ESJ Social Sciences Peer-reviewed

The Carbon Footprint as a Key Indicator for Environmental Management Controllers: Towards Environmental Performance – A Literature Review

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Doi:10.19044/esj.2025.v21n4p109

Submitted: 07 December 2024
Accepted: 07 February 2025
Published: 28 February 2025

Cite As:
Bouchouit K. & Elhamma A. (2025). *The Carbon Footprint as a Key Indicator for Environmental Management Controllers: Towards Environmental Performance – A Literature Review.* European Scientific Journal, ESJ, 21 (4), 109. https://doi.org/10.19044/esj.2025.v21n4p109

Abstract

Environmental considerations are increasingly critical for corporate sustainability and success. While businesses integrate environmental management into their strategies, the practical implementation of environmental management control systems, or "eco-control," remains underexplored. This paper examines the conditions necessary for effectively integrating carbon footprint requirements and regulatory codes into eco-control systems. We articulate the importance of environmental performance objectives in addition to traditional performance objectives as core values of control management. Additionally, we highlight the pivotal role of environmental management controllers in aligning environmental sustainability with traditional business objectives. By measuring greenhouse gas emissions and developing strategies that are both economically viable and environmentally sound, controllers embed environmental objectives into core business processes. Despite challenges like capturing indirect emissions and the lack of standardized reporting methods, they have the potential to make sustainability a strategic component of corporate management. Future research should focus on enhancing their role by developing better tools and standardized methodologies for measuring environmental performance.

Keywords: Environmental Management Control, Environmental Performance, Carbon Footprint, Management Control Tools, Sustainability

Introduction

Growing environmental awareness and regulatory pressures have led businesses to integrate environmental management into their operational strategies. Researchers have extensively explored these issues with a focus on the impact of environmental control on organizational performance (Henri & Journeault, 2006; Wagner, 2005; AlTuwaijri et al., 2004; Antheaume, 2004; Melnyk et al., 2003; Figge et al., 2002; Lothe et al., 1999) and on environmental reporting and disclosure (Wagner, 2005; AlTuwaijri et al., 2004; Antheaume, 2004).

Henri and Journeault (2006) introduced the term "eco-control" to describe environmental management control systems that incorporate traditional management accounting components while addressing societal responsibilities. Eco-control encourages companies to manage human, financial, material, and natural resources more rationally to gain a competitive advantage (CMA Canada, 1999a, 1999b). Unlike traditional management control, eco-control holds companies accountable for the environmental and sustainable development impacts of their activities (Pasquero, 2005; Capron & Quairel-Lanoizelée, 2004; Igalens, 2004), serving as a tool for macroeconomic regulation (Langevin, 1999). By extending management control beyond internal boundaries, eco-control introduces performance indicators that address societal needs related to environmental sustainability. Despite its potential, eco-control remains underexplored, with most research focusing on its financial and environmental performance impacts rather than the practical conditions required for its successful implementation. Given its relatively recent introduction and limited adoption, studies tend to emphasize system design and outcomes, leaving its internal workings something of a "black box."

In this paper we aim to explore the conditions necessary for forming an effective environmental management control system. By "opening the black box" of management control (Latour, 1989), we seek to uncover the actors and entities—both human and non-human—involved in eco-control that can recruit other stakeholders to form a robust network (Callon, 1986; Latour, 2005). For eco-control to operate effectively as an environmental regulation mechanism, it must gain support from both local and global stakeholders, through the use of accounting innovations like activity-based costing (Briers & Chua, 2001) and balanced scorecards (Hansen & Mouritsen, 2005). This exploration highlights the social processes upon which the effectiveness of eco-control ultimately depends.

ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Methodology

In conducting this literature review, we relied on a structured and deliberate approach to identify, select, and analyze relevant academic works on carbon footprint as a metric in environmental management. The methodology centers on a targeted process to ensure relevant studies are included.

We used Google Scholar and Scopus, selected for their breadth of peer-reviewed content and scholarly works. The focus was on finding studies addressing "carbon footprint," "environmental management control," and related terms. Searches employed specific keywords and Boolean operators to combine relevant terms and ensure accuracy. Filters prioritized publications from the last two decades, emphasizing recent developments, but we haven't excluded older studies when the content is relevant.

We followed a strict inclusion and exclusion criteria. Studies were included if they addressed carbon footprint as a metric in environmental management, provided theoretical or empirical insights into environmental performance, or explored eco-control systems. Exclusions applied to works lacking direct relevance or rigorous academic contribution. Abstracts were reviewed first; if unclear, full texts were analyzed. The outcome was a curated selection of studies closely tied to the research objective.

Our analysis focused on identifying central themes, key findings, and methodological approaches. Each selected work was reviewed for its treatment of carbon footprint as a metric, its methodological rigor, and its contributions to understanding environmental performance. The review emphasized studies discussing implementation challenges, comparative results, and frameworks for integrating carbon footprint metrics into environmental control systems.

The review's scope was shaped by available studies and access to full texts. Limitations include potential exclusion of relevant works due to language constraints or inaccessible publications. Despite this, the selected literature forms a focused and representative basis for analysis.

The literature review will be structured as follows. The first part will address "The Evolution of management control into eco-control: theoretical approaches and transformational challenges." The next part will discuss "Environmental management control: a conceptual framework." This will be followed by "Role of controllers in environmental management: a brief review of the literature." The review will then examine "A theoretical perspective of Environmental Performance" and conclude with "Optimizing environmental performance through the use of carbon footprint." This structure ensures a systematic exploration of the topic and its dimensions.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

The Evolution of management control into eco-control: theoretical approaches and transformational challenges

Management control and its historical evolution

Management control has evolved significantly as a scientific discipline, adapting to the changing dynamics of business operations. Initially focused on basic financial oversight, it gained prominence in the early 20th century with the emergence of Scientific Management by Taylor (1905), productivity innovations by Gantt (1906), and General Motors' structural decisions in 1923. These advancements underscored the importance of anticipating actions, setting objectives, and measuring performance, particularly in large organizations. As businesses grew in size and complexity, the need for task division and operational oversight gave rise to more structured management control practices. By the 1930s, cost analysis, forecasted budgets, and budgetary control became essential tools for identifying discrepancies and improving competitiveness, marking a shift toward analytical accounting and the introduction of dashboards (Pezet, 2009).

The scope of management control has expanded further in response to evolving business challenges, including environmental concerns and technological advancements. Traditionally centered on profit maximization and cost management, it has transitioned toward a more holistic approach, such as environmental management control (EMC), reflecting the growing importance of sustainability. Significant changes in the 1970s, driven by globalization and technological disruptions, redefined management control as a tool for influencing organizational decision-making and individual conduct. By the 1980s, figures like Anthony (1988) and Bouquin (1989) emphasized its role as a bridge between operational and strategic control. Innovations like Kaplan and Norton's (1992) balanced scorecard and Simons' (1995) research on organizational control further enriched the discipline. Despite these advancements, foundational definitions, such as Robert Anthony's (1965) view of management control as ensuring efficient and effective resource use to meet organizational objectives, and Chandler's (1967) description of it as a tool for coordination, judgment, and planning, continue to underpin its theoretical framework.

Evolving perspectives on management control: from operational to strategic integration

Originally focused on operational tasks such as planning, monitoring, and sanctioning within corporate management, management control has expanded over time to include strategic elements. This evolution is reflected in Anthony's (1980) updated definition, describing management control as "the process that allows managers to influence other members of the organization to implement its strategies." From that point onward, the

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

connection between operational control and strategy became a central focus, as highlighted in figure 2. Ardouin, Michel, and Schmidt (1985) defined management control as "the set of actions, procedures, and documents aimed at helping operational managers manage their activities to achieve their objectives." Similarly, Kerviller and Kerviller (1994) described it as "the set of measures implemented by the company to help operational managers manage their activities to reach their targeted goals." These definitions underscore the role of management control in bridging operational activities and strategic objectives.

Later contributions further emphasized the integration of processes, systems, and strategic alignment in management control. Simons (1995) defined it as "the set of formal processes and procedures, built upon information, that managers use to manage the organization's activities." Alazard (2004) described it as "a process comprising a set of calculation, analysis, and decision-making tools (both quantitative and qualitative), aiming to guide the organization's products, activities, and processes toward its objectives." Bouquin (2010) elaborated on this by stating that management control ensures leaders can trust that strategic choices and actions are coherent across time. Coucoureux (2010) emphasized leadership's role, asserting that effective management control requires a clear vision of the company's short- and long-term future and persistent determination to align actions with strategy. Together, these perspectives reinforce the critical role of management control as a tool for implementing and sustaining strategic coherence within organizations.

The emergence of eco-control: integrating environmental objectives into management control

With the rise of environmental concerns, management control has expanded to include environmental objectives, leading to the concept of eco-control (see figure below). Eco-control refers to the integration of environmental management into traditional management control systems, aiming to guide organizations toward sustainable practices (Schaltegger & Burritt, 2000). Its relevance lies in helping companies not only comply with environmental regulations but also improve their environmental performance as part of their strategic goals.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

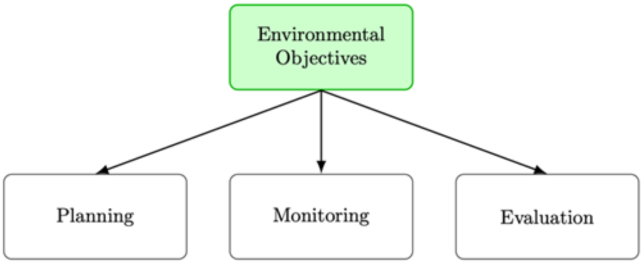

Figure 1. Eco control Integration model, source: authors

The eco-control model is driven mainly by the growing environmental concerns, increased stakeholder pressure, and a heightened sense of corporate responsibility. Organizations face demands from customers, investors, and regulators to minimize their environmental footprint (Burritt, Schaltegger, & Zvezdov, 2011). Thus, this shift compels management controllers to incorporate environmental metrics into their performance evaluations, balancing financial outcomes with sustainability objectives.

Early adaptations of eco-control are evident in companies implementing environmental management systems and sustainability reporting. The adoption of the ISO 14001 standard provided a framework for organizations to systematically manage their environmental responsibilities (International Organization for Standardization, 2015). For instance, Interface Inc., a global manufacturer of modular flooring, integrated eco-control into its operations by setting goals to reduce waste and carbon emissions, demonstrating that environmental sustainability can align with business success (Anderson, 1998).

Environmental management control: a conceptual framework

Definition and scope of environmental management control (EMC)

Environmental Management Control (EMC) emerged in the 1990s as organizations increasingly needed to incorporate environmental considerations into their management practices. Hofbeck (1993) introduced the term, identifying its primary dimensions as environmental management accounting, environmental management information systems, and environmental management tools. Although Hofbeck did not provide a precise definition, her work laid the foundation for understanding EMC's scope. The integration of environmental aspects into management control intensified with the rise of new technologies and Industry 4.0, recognizing ecological considerations, intangible assets, and human capital as key drivers of performance (Renaud, 2015). This shift led to the development of EMC as a means to align traditional management control systems with sustainability objectives (Henri & Journeault, 2010).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Several scholars have proposed definitions of EMC. Capron and Quairel (1998) describe it as "any process established to ensure that an organization is steered in alignment with its strategy and environmental objectives," while Pondeville (2003) similarly defines it as a "process implemented to guarantee the management of the enterprise in full coherence with its strategy and environmental goals." Antheaume (2013) views EMC as a mechanism ensuring that individual behaviors within an organization align with environmental objectives, facilitating the rational and efficient use of natural resources. Renaud (2015) further defines EMC as a process enabling managers to influence others to implement or support green strategies, utilizing tools from environmental accounting, environmental management accounting, and eco-control, along with environmental information systems and eco-tools for performance monitoring. Schaltegger & Burritt (2000) frame EMC as a system that aids in managing environmental activities by providing information for planning, decision-making, and performance evaluation, incorporating environmental costs and benefits of sustainability practices. Similarly, Henri Savall (1995) sees EMC as a management system for measuring, analyzing, and adjusting environmental performance in relation to economic and social performance, serving as a strategic tool for integrating ecological responsibility into corporate management.

EMC thus represents an extension of traditional management control into the environmental dimension, evolving alongside technological advancements. It ensures organizational alignment with sustainability objectives, guiding decision-making and performance monitoring. As a strategic tool, EMC balances environmental, economic, and social performance, fostering sustainable practices within organizations and, ultimately, broader society.

Key components of EMC: tools, processes, and systems

The key components of EMC encompass a variety of tools, processes, and systems designed to measure and manage environmental performance. Tools such as environmental performance indicators, eco-efficiency metrics, and life cycle assessments provide quantitative data to inform decisions (Epstein & Roy, 2001). Processes involve integrating environmental objectives into budgeting, reporting, and performance appraisal systems (Ferreira, Moulang, & Hendro, 2010). Systems like Environmental Management Systems (EMS), exemplified by ISO 14001 standards, offer structured frameworks for managing environmental responsibilities (International Organization for Standardization [ISO], 2015).

These components enable organizations to monitor costs related to energy consumption, natural resources, and pollution prevention or treatment. Taking into account the environmental impacts of their activities, and

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

implementing tools to reduce them, organizations can align their operations with both environmental and strategic objectives (Burritt, Schaltegger, & Zvezdov, 2011). EMC tools stem from environmental accounting, environmental management accounting, and eco-control, based on environmental information systems and eco-tools.

Conceptual models and theoretical foundations of EMC

The theoretical foundations of EMC draw from management control theories and environmental management practices. Contingency theory suggests that EMC systems should be tailored to an organization's specific context and environmental challenges (Otley, 2016). Stakeholder theory emphasizes the importance of responding to the environmental expectations of various stakeholders, including customers, regulators, and the community (Freeman, 1984).

Conceptual models like the Sustainability Balanced Scorecard integrate environmental and social dimensions into traditional performance measurement frameworks (Figge et al., 2002). Environmental Management Accounting (EMA) focuses on identifying and allocating environmental costs for better decision-making (Burritt & Schaltegger, 2000). These models provide a foundation for developing EMC practices that align environmental sustainability with organizational strategy and control mechanisms.

This evolution illustrates how EMC has grown from a niche concept to a critical component of modern management control. It requires management controllers to adopt a broader perspective that balances organizational performance with environmental sustainability, integrating ecological responsibility into the overall management of the company (Savall, 1995).

Role of controllers in environmental management: a brief review of the literature

Since the 1990s, research on management controllers has expanded (Bollecker, 2007), yet their role in environmental management remains poorly understood. EMC literature has primarily focused on tools (Marquet-Pondeville, 2003; Janicot, 2007; Caron et al., 2007; Henri & Journeault, 2010; Schaltegger, 2011; Antheaume, 2013), often portraying EMC as a process detached from management controllers. Historically confined to accounting and finance (Capron & Quairel, 1998; Wilmshurst & Frost, 2001; Quairel, 2006; Rivière-Giordano, 2007; Berland, 2007; Caron & Fortin, 2010), controllers have been bypassed by environmental specialists who have taken on advisory and auditing roles (Moquet, 2008). Marquet-Pondeville (2003) notes that "environmental management control often escapes the management control function and is rather articulated at the level of the environmental

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

department." Bouquin (2010) further observes that controllers have been "bypassed by other functions pursuing the same objectives but closer to operators." Consequently, environmental control experts have assumed responsibility for implementing green strategies and guiding leadership in identifying strategic environmental opportunities (Renaud, 2013a).

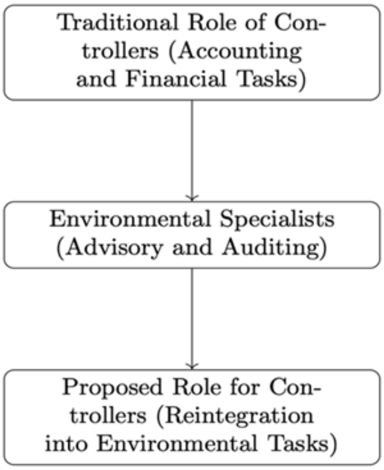

Figure 2. The new tasks of management controller, source: authors

Despite limited empirical evidence, some authors argue that finance professionals should play a more active role in environmental responsibility. Quairel (2004) suggests their involvement could enhance the credibility of environmental reports and strengthen investor confidence (Rivière-Giordano, 2007). Sobczak (2011) further contends that management controllers could become indispensable to managers and sustainability officers by developing tools to address environmental challenges and ensuring transparent stakeholder communication. A key responsibility in this regard is monitoring greenhouse gas emissions, with controllers conducting carbon footprint assessments using methodologies like ADEME's, which measure emissions in tons of CO_2 equivalent across activity categories such as transportation, travel, packaging, energy consumption, and waste management.

A theoretical perspective of Environmental Performance

Under increasing pressure from stakeholders, companies can no longer focus solely on meeting the expectations of their shareholders. They are now expected to assume broader societal responsibility by considering the interests of all stakeholders (Freeman et al., 2004). As a result, organizational performance is no longer limited to economic criteria but also includes intangible aspects, such as environmental performance (Yeo, 2003). According to stakeholder and neo-institutional theories, companies are increasingly required to be accountable for their environmental performance.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

This accountability manifests through the adoption of environmental management controls, which are either responses to explicit stakeholder expectations (Freeman, 1984) or reactions to institutional pressures—whether coercive, normative, or mimetic (Di Maggio & Powell, 1983; Oliver, 1991). However, while companies may not have a choice about compliance, they can still choose how to implement it. The management of environmental performance therefore involves a balance between formal representations and external stakeholders' subjective interpretations of those representations.

The concept of environmental performance

Few authors have explicitly defined environmental performance, often equating it with a company's environmental impact (King & Lenox, 2001; Cole et al., 2008) or its ability to manage resources sustainably and efficiently (Janicot, 2007). The ISO 14000 standard defines it as the measurable outcomes of an environmental management system, reflecting an organization's control over its environmental aspects in line with its policy and objectives (ISO, 1996). Similarly, ISO 14031 (2013) evaluates environmental performance by assessing the impact of an organization, industry, or policy on the environment.

Schaltegger, Burritt & Petersen (2003) describe environmental performance as a company's ability to reduce its ecological footprint and efficiently manage resources using specific indicators. Boiral (2007) expands this view, arguing that it goes beyond regulatory compliance to involve the proactive integration of ecological concerns into corporate strategy, enhancing stakeholder satisfaction and competitiveness. Sarkis (1999) presents it as an integrated approach that assesses an organization's efforts to minimize environmental harm through sustainable processes and technologies. Turki (2014) adds that environmental performance results from eco-friendly initiatives adopted in response to evolving environmental pressures, further detailing this through a model comprising strategic, operational, and relational components (Turki, 2009).

Measurement of environmental performance

Laforest et al. (2015) highlight the significance of measuring environmental performance through specific indicators that evaluate the environmental impact of a product or process, covering the entire lifecycle from raw material extraction to disposal . Various authors have attempted to measure a company's environmental performance using different frameworks. For example, Xie & Hayase (2007), Henri and Journeault (2008), Trumpp et al. (2015), and Xue et al. (2017) emphasize two primary dimensions: managerial and operational. In contrast, Thomson Reuters (2015), through its

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

ASSET4-ESG database, identifies three dimensions: reducing environmental emissions, product innovation, and minimizing resource consumption.

Turki's model (2014) incorporates three dimensions: strategic, operational, and relational. Meanwhile, Henri and Giasson (2006) present a model with four dimensions: product and process improvement, stakeholder relations, regulatory compliance, financial and environmental impacts, as well as corporate image .

Apitsa (2019) underscores the rise of new technologies and practices designed to enhance environmental performance, including the use of renewable energy, circular economy approaches, CO2 emissions reduction, and the integration of eco-design in product development. Da Silva (2013) emphasizes the need for coherent environmental policies and regulatory incentives to encourage companies to adopt sustainable practices. Additionally, Becheker & Bekour (2021) highlight the essential role of awareness, education, and stakeholder engagement in the ongoing improvement of environmental performance .

Key Metrics and indicators for environmental performance

Measuring environmental performance involves specific metrics that reflect an organization's impact on the environment. Common indicators include greenhouse gas emissions, energy and water consumption, waste generation, and pollution levels (Epstein & Roy, 2001). These metrics help organizations quantify their environmental footprint and identify areas for improvement. The Global Reporting Initiative (GRI) provides widely recognized guidelines for sustainability reporting, offering standardized indicators that many organizations adopt (GRI, 2016).

Tools for measuring environmental impact in organizations

Organizations rely on various tools to assess and manage their environmental impact. Life Cycle Assessment (LCA) examines the environmental aspects of a product or service throughout its entire life cycle, from raw material extraction to disposal (Guinée et al., 2011). EMS as outlined earlier offer a structured approach to managing environmental responsibilities. Carbon footprint calculators estimate total greenhouse gas emissions associated with organizational activities (Wiedmann & Minx, 2008). Additionally, material flow analysis and ecological footprinting are tools that help in understanding resource use and ecological impacts (Bastianoni et al., 2013).

Limitations and challenges in current measurement approaches

Despite these tools and metrics, measuring environmental performance presents challenges. Data quality and availability can be

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

inconsistent, leading to unreliable assessments (Searcy, 2012). The lack of standardization across industries complicates benchmarking and comparison of environmental performance (Morioka & de Carvalho, 2016). Moreover, current measurement approaches often overlook indirect environmental impacts, such as those occurring in the supply chain (Lenzen et al., 2013). There is also the challenge of integrating environmental metrics with financial performance indicators to provide a holistic view of organizational performance (Burritt & Schaltegger, 2010). These limitations underscore the need for improved measurement methods that are more comprehensive and universally applicable.

Optimizing environmental performance through the use of carbon footprint

The Carbon footprint as a tool for environmental management

The carbon footprint has become a key strategic tool for environmental management controllers, essential for overseeing a company's environmental performance. Moquet (2008) notes that calculating the carbon footprint is often one of their first responsibilities, enabling them to measure greenhouse gas (GHG) emissions—a crucial step in managing environmental impact. Controllers then analyze these results to recommend corrective measures, positioning themselves at the center of emissions tracking and strategy development (Capron & Quairel, 1998).

Beyond measurement, controllers actively contribute to emission reduction strategies and broader environmental performance improvements (Renaud, 2013). They identify opportunities for optimization and ensure ongoing monitoring to align with environmental commitments. Sobczak (2011) emphasizes that the carbon footprint is not merely a reporting tool but also a strategic instrument guiding corrective actions that enhance both environmental and economic performance.

Steps in developing and implementing carbon footprint assessments

The process of developing the carbon footprint tool can be broken down into three main stages: establishing an action plan, evolving toward reporting, and refining the original strategy.

In the early 2000s, engineer Jean-Marc Jancovici identified a lack of proper tools for businesses to pinpoint activities contributing to GHG emissions, especially indirect emissions often overlooked but constituting the majority of a company's emissions (Jancovici, 2000). To address this gap, Jancovici developed a calculation tool in partnership with ADEME (French Agency for Environment and Energy Management). The goal was to create a user-friendly tool where companies could input activity data and convert it into CO_2 emissions using a database of emission factors (Poivet, 2014).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

The creation of this emission factor database was essential, enabling the conversion of activity data into tons of CO_2 equivalent using specific calculations. For instance, determining CO_2 emissions from electricity consumption requires understanding the country's energy mix and the emissions associated with each energy production method (Jancovici, 2000). Unlike the complex life cycle assessment tools available at the time, this tool was designed to be user-friendly, providing straightforward and practical evaluations to support environmental initiatives (Riot, 2013).

Initial feedback showed growing interest from businesses in this "eco-balance" approach, which provided quick estimates to inform decision-making on emission reduction actions (Jancovici, 2000). The tool evolved into a diagnostic instrument for companies to understand their climate challenges and guide necessary actions.

Strategic use of carbon footprint data for performance improvement

The carbon footprint is not just a measurement tool but a strategic asset for guiding companies toward reducing their environmental impact. Environmental management controllers can rank the actions that provide the greatest reductions in emissions by identifying the main sources of emissions. According to Renaud (2013), this method ensures that efforts to reduce emissions also contribute to operational efficiency and cost savings by bringing environmental objectives into line with corporate strategy.

Continuous monitoring and analysis enable companies to track progress toward environmental goals and adjust strategies as needed. The carbon footprint thus serves as a feedback mechanism, informing management decisions and fostering a culture of sustainability within the organization.

Limitations of the carbon footprint

While the carbon footprint is a valuable tool, it has limitations. Jancovici points out that the tool may not fully account for the complexity of production systems and supply chains, potentially missing some indirect emissions, particularly those associated with the use of products (Jancovici, 2000). Renaud (2013) mentions that capturing Scope 3 emissions—indirect emissions upstream and downstream—is challenging but essential, as they can represent a significant portion of total emissions.

Capron and Quairel (1998) point out that lack of standardization in calculation methods can make comparisons between companies or sectors difficult. Sobczak (2011) warns that focusing solely on GHG emissions may lead to a simplistic approach, neglecting other significant environmental impacts like resource use or biodiversity effects. Garrone and Melac (2015) highlight that relying only on quantitative indicators can limit the effectiveness

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

of emission reduction strategies, as companies might miss more integrated and sustainable solutions.

What role for management controllers in corporate environmental objectives?

Environmental management controllers (EMCs) use the carbon footprint as both a transformational lever and a key metric, working at the intersection of corporate strategy and environmental oversight. Their role extends beyond observation to converting carbon data into actionable business plans, linking emissions to operational inefficiencies to minimize energy consumption and optimize resource allocation (Renaud, 2013). By identifying high-impact areas, they prioritize reduction efforts that align with cost savings and operational improvements, ensuring measurable results (Burritt & Schaltegger, 2010).

EMCs employ various tools to monitor pollution, waste production, and water usage, generating data that informs both short-term and long-term decision-making. Integrating environmental performance into corporate operations requires a data-driven approach that balances sustainability with financial objectives. Thus, EMCs go beyond carbon reduction, embedding environmental management systems and life cycle assessments into business practices (Epstein & Roy, 2001). Their ability to manage stakeholder expectations and regulatory constraints, particularly through frameworks like ISO 14001 (ISO, 2015), is critical to corporate success. However, they must ensure that compliance enhances rather than undermines competitive positioning, often by implementing environmental improvements that drive innovation in supply chain management and product design (Schaltegger & Burritt, 2000).

Rather than imposing external norms, EMCs internalize environmental metrics into core decision-making, ensuring sustainability and business continuity remain aligned. Their capacity to deliver precise, quantifiable results helps reconcile operational and environmental goals, minimizing conflicts between profitability and sustainability.

Integrating carbon footprint requirements and regulatory codes into environmental management control systems

Understanding and Incorporating Regulatory Requirements

Regulatory bodies such as the European Union Emissions Trading System (EU ETS) mandate the reporting of greenhouse gas (GHG) emissions and establish specific reduction targets (European Commission, 2021). Control managers need to stay informed about these regulations to ensure compliance.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Developing explicit environmental policies that reference compliance with pertinent regulations is crucial. These policies should articulate the organization's commitment to reducing emissions and fulfilling legal obligations (ISO, 2015). In fact, integrating regulatory requirements into Key Performance Indicators (KPIs) enables organizations to monitor and manage their environmental impact effectively (for instance, see table below)

Table 1: Emissions monitoring and compliance

Category	Description
Total GHG Emissions	Tracking total emissions to ensure they remain within legal limits (GHG Protocol, 2015).
Emission Intensity Metrics	Measuring emissions per unit of production or revenue (Schaltegger & Wagner, 2006).
Compliance Rates	Monitoring adherence to emission caps or reduction commitments (Bebbington & Larrinaga, 2014).

Source: Authors

These KPIs should be regularly reviewed and incorporated into management reports. Adopting standardized carbon accounting frameworks, such as the Greenhouse Gas Protocol, allows for accurate measurement and reporting of emissions (GHG Protocol, 2015). This involves accounting for three types pf scope emissions (see table below).

Table 2: Scopes of emissions

Scope	Description
Scope 1 Emissions	Direct emissions from owned or controlled sources.
Scope 2 Emissions	Indirect emissions from the generation of purchased energy.
Scope 3 Emissions	Other indirect emissions occurring in the value chain.

Source : Authors

Integrating Environmental Objectives into Management Control Systems

Embedding environmental objectives within management control systems aligns sustainability goals with organizational operations (Epstein & Buhovac, 2014). Incorporating carbon reduction targets into strategic planning ensures that sustainability becomes a core organizational objective (Figge et al., 2002), while budgeting for investments in energy-efficient technologies and renewable energy sources supports emission reduction efforts (Porter & Kramer, 2006). Operational controls such as monitoring energy consumption and waste generation improve efficiency (Hart, 1995), and updating standard operating procedures (SOPs) to include environmental considerations ensures daily operations meet sustainability goals (Angell & Klassen, 1999). Integrating environmental KPIs into performance evaluations (Kaplan & Norton, 1996) and linking employee incentives to environmental targets further embeds sustainability into the organizational structure (Govindarajan & Gupta, 1985).

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

Strategies for Ensuring Compliance and Continuous Improvement

Ensuring compliance and fostering continuous improvement rely on the integration of technology, employee engagement, and supply chain management. Environmental Management Information Systems (EMIS) enable real-time monitoring of emissions and resource use, supporting compliance and informed decision-making (Melville & Whisnant, 2014), while predictive analytics allow organizations to forecast future emissions and make proactive adjustments (Henri & Journeault, 2010). Regular internal audits and external certifications, such as ISO 14001, ensure adherence to environmental standards (Simnett et al., 2009; Darnall et al., 2008), and transparent reporting through frameworks like the Global Reporting Initiative (GRI) enhances stakeholder communication (Kolk, 2008). Employee training fosters a culture of compliance (Daily & Huang, 2001), and engagement initiatives encourage active participation in sustainability efforts (Ramus, 2001). Evaluating suppliers based on environmental performance and adopting sustainable procurement policies ensure alignment across the supply chain (Seuring & Müller, 2008; Carter & Rogers, 2008). Continuous improvement is achieved by reviewing environmental KPIs and staying updated with regulatory changes (Searcy, 2012; Delmas & Toffel, 2008).

Conclusion

In this paper we have emphasizes the crucial role that environmental management controllers can play in addressing environmental issues within companies while balancing traditional business objectives. Controllers help businesses cut their environmental footprint without sacrificing operational effectiveness or profitability. As a quantifiable measure of environmental performance, the carbon footprint enables controllers to evaluate greenhouse gas emissions and create plans that are both economically sound for the company and environmentally friendly.

Moreover, environmental management controllers are positioned to bridge the gap between environmental sustainability and business performance. They can identify opportunities for reducing emissions that also result in cost savings, such as energy efficiency improvements or resource optimization. In doing so, they help companies maintain competitiveness in an increasingly eco-conscious marketplace while fulfilling regulatory requirements and stakeholder expectations. Their role extends beyond the technicalities of environmental measurement; they contribute to strategic decision-making that integrates environmental objectives into the core operations of the business.

Integrating carbon footprint requirements and regulatory codes into environmental management control systems allows controllers to ensure that companies not only comply with legal obligations but also proactively

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

enhance their environmental performance. This involves establishing environmental policies aligned with regulatory standards, developing specific environmental KPIs, and adopting standardized carbon accounting practices to accurately measure emissions across all scopes. Embedding environmental objectives into strategic planning, operational controls, and performance measurement systems facilitates a comprehensive approach that aligns sustainability with core business processes. Additionally, leveraging technology such as Environmental Management Information Systems and engaging in continuous improvement through audits and employee engagement strengthens the company's ability to meet environmental targets while maintaining operational efficiency and profitability.

At the same time, environmental management controllers must navigate the complexity of capturing indirect emissions, particularly those within supply chains (Scope 3 emissions), and address the challenges posed by the lack of standardized methods for environmental reporting across industries. Despite these challenges, they have the potential to make environmental management a core component of corporate strategy, ensuring that businesses meet their environmental responsibilities without losing sight of profitability, growth, and overall operational efficiency.

Future research should further explore the expanding role of environmental management controllers, particularly how they can more effectively manage the dual objectives of environmental sustainability and traditional business success. Developing better tools and standardized methodologies for measuring environmental performance will empower controllers to play a more strategic role in shaping the future of corporate sustainability practices. In this evolving landscape, environmental management controllers are key to ensuring that sustainability becomes an integrated, strategic part of business management, rather than a separate or secondary concern.

Conflict of Interest: The authors reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

Funding Statement: The authors did not obtain any funding for this research.

References:

1. Alazard, C. (2004). Contrôle de gestion: Outils et applications (3rd ed.). Dunod.
2. AlTuwaijri, S. A., Christensen, T. E., & Hughes, K. E. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations

approach. Accounting, Organizations and Society, 29(5-6), 447-471. https://doi.org/10.1016/S0361-3682(03)00032-1
3. Anderson, R. C. (1998). Mid-course correction: Toward a sustainable enterprise: The Interface model. Chelsea Green Publishing.
4. Antheaume, N. (2004). Valuing external costs—from theory to practice: Implications for full cost environmental accounting. European Accounting Review, 13(3), 443-464. https://doi.org/10.1080/0963818042000216832
5. Antheaume, N. (2013). Le contrôle de gestion environnemental: Définitions et enjeux pour le pilotage de la performance globale. Management & Avenir, 61, 143-157. https://doi.org/10.3917/mav.061.0143
6. Anthony, R. N. (1965). Planning and control systems: A framework for analysis. Harvard University Graduate School of Business Administration.
7. Anthony, R. N. (1980). The management control function (2nd ed.). Harvard Business School Press.
8. Anthony, R. N. (1988). The management control function. Harvard Business School Press.
9. Apitsa, S. M. (2019). Sustainable innovations and environmental performance: The role of eco-design, circular economy, and carbon footprint reduction. Journal of Cleaner Production, 234, 923-937. https://doi.org/10.1016/j.jclepro.2019.06.089
10. Ardouin, P., Michel, C., & Schmidt, M. (1985). Le contrôle de gestion. Economica.
11. Bastianoni, S., Pulselli, F. M., & Tiezzi, E. (2013). The ecological footprint as a measure of environmental impact: Methods and applications. Journal of Environmental Management, 114, 6-12. https://doi.org/10.1016/j.jenvman.2012.09.010
12. Becheker, H., & Bekour, L. (2021). The role of environmental awareness, education, and stakeholder participation in enhancing corporate environmental performance. Sustainable Development, 29(3), 341-355. https://doi.org/10.1002/sd.2117
13. Berland, N. (2007). Le contrôle de gestion dans les PME: Une mise à jour théorique. Revue Finance Contrôle Stratégie, 10(1), 127-149.
14. Boiral, O. (2007). Corporate greening through ISO 14001: A rational myth? Organization Science, 18(1), 127-146. https://doi.org/10.1287/orsc.1060.0224
15. Bollecker, M. (2007). Les nouvelles frontières du contrôle de gestion. Revue Française de Gestion, 33(175), 61-78. https://doi.org/10.3166/rfg.175.61-78

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

16. Bouquin, H. (1989). Le contrôle de gestion. Presses Universitaires de France.
17. Bouquin, H. (2010). Le contrôle de gestion (6th ed.). Presses Universitaires de France.
18. Briers, M., & Chua, W. F. (2001). The role of actor-networks and boundary objects in management accounting change: A field study of an implementation of activity-based costing. Accounting, Organizations and Society, 26(3), 237-269. https://doi.org/10.1016/S0361-3682(00)00029-5
19. Burritt, R. L., & Schaltegger, S. (2010). Sustainability accounting and reporting: Fad or trend? Accounting, Auditing & Accountability Journal, 23(7), 829-846. https://doi.org/10.1108/09513571011080144
20. Burritt, R. L., Schaltegger, S., & Zvezdov, D. (2011). Carbon management accounting: Explaining practice in leading German companies. Australian Accounting Review, 21(1), 80-98. https://doi.org/10.1111/j.1835-2561.2010.00117.x
21. Callon, M. (1986). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. In J. Law (Ed.), Power, action, and belief: A new sociology of knowledge? (pp. 196-233). Routledge & Kegan Paul.
22. Capron, M., & Quairel, F. (1998). Développement durable et entreprise: Enjeux pour la comptabilité et le contrôle de gestion. La Découverte.
23. Capron, M., & Quairel-Lanoizelée, F. (2004). Mythes et réalités de l’entreprise responsable. La Découverte.
24. Caron, M., Fortin, A., & Janicot, G. (2007). Les systèmes de gestion de la performance environnementale: Une approche exploratoire. Comptabilité Contrôle Audit, 13(1), 117-139.
25. Chandler, A. D. (1967). Strategy and structure: Chapters in the history of the industrial enterprise. MIT Press.
26. CMA Canada. (1999a). The management accounting guideline: Environmental costing. The Society of Management Accountants of Canada.
27. CMA Canada. (1999b). The management accounting guideline: Implementing environmental management accounting. The Society of Management Accountants of Canada.
28. Cole, M. A., Elliott, R. J. R., & Strobl, E. (2008). The environmental performance of firms: The role of foreign ownership, training, and experience. Ecological Economics, 65(3), 538-546. https://doi.org/10.1016/j.ecolecon.2007.07.025
29. Coucoureux, M. (2010). Stratégie et contrôle de gestion. Foucher.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

30. Da Silva, A. S. (2013). Corporate environmental policies and their impact on organizational performance: The role of environmental regulations. Environmental Management, 52(4), 761-775. https://doi.org/10.1007/s00267-013-0134-5
31. 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. https://doi.org/10.2307/2095101
32. Epstein, M. J., & Roy, M. J. (2001). Sustainability in action: Identifying and measuring the key performance drivers. Long Range Planning, 34(5), 585-604. https://doi.org/10.1016/S0024-6301(01)00097-9
33. Figge, F., Hahn, T., Schaltegger, S., & Wagner, M. (2002). The sustainability balanced scorecard—Linking sustainability management to business strategy. Business Strategy and the Environment, 11(5), 269-284. https://doi.org/10.1002/bse.339
34. Freeman, R. E. (1984). Strategic management: A stakeholder approach. Pitman Publishing.
35. Freeman, R. E., Wicks, A. C., & Parmar, B. (2004). Stakeholder theory and "The corporate objective revisited." Organization Science, 15(3), 364-369. https://doi.org/10.1287/orsc.1040.0066
36. Gantt, H. L. (1906). Work, wages, and profits. Engineering Magazine Company.
37. Garrone, P., & Melac, G. (2015). The value of strategic carbon footprint management in competitive markets. Journal of Business Strategy, 36(5), 39-48. https://doi.org/10.1108/JBS-05-2014-0057
38. Global Reporting Initiative (GRI). (2016). GRI sustainability reporting standards. https://www.globalreporting.org/standards/
39. Guinée, J. B., Gorrée, M., Heijungs, R., Huppes, G., Kleijn, R., Koning, A. D., ... & Suh, S. (2011). Life cycle assessment: An operational guide to the ISO standards. Springer.
40. Hansen, A., & Mouritsen, J. (2005). Strategies and organizational problems: Constructing corporate value and coherence in balanced scorecard processes. In C. S. Chapman (Ed.), Controlling strategy: Management, accounting, and performance measurement (pp. 125-150). Oxford University Press.
41. Henri, J. F., & Giasson, R. (2006). A conceptual framework for measuring environmental performance: Four dimensions for sustainable success. Comptabilité Contrôle Audit, 12(2), 89-110.
42. Henri, J. F., & Journeault, M. (2006). Eco-control: The influence of management control systems on environmental and economic

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

performance. Accounting, Organizations and Society, 35(1), 63-80. https://doi.org/10.1016/j.aos.2009.02.001
43. Henri, J. F., & Journeault, M. (2008). Environmental performance indicators: An empirical study of Canadian manufacturing firms. Journal of Environmental Management, 87(1), 165-176. https://doi.org/10.1016/j.jenvman.2007.01.009
44. Hofbeck, G. (1993). Le contrôle de gestion environnemental. Revue Française de Gestion.
45. Igalens, J. (2004). La responsabilité sociétale des entreprises. Presses Universitaires de France.
46. International Organization for Standardization (ISO). (1996). ISO 14000: Environmental management systems – General guidelines on principles, systems, and supporting techniques. ISO.
47. International Organization for Standardization (ISO). (2013). ISO 14031: Environmental management – Environmental performance evaluation – Guidelines. ISO.
48. International Organization for Standardization (ISO). (2015). ISO 14001: Environmental management systems – Requirements with guidance for use. ISO.
49. Jancovici, J. M. (n.d.). Carbon footprint tool: Calculating greenhouse gas emissions. ADEME (Agence de l'Environnement et de la Maîtrise de l'Énergie).
50. Janicot, G. (2007). Écologie et entreprise: Une approche par le contrôle de gestion. Revue Française de Gestion, 175, 97-108.
51. Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard—Measures that drive performance. Harvard Business Review, 70(1), 71-79.
52. Kerviller, Y., & Kerviller, G. (1994). La pratique du contrôle de gestion. Editions d'Organisation.
53. King, A. A., & Lenox, M. J. (2001). Does it really pay to be green? An empirical study of firm environmental and financial performance. Journal of Industrial Ecology, 5(1), 105-116. https://doi.org/10.1162/108819801753358526
54. Laforest, L., Trumpp, C., Guenther, T., & Hahn, R. (2015). Measuring corporate environmental performance: Empirical evidence from the German stock market. Journal of Business Economics, 85(4), 457-490. https://doi.org/10.1007/s11573-014-0761-7
55. Langevin, P. (1999). Le contrôle de gestion dans l'entreprise intégrée: Vers une perspective macro-économique. Revue Française de Comptabilité, 306, 64-70.
56. Latour, B. (1989). Science in action: How to follow scientists and engineers through society. Harvard University Press.

 ISSN: 1857-7881 (Print) e - ISSN 1857-7431

57. Latour, B. (2005). Reassembling the social: An introduction to actor-network theory. Oxford University Press.
58. Lenzen, M., Murray, J., Sack, F., & Wiedmann, T. (2013). Shared producer and consumer responsibility—Theory and practice. Ecological Economics, 93, 162-168. https://doi.org/10.1016/j.ecolecon.2013.05.012
59. Lothe, S., Myrtveit, I., & Trapani, T. (1999). The link between environmental and economic performance: Experiences from the petroleum industry. Business Strategy and the Environment, 8(5), 339-344. https://doi.org/10.1002/(SICI)1099-0836(199909/10)8:5<339::AID-BSE207>3.0.CO;2-K
60. Marquet-Pondeville, S. (2003). Le contrôle de gestion environnemental: Émergence et perspectives. Comptabilité Contrôle Audit, 9(3), 101-122.
61. Melnyk, S. A., Sroufe, R. P., & Calantone, R. J. (2003). Assessing the impact of environmental management systems on corporate and environmental performance. Journal of Operations Management, 21(3), 329-351. https://doi.org/10.1016/S0272-6963(02)00109-2
62. Moquet, A. (2008). Le rôle des spécialistes environnementaux dans le contrôle de gestion. Revue du Financier, 166, 76-85.
63. Morioka, S. N., & de Carvalho, M. M. (2016). A systematic literature review towards a conceptual framework for integrating sustainability performance into business. Journal of Cleaner Production, 136, 134-146. https://doi.org/10.1016/j.jclepro.2016.01.104
64. Oliver, C. (1991). Strategic responses to institutional processes. Academy of Management Review, 16(1), 145-179. https://doi.org/10.5465/amr.1991.4279002
65. Pasquero, J. (2005). La gouvernance d'entreprise: La recherche de l'équilibre entre l'intérêt des propriétaires et celui des parties prenantes. Revue Française de Gestion, 157, 137-159.
66. Pezet, A. (2009). Contrôler et gérer: Une histoire du contrôle de gestion. La Découverte.
67. Poivet, P. (2014). Calculating the carbon footprint: A guide to corporate carbon emissions. Editions Quae.
68. Pondeville, S. (2003). Les systèmes d'information environnementaux: Un levier pour le développement durable. Editions Management et Société.
69. Quairel, F. (2004). Reporting environnemental et démarche stratégique: La place de la RSE dans la stratégie des entreprises. Revue Française de Comptabilité, 367, 55-59.

70. Quairel, F., & Rivière-Giordano, G. (2006). Sustainability management and control: Facing complex regulations and societal pressures. Revue Française de Comptabilité, 388, 45-50.
71. Renaud, M. (2013). Le rôle des contrôleurs de gestion dans la performance environnementale. Revue Française de Comptabilité, 469, 66-73.
72. Renaud, M. (2013a). Le contrôle de gestion environnemental: Vers une nouvelle dynamique stratégique. Revue Française de Comptabilité.
73. Renaud, M. (2015). Le contrôle de gestion environnemental: Vers une nouvelle dynamique stratégique. Revue Française de Comptabilité.
74. Riot, M. (2013). Measuring environmental impacts: Tools for integrating ecological indicators in corporate strategy. Environmental Science & Policy, 27, 114-124. https://doi.org/10.1016/j.envsci.2012.07.005
75. Rivière-Giordano, G. (2007). Le rôle du contrôleur de gestion dans la gestion environnementale. Revue Finance Contrôle Stratégie, 10(3), 55-72.
76. Sarkis, J. (1999). A strategic decision framework for green supply chain management. Journal of Cleaner Production, 7(4), 397-409. https://doi.org/10.1016/S0959-6526(99)00012-8
77. Savall, H. (1995). Le contrôle de gestion environnemental: Outils de gestion pour la performance globale. Economica.
78. Schaltegger, S., & Burritt, R. L. (2000). Contemporary environmental accounting: Issues, concepts, and practice. Greenleaf Publishing.
79. Schaltegger, S., Burritt, R. L., & Petersen, H. (2003). An introduction to corporate environmental management: Striving for sustainability. Greenleaf Publishing.
80. Searcy, C. (2012). Corporate sustainability performance measurement systems: A review and research agenda. Journal of Business Ethics, 107(3), 239-253. https://doi.org/10.1007/s10551-011-1038-z
81. Simons, R. (1995). Levers of control: How managers use innovative control systems to drive strategic renewal. Harvard Business School Press.
82. Sobczak, A. (2011). L'évolution du rôle du contrôleur de gestion face aux nouvelles exigences en matière de responsabilité sociale des entreprises. Management & Avenir, 55, 61-74. https://doi.org/10.3917/mav.055.0061
83. Taylor, F. W. (1905). Shop management. Harper & Brothers.
84. Thomson Reuters. (2015). ASSET4 ESG data analysis framework. Thomson Reuters.

85. Trumpp, C., Guenther, T., & Hahn, R. (2015). Corporate environmental performance: A meta-analysis of empirical evidence. Journal of Business Economics, 85(4), 457-490.
86. Turki, A. (2009). Évaluation de la performance environnementale des entreprises: Modèle conceptuel et application pratique. Economica.
87. Turki, A. (2014). Un cadre stratégique pour mesurer la performance environnementale des entreprises. Revue Française de Gestion, 40(245), 107-122.
88. 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. https://doi.org/10.1016/j.jenvman.2004.11.021
89. Wiedmann, T., & Minx, J. (2008). A definition of carbon footprint. In C. C. Pertsova (Ed.), Ecological economics research trends (pp. 1-11). Nova Science Publishers.
90. Wilmshurst, T. D., & Frost, G. R. (2001). The role of accounting and the accountant in the environmental management system. Business Strategy and the Environment, 10(3), 135-147. https://doi.org/10.1002/bse.283
91. Xie, H., & Hayase, K. (2007). Corporate environmental performance: The role of firm size and industry type in an emerging market. Environmental Science & Policy, 10(4), 328-336. https://doi.org/10.1016/j.envsci.2007.01.004
92. Xue, Y., Xu, X., & Zhang, L. (2017). Corporate environmental performance, CEO compensation, and firm value: Evidence from China. Journal of Cleaner Production, 165, 1031-1045. https://doi.org/10.1016/j.jclepro.2017.07.146
93. Yeo, R. (2003). Linking organisational learning to organisational performance and success: Singapore case studies. Leadership & Organization Development Journal, 24(2), 70-83. https://doi.org/10.1108/01437730310463262