the elements of its activities, products, and services that may have environmental impacts (6.1.2.2). These elements are referred to as environmental aspects. Condor Logistics should identify the environmental aspects it can control and those over which it can exert influence (6.1.2.3), taking into account a life cycle perspective.

The changes in the environment, whether adverse or beneficial, that result either fully or partially from environmental aspects are known as environmental impacts. The relationship between environmental aspects and their associated impacts is one of cause and effect. Condor Logistics should understand those aspects that have, or can have, significant environmental impacts; these are referred to as significant environmental aspects (6.1.2.4). Identifying such aspects may highlight the need for action to protect the environment.

Identifying significant environmental aspects and their related impacts is essential for determining the necessary controls or improvements, as well as for setting priorities for management actions (6.1.2.5). The identification of significant environmental aspects is an ongoing process. It enhances Condor Logistics' understanding of its relationship with the environment and contributes to the continuous improvement of its environmental performance through the enhancement of its Environmental Management System (EMS).

### Environmental Aspect Evaluation

To identify significant environmental aspects within an Environmental Management System (EMS), it is essential to assess the criticality of each aspect. This is generally calculated using the following formula (Equation 01):  $\text{Criticality} = \text{Severity of the Impact} \times \text{Frequency of Occurrence}$  (Equation 01). This approach allows for the classification of aspects according to their priority level and helps guide corrective or preventive actions toward the most critical aspects. The severity levels used in the criticality assessment are defined in Table 1. Similarly, the frequency categories of the impact are outlined in Table 2.

**Table 1.**

Severity of the Impact (G)  
The severity corresponds to the intensity of an aspect's effect on the environment

1	Low	Negligible impact on the environment
2	Medium	Noticeable disturbance to the environment, significant degradation of one or more environmental media
3	High	Severe degradation of environmental quality
4	Very High	Very severe degradation of environmental quality, possibly irreversible

**Table 2.**

Frequency of Occurrence of the Impact

1	Low	The impact occurs discontinuously ( $\leq 20\%$ of the time).
2	Medium	The impact occurs discontinuously (between 20% and 50% of the time).
3	High	The impact occurs almost continuously (between 50% and 80% of the time).
4	Very High	The impact is quasi-continuous (more than 80% of the time).

Environmental aspects are considered significant when the observed significance is assessed to be above a defined threshold, namely  $(G \times F)$  greater than the threshold to be determined. Aspects rated as NC (Non-Conforming) are systematically classified as significant.

## RESULTS AND DISCUSSION

### Results of the Environmental Study of the Site

The systematic analysis of environmental aspects within the logistics institution studied in Bordj Bou Arréridj identified a broad spectrum of interactions between operational activities and the environment. Applying the ISO 14001 methodology (see Table 3), which is based on the calculation of criticality ( $C = \text{Severity} \times \text{Frequency}$ ), revealed that the majority of identified aspects—particularly fuel consumption, exhaust emissions, and waste similar to municipal solid waste—are classified as "Conforming" (C). This classification indicates that although these impacts are omnipresent during normal operations (N situation), they are considered to pose an acceptable or manageable level of risk under the company's current practices. Their criticality, generally less than or equal to 8, reflects either moderate severity, controllable frequency, or both.

However, the evaluation exercise highlighted four (04) critical aspects classified as "Non-Conforming" (NC), characterized by high criticality ( $C = 12$ ) and occurrence in abnormal situations (AN) or with significant environmental impact. These aspects represent the system's major vulnerabilities and require the urgent implementation of corrective and preventive measures:

**Diesel spillage during transport:** This aspect, associated with soil pollution, exhibits high severity ( $G=3$ ) and very high frequency ( $F=4$ ). It reflects a significant operational risk linked to fuel transportation activities, potentially leading to widespread and persistent soil contamination with potentially irreversible consequences for local ecosystems.

**Liquid discharges (oily water) from the washing area:** Classified under normal conditions (N) but with maximum criticality ( $C=12$ ), this aspect underscores a structural failure in wastewater management. The high severity ( $G=3$ ) of water pollution combined with its quasi-continuous occurrence ( $F=4$ ) makes it a top

priority, jeopardizing the quality of surrounding water resources.

**Waste (sludge) from the washing area:** Similarly, sludge generated from vehicle washing, rich in hydrocarbons and particles, is produced quasi-continuously ( $F=4$ ) and presents a high risk of soil and water pollution through infiltration ( $G=3$ ). Its inadequate management represents a source of diffuse and chronic pollution.

**Toxic gas emissions (THT) from the neighboring gas pressure regulation station:** Although originating from an external source, this aspect

was included because the company can exert influence over its immediate environment. The very high severity ( $G=3$ ) and constant frequency ( $F=4$ ) of this risk justify its inclusion within the EMS scope, in accordance with the spirit of the ISO 14001 standard, which encourages consideration of aspects over which the organization can exert influence.

The identification of these four NC aspects demonstrates the effectiveness of the ISO 14001 methodology in precisely targeting environmental hotspots. It enables a shift from a reactive to a proactive risk management approach. These results confirm that the most severe impacts are not necessarily linked to core activities (such as fuel consumption), but rather to control failures, recurring incidents, or poorly managed externalities. This prioritization forms the scientific and operational foundation of the Environmental Management Program (EMP) developed by the company, which assigns specific objectives, actions, responsibilities, and deadlines to address each of these critical aspects. These results highlight that the ISO 14001 tool, when rigorously applied, not only allows for the assessment of a logistics company's environmental footprint but also transforms this assessment into a strategic action plan. It is an essential lever for reconciling operational performance with environmental responsibility, particularly in a context of limited resources, as observed in this Algerian case study.

**Table 3.**

Identification of Environmental Aspects of Site Activities and Assessment of Their Frequency (F), Severity (G), Criticality (C)

Process / Activity	Tasks	Aspect	Impact	Situation		Impact Assessment				
				N	AN	G	P	C	C/NC	
Transport activity	Fuel transport (diesel)	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Spillage of transported diesel	Soil pollution		AN	3	4	12	NC	
		Fuel spillage	Soil pollution		AN	2	3	6	C	
	Goods transportation	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Fuel spillage	Soil pollution		AN	1	3	3	C	
	Personnel transportation	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Fuel spillage	Soil pollution		AN	1	3	3	C	
	Vehicle parking lots	Office work	Similar household waste (paper, plastic, glass, metal)	Soil pollution	N		1	4	4	C
			Special waste (electric batteries, fluorescent lamps)							
Vehicle parking		Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Fuel spill	Soil pollution		AN	1	3	3	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
Semi-trailer coupling/uncoupling		Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Fuel spill	Soil pollution		AN	2	3	6	C	
Vehicle verification operation		Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Fuel spill	Soil pollution		AN	2	3	6	C	
Traffic area		Similar household waste (plastic packaging and cardboard)	Soil pollution	N		1	4	4	C	
		Special waste (contaminated sand))								
		Exhaust gas and dust emissions	Air pollution	N		1	4	4	C	
		Fuel spill	Soil pollution		AN	2	3	6	C	
Vehicle maintenance workshop		Vehicle reception	Fuel consumption	Depletion of natural resources	N		2	4	8	C
			Exhaust gas emissions	Air pollution	N		1	4	4	C
			Fuel spill	Soil pollution		AN	1	3	3	C
	Vehicle diagnostics	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Electricity consumption	Depletion of natural resources	N		1	4	4	C	
		Fuel spill	Soil pollution		AN	1	3	3	C	
	Maintenance/repair work	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Lubricant consumption	Depletion of natural resources	N		1	4	4	C	
		Electricity consumption	Depletion of natural resources	N		1	4	4	C	
		Special waste (metal parts, used tires, brake pads)	Soil pollution	N		2	4	8	C	
		Special hazardous waste (batteries, used oil, soiled rags, sawdust) similar household waste (plastic packaging, cardboard)								
		Liquid discharges	Water pollution	N		2	4	8	C	
		Oil/Fuel Spill	Soil pollution		AN	1	4	4	C	



Process / Activity	Tasks	Aspect	Impact	Situation		Impact Assessment				
				N	AN	G	P	C	C/NC	
	Traffic area	Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Similar household waste (paper, plastic, glass)	Soil pollution	N		1	4	4	C	
Washing area	Vehicle reception	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Oil/Fuel Spill	Soil pollution		AN	1	4	4	C	
	Vehicle cleaning	Water consumption	Depletion of natural resources	N		1	4	4	C	
		Electricity consumption	Depletion of natural resources	N		1	4	4	C	
		Liquid discharges	Water pollution	N		3	4	12	NC	
		Special hazardous waste (sludge)	Soil pollution	N		3	4	12	NC	
	Traffic area	Oil/Fuel Spill	Soil pollution		AN	1	4	4	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Similar household waste (plastic packaging, cardboard) Special hazardous waste (contaminated sand)	Water pollution	N		2	4	8	C	
Oil/Fuel Spill		Soil pollution		AN	1	4	4	C		
Generator set	Electricity production	Fuel consumption	Depletion of natural resources	N		2	2	4	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Noise	Auditory fatigue	N		2	4	8	C	
		Fuel spill	Soil pollution		AN	2	4	8	C	
Air compressor	Compressed air production	Electricity consumption	Depletion of natural resources	N		2	4	8	C	
		Noise	Auditory fatigue	N		2	4	8	C	
Storage warehouse	PDR and consumable reception	Fuel consumption	Depletion of natural resources	N		2	4	8	C	
		Exhaust gas emissions	Air pollution	N		1	4	4	C	
		Oil/Fuel Spill	Soil pollution		AN	1	4	4	C	
		Chemical spill	Soil pollution		AN	1	4	4	C	
	Layout/ storage	Electricity consumption	Depletion of natural resources	N		2	4	8	C	
		Oil spill			AN	2	3	6	C	
	Delivery	Chemical spill	Soil pollution		AN	1	4	4	C	
Administrative block	Office work	Electricity consumption	Depletion of natural resources	N		2	4	8	C	
		Similar household waste (plastic and cardboard packaging, paper, etc.) Hazardous special waste (neon tubes, printing toner)	Soil pollution	N		1	4	4	C	
	Document archiving	Electricity consumption	Depletion of natural resources	N		1	4	4	C	
		Paper consumption	Depletion of natural resources	N		2	4	8	C	
	Traffic area	Electricity consumption	Depletion of natural resources	N		1	4	4	C	
		Similar household waste (plastic and cardboard packaging, paper, etc.)	Soil pollution	N		2	4	8	C	
	Guarding	Internal security	Electricity consumption	Depletion of natural resources	N		1	4	8	C
			Similar household waste (plastic packaging waste, garbage)	Soil pollution	N		2	4	8	C
Sanitary facilities	Shared bathroom	Water consumption	Depletion of natural resources	N		1	4	4	C	
		Electricity consumption	Depletion of natural resources	N		1	4	4	C	

Process / Activity	Tasks	Aspect	Impact	Situation		Impact Assessment			
				N	AN	G	P	C	C/NC
Waste area	Waste management and storage	Liquid discharges (wastewater)	Water pollution	N					
		Chemical spill	Water pollution		AN	1	4	4	C
		Fuel consumption	Depletion of natural resources	N		2	4	8	C
	Waste disposal	Exhaust gas emissions	Air pollution	N		1	4	4	C
		Oil spill	Soil pollution		AN	3	4	12	NC
		Fuel consumption	Depletion of natural resources	N		2	4	8	C
Neighboring activities	RN45 road traffic circulation	Exhaust gas emissions	Air pollution	N		2	4	8	C
		Exhaust gas emissions	Air pollution	N		1	1	4	C
	Construction work	Inert waste	Soil pollution	N		1	3	3	C
		toxic gases (THT)	Air pollution		AN	3	4	12	NC
	Gas pressure regulators								

Table 4.

Environmental Aspects Management Program

N°	Environmental Aspect	Environmental Impact	Objective (Target)	Involved Department	Actions	Deadline	Responsible	Human/Technical Resources	Indicator
01	Spillage of transported diesel	Soil pollution	Minimize spills	Operations	Equip with suitable tanks	4 months	Operations Department Head	Monitoring and measurement procedure	No spillage
02	Liquid discharges (oily water) from workshop	Water pollution	Control and treat oily water	Maintenance	Recover oily water (install treatment system)	6 months	Maintenance Department Head	Monitoring and measurement procedure/The oil-water separator tank	Discharge limit values respected
03	Liquid discharges (oily water) from washing area	Water pollution	Control and treat oily water	Operations	Treat water before discharge	6 months	Operations Department Head	Monitoring and measurement procedure/The oil-water separator tank	Discharge limit values respected
04	Waste (sludge) from washing area	Water pollution	Minimize the quantity of sludge discharged	Operations	Sludge recovery	6 months	Operations Department Head	Monitoring and measurement procedure/Waste management procedure	Sludge recovered and removed
05	Toxic gases from gas pressure regulating station	Air pollution	/	Operations		12 months	General Manager/Operations Department Head	/	

**Results Obtained from the Environmental Aspects Management Program**

The program analysis highlights a structured approach addressing four non-conforming aspects identified during the initial assessment, complemented by one external aspect related to the organization's sphere of influence. Each action plan incorporates the core components of objective-based management: target, actions, timeline, responsible party, resources, performance indicator, and are summarized in Table 4.

The first four actions demonstrate strong operational effectiveness:

Diesel spill prevention (Aspect 01): Installation of containment tanks provides a simple yet high-impact prevention measure. The indicator "no spillage" reflects zero tolerance for this high-risk incident (C=12).

Treatment of oily water (Aspects 02-03): Implementation of an oil-water separator ensures regulatory compliance. The indicator "discharge limit values" is quantitative, verifiable, and legally aligned, strengthening EMS credibility.

Sludge management (Aspect 04): Minimization and safe recovery of washing sludge, monitored through

the indicator "sludge recovered and removed," integrate seamlessly into existing waste procedures and ensure long-term sustainability.

These measures are technically feasible, economically accessible, and rapidly deployable (within 4–6 months). They illustrate how an EMS can deliver tangible environmental benefits without heavy investments, consistent with findings by Aragon-Correa et al. (2020) on SMEs in emerging markets.

By contrast, the fifth aspect toxic gas emissions (THT) from a neighboring station reveals a methodological weakness. Its inclusion reflects ISO 14001's principle of "influence," yet the absence of objectives, an action plan, and performance indicators leaves a significant risk (C=12) unaddressed. A more rigorous approach, in line with ISO 14001:2015 Clause 6.1.2, would involve:

Establishing a reporting protocol with operators and authorities;

Installing on-site air quality monitoring sensors;

Developing an emergency response plan;

Initiating structured dialogue with the neighboring operator.

This omission undermines EMS credibility and aligns with institutional theory perspectives (DiMaggio & Powell, 1983), suggesting that in emerging economies, ISO 14001 adoption may drift towards coercive isomorphism (meeting basic regulations) rather than normative isomorphism (genuine environmental stewardship), particularly regarding externalities beyond direct operational control. This omission undermines EMS credibility and highlights a recurring challenge in ISO 14001 implementation: integrating externalities and systemic risks into internal action plans. To address this gap, we propose a three-tier framework for managing 'influenceable' externalities in industrial clusters: (1) mapping stakeholder influence networks, (2) establishing collaborative monitoring protocols, and (3) developing joint emergency response mechanisms. This framework warrants empirical testing in future multi-case studies. Overall, the program confirms the relevance of the ISO 14001 framework for logistics companies with limited resources, providing a reproducible model for prioritizing and mitigating critical environmental impacts, but its effectiveness remains constrained by incomplete treatment of external aspects.

### **Comparative Insights : Algeria in the Global Context of Emerging Economies**

The experience of Condor Logistics in Algeria gains broader relevance when compared with ISO 14001 implementations in other emerging economies, particularly in the logistics sector. Recent studies from Malaysia, Colombia, Turkey, and Brazil reveal both

convergences and divergences that illuminate the contextual nature of EMS effectiveness. A synthesis of these international experiences is presented in Table 5.

In Malaysia, Omran and Yahya (2020) found that logistics firms often adopt ISO 14001 primarily to meet client demands or enhance corporate image, with limited operational integration. Environmental management remains largely symbolic, and external aspects such as emissions from neighboring facilities are systematically ignored. By contrast, our study demonstrates a more rigorous and technically grounded approach, particularly through its use of a quantitative criticality matrix ( $G \times F$ ) to prioritize actions. This suggests that local managerial commitment can drive substantive EMS implementation even in contexts of institutional weakness.

In Colombia, Molina-Reyes et al. (2022) documented the successful integration of ISO 14001 with occupational health standards (ISO 45001), enabling synergies in risk management. While Condor Logistics has not yet pursued such integration, its Environmental Management Program (EMP) shows comparable rigor in addressing internal operational risks (e.g., oily water discharges). However, both the Colombian and Algerian cases share a critical gap: the inadequate treatment of external environmental aspects. In Colombia, upstream supply chain emissions are deprioritized; in Algeria, toxic gas emissions from a neighboring pressure station (Aspect 05) are correctly identified as significant but are left without concrete mitigation measures.

Expanding the comparison, Turkish logistics firms (Yıldız & Özdemir, 2021) exhibit strong documentation and audit readiness driven by EU market pressures, but struggle with translating EMS into daily operational practices. Similarly, Brazilian companies (Oliveira et al. 2022) show advanced stakeholder engagement but often lack the technical capacity to manage cross-boundary risks, mirroring the challenge faced by Condor Logistics with Aspect 05.

These cross-national patterns confirm a key insight: ISO 14001 certification alone does not guarantee environmental performance. What matters is how the standard is contextualized, resourced, and operationalized. The Algerian case contributes a valuable model: even with limited budgets, a methodologically sound EAE process and a targeted EMP can yield tangible improvements. Yet, like its peers in Malaysia, Colombia, Turkey, and Brazil, it stumbles on the same systemic blind spot: the operationalization of externalities. This recurring limitation calls for a reinterpretation of Clause 6.1.2 of ISO 14001:2015 not as a theoretical footnote, but as a practical imperative for collaborative risk governance in industrial clusters.

**Table 5.**

Comparative Analysis of ISO 14001 Implementation in the Logistics Sector Across Emerging Economies

Country	Main Motivation	EMS Strength	Major Weakness	Reference
Algeria	Operational improvement + compliance	Rigorous G×F matrix	Aspect 05 untreated	Current Study
Malaysia	Image / customers	Low integration	Ignored externalities	Omran & Yahya (2020)
Colombia	Regulation + SMS integration	ISO 14001/45001 Synergy	Qualitative assessment	Molina-Reyes et al. (2022)
Turkey	EU pressure	Good documentation	Low operational action	Yıldız & Özdemir (2021)
Brazil	Stakeholder pressure	Supply chain integration	External risks ignored	Oliveira et al. (2022)
India	National regulations	Detailed KPIs	Limited resources	Sharma & Bansal (2023)

## CONCLUSION

This research underscores the applicability of ISO 14001 as an effective framework for managing environmental risks in the logistics sector, even within the constraints of emerging markets. The program implemented at Condor Logistics successfully addressed four non-conforming aspects through technically sound, economically viable, and rapidly deployable measures. These results confirm that meaningful environmental improvements can be achieved without heavy investments, thereby reinforcing the value of resource-efficient strategies for SMEs.

Nonetheless, the treatment of the external aspect toxic gas emissions from a neighboring station reveals a critical methodological shortcoming. By neglecting to define objectives, actions, and performance indicators, the program falls short of ISO 14001's requirement to manage significant impacts within the organization's sphere of influence. This omission highlights a broader challenge in EMS implementation: the difficulty of integrating systemic and external risks into organizational practices.

The contribution of this study lies in demonstrating both the strengths and the limitations of EMS in contexts where resources are limited but environmental stakes are high. To enhance managerial and scientific validity, future research should adopt multi-case and comparative designs, enabling cross-sectoral learning and broader generalization. Such an approach would clarify how ISO 14001 can evolve beyond regulatory compliance into a strategic instrument for resilience, competitiveness, and sustainable growth in logistics and other high-impact industries.

## Strategic Recommendations

### For Condor Logistics:

**Complete Aspect 05 Management Plan:** Define clear objectives (e.g., "Mitigate exposure risk from THT emissions"), implement concrete actions (install air quality sensors, establish a formal dialogue with the neighboring operator, develop an emergency response protocol), and assign measurable indicators (e.g., "number of joint safety drills conducted annually" or "Air quality alerts resolved within 24h").

**Institutionalize Environmental Training:** Launch mandatory, role-specific environmental awareness and competency programs, particularly for frontline operational staff, to embed environmental responsibility into organizational culture.

**Secure Dedicated EMS Funding:** Establish an annual environmental improvement budget to ensure continuity, scalability, and responsiveness to emerging environmental risks and opportunities.

### For Policymakers and Industry Leaders:

**Launch Sector-Specific EMS Promotion Programs:** Develop targeted awareness campaigns and provide technical/financial incentives, especially for SMEs, to overcome adoption barriers (Amara & Bougherara, 2023).

**Develop Contextualized Implementation Toolkits:** Create simplified, Arabic/French-language ISO 14001 implementation guides tailored to the Algerian logistics context, addressing common operational and regulatory challenges.

**Foster Academic-Industry Collaboration:** Encourage multi-case research across Algerian logistics hubs to validate implementation models, particularly concerning cross-boundary environmental risks and supply chain pressures (Boiral et al., 2022).

## Global Context and Future Outlook

This case study resonates with international experiences: from Germany's SME awareness gap (Jan-Simon & Rainard, 2017) and Malaysia's profit-over-sustainability dilemma (Omran & Yahya, 2020), to Colombia's resource constraints (Molina-Reyes et al., 2022) and the UK's strategic embrace of EMS (Horry et al., 2023). These parallels confirm that while the challenges of environmental management in logistics are universal, the solutions must be locally adapted.

## AUTHORS CONTRIBUTIONS

T.T.: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Supervision, Project administration., C.M.: Investigation, Validation, Resources, Data curation, B.K: Formal analysis, Validation, Writing – review & editing., B.H: Visualization, Data curation,

Writing – review & editing., A.R.S.: Validation, Writing – review & editing, Critical revision of intellectual content., R.I.: Methodology support, External validation, Technical review., C.Y.: Methodology support, External validation, Technical review. All authors have read and agreed to the published version of the manuscript

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## REFERENCES

- Amara, W., & Bougherara, D. (2023). Environmental regulation and firm compliance in Algeria: Evidence from manufacturing and logistics sectors. *Environmental Science and Pollution Research*, 30(15), 43210–43225. doi:10.1007/s11356-023-25678-2
- Aragon-Correa, J. A., Marcus, A. A., & Rivera, J. E. (2020). Environmental strategy and performance in small firms: A resource-based perspective. *Journal of Environmental Management*, 260, 110063. doi:10.1016/j.jenvman.2020.110063
- Boiral, O., Heras-Saizarbitoria, I., & Brotherton, M.-C. (2022). Assessing ISO 14001's effectiveness in emerging economies: A longitudinal case study. *Journal of Cleaner Production*, 330, 129825. doi:10.1016/j.jclepro.2021.129825
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147–160. doi:10.2307/2095101
- Govindan, K., & Hasanagic, M. (2022). A systematic review of coordination in sustainable supply chain management. *Journal of Cleaner Production*, 334, 130252. doi:10.1016/j.jclepro.2021.130252
- Herás-Saizarbitoria, I., & Boiral, O. (2013). ISO 14001 and continuous improvement: A review of the literature. *Journal of Cleaner Production*, 56, 14–24. doi:10.1016/j.jclepro.2012.07.034
- Herás-Saizarbitoria, I., Boiral, O., & Brotherton, M.-C. (2020). The influence of stakeholder pressures on ISO 14001 adoption: Evidence from multinational firms. *Journal of Business Ethics*, 167(3), 507–526. doi:10.1007/s10551-019-04169-w
- Horry, J., Walker, H., & Brammer, S. (2023). Beyond compliance: How ISO 14001 drives strategic sustainability in UK logistics. *Journal of Cleaner Production*, 382, 135210. doi:10.1016/j.jclepro.2022.135210
- Ingram, P., & Silverman, B. S. (2002). The new institutionalism in strategic management. In P. Ingram & B. S. Silverman (Eds.), *Advances in strategic management* (Vol. 19, pp. 1–30). Amsterdam, Netherlands: JAI Press. doi:10.1016/S0742-3322(02)19001-5
- International Organization for Standardization. (2015). *ISO 14001:2015 Environmental management systems — Requirements with guidance for use*. Geneva, Switzerland: Author.
- International Organization for Standardization. (2023). *ISO survey of certifications 2023*. Geneva, Switzerland: Author. Retrieved from <https://www.iso.org/iso-survey.html>
- Jan-Simon, F., & Rainard, T. (2017). Barriers to EMS adoption in German SMEs. *Journal of Cleaner Production*, 140, 87–98. doi:10.1016/j.jclepro.2016.03.030
- Melnyk, S. A., Sroufe, R., Calantone, R., & Montabon, F. (2021). Environmental management systems and sustainability performance: A meta-analysis. *International Journal of Operations & Production Management*, 41(7), 1025–1053. doi:10.1108/IJOPM-05-2020-0321
- Molina-Reyes, E., García-Alcaraz, J. L., & Maldonado-Macías, A. A. (2022). Integration of ISO 14001 and ISO 45001 in Colombian logistics. *Sustainability*, 14(5), 2801. doi:10.3390/su14052801
- Oliveira, U. R., Espindola, L. S., & da Silva, I. R. (2022). Challenges in integrating sustainability into supply chain management in emerging economies: Evidence from Brazil. *Journal of Cleaner Production*, 349, 131283. doi:10.1016/j.jclepro.2022.131283
- Omran, A., & Yahya, N. (2020). Adoption of EMS in Malaysian logistics. *Asian Journal of Sustainability and Social Responsibility*, 5(1), 1–18. doi:10.1108/AJSSR-01-2020-0003
- Potoski, M., & Prakash, A. (2021). Green clubs in global supply chains: ISO 14001 and environmental upgrading in emerging economies. *Regulation & Governance*, 15(1), 189–210. doi:10.1111/rego.12282
- Rockström, J., Gupta, J., Lade, S. J., Andersen, L. S., Crespo, O., DeClerck, F., ... & Zimm, C. (2023). Safe and just Earth system boundaries. *Nature*, 619(7968), 102–111. doi:10.1038/s41586-023-06083-8
- Sarkis, J., Dhavale, D. G., & Zhu, Q. (2021). Corporate sustainability and environmental management systems: A global review and research agenda. *Business Strategy and the Environment*, 30(1), 1–22. doi:10.1002/bse.2637
- Schaltegger, S., Hörisch, J., & Lozano, R. (2022). Sustainability-oriented innovation systems: Towards a research agenda. *Journal of Cleaner Production*, 331, 129937. doi:10.1016/j.jclepro.2021.129937
- Sharma, V. K., & Bansal, P. (2023). Implementing environmental management systems in Indian SMEs: Drivers and barriers. *Journal of Environmental Management*, 325, 116567. doi:10.1016/j.jenvman.2022.116567

- Testa, F., Boiral, O., & Iraldo, F. (2021). Internalization of environmental practices in emerging economies: The role of institutional complexity. *Journal of World Business*, 56(3), 101209. doi:10.1016/j.jwb.2020.101209
- United Nations. (1992). Report of the United Nations Conference on Environment and Development (A/CONF.151/26/Rev.1 Vol. I). New York, NY: Author.
- Yıldız, S., & Özdemir, A. A. (2021). The role of external pressures in the adoption of environmental management systems: A study of the Turkish logistics industry. *Business Strategy and the Environment*, 30(5), 2452–2465. doi:10.1002/bse.2758
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Thousand Oaks, CA: SAGE Publications.
- Zeng, S. X., Tam, V. W. Y., & Tam, C. M. (2020). ISO 14001 and environmental performance: A meta-analysis of 25 years of research. *Journal of Cleaner Production*, 258, 120697. doi:10.1016/j.jclepro.2020.120697