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MODESTUM

Review Article

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Digitalization of integrated management systems for operational efficiency: Insights from industry and sustainability reports–A systematic review

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ABSTRACT

This systematic review examines how digitalizing integrated management systems (IMS) transforms operational effectiveness, sustainability, and strategic value generation in several industries. Using 69 peer-reviewed studies, corporate sustainability reports, and cross-sector case studies, the study emphasizes how AI, IoT, and cloud technologies come together to enable real-time compliance monitoring, predictive maintenance, and data-driven environmental, social, and governance (ESG) reporting. Reducing redundancy, enhancing risk management, and supporting standards like ISO 9001, 14001, and 45001, digital IMS systems surpass conventional methods. Significant performance improvements, including 30-40% reductions in audit preparation time and enhanced incident response, are shown in case studies from manufacturing, oil and gas, healthcare, and energy sectors. Even with these advantages, there are still difficulties in small company adoption, workforce training, and cybersecurity. Particularly in promoting circular economy principles and ESG openness, the review notes strategic alignment between digital IMS and sustainability objectives as a major success driver. It demands policy backing and modular, scalable IMS solutions to span the digital gap. Incorporating compliance, innovation, and sustainable performance into unified, value-driven organizational structures, this research positions digital IMS as a core pillar for Industry 5.0.

Keywords: digital IMS, operational excellence, sustainability reports, ISO standards, ESG, continuous improvement

INTRODUCTION

The digitalization of organizational management models has become a key enabler of operational excellence in a world characterized by technological disruption and the imperative of sustainability (Kuzmina & Zhernakova, 2020). Integrated management systems (IMS), integrating quality, health, safety, environmental, and compliance procedures into a unified system, have evolved from disjointed, paper-based systems to smart digital platforms for real-time data consolidation and predictive insights. Such a transformation meets increasing pressures across sectors to balance operational effectiveness with rigid regulatory compliance and stakeholder expectations of open sustainability reporting (Polevaya & Shustova, 2023). With companies managing complicated supply chains, fluid market environments, and environmental, social, and governance (ESG) oversight measures, digital IMS solutions offer the architectural scaffolding for aligning strategic plans with executable, data-backed processes (Chauhan et al., 2023).

The intersection of cloud computing, the Internet of things (IoT)-based sensors, and artificial intelligence (AI) with conventional management systems has changed the definition of operational excellence. Where legacy systems used to work in silos with quality, safety, and environmental teams keeping their own documentation and compliance procedures digital IMS platforms enable cross-functional sight through centralized data stores and automated workflow orchestration (Colli et al., 2020). For example, manufacturing industries using digital twins and cloud-based document repositories achieve 30-40% decreases in compliance audit preparation time, along with enhanced incident response capacity (Onaji et al., 2022). Such technological convergences turn IMS from passive compliance solutions into active systems that detect process bottlenecks ahead of time, anticipate equipment failure, and streamline resource allocation across geographically distributed facilities (Sun et al., 2021).

One tries via this thorough review to determine how digital IMS support operational excellence, legislative compliance, health and safety performance, environmental stewardship, and sustainability clarity across a range of industrial segments.

Table 1. Comparison of traditional IMS vs. digital IMS across key performance dimensions

Dimension	Traditional IMS	Digital IMS
System structure	Paper-based or siloed digital tools	Centralized, cloud-based platforms integrating all management systems
Data accessibility	Limited to physical access or fragmented systems	Real-time access from anywhere, enabling remote audits and decisions
Compliance tracking	Manual logs, risk of human error	Automated alerts, dashboards, and audit trails with version control
Risk management	Reactive and post-incident based	Predictive risk analytics using AI and IoT
Operational efficiency	Slow workflows, redundancy across departments	Streamlined processes with automated workflows and reduced duplication
Sustainability reporting	Annual, manually prepared reports	Dynamic ESG dashboards and automated sustainability disclosures
Employee involvement	Limited user engagement and training via manual documentation	Interactive modules, mobile access, and real-time safety checklists
Scalability	Difficult and resource-intensive	Highly scalable across sites, regions, and functions with minimal setup
Cybersecurity & data integrity	Low-tech controls, physical storage vulnerabilities	Role-based access control, encryption, and real-time data backup

Table 2. Industry use-cases and benefits of digitalized IMS solutions

Industry	Technology integrated	Key benefits achieved	Reported impact
Manufacturing	Digital twins, cloud-based repositories	Assessment/Audit efficiency, predictive maintenance	30-40% reduction in assessment/audit prep time (Kelnich, 2024)
Healthcare	Integrated patient safety & environmental modules	Fewer medical errors, improved sustainability	22% drop in medical errors, 15% reduction in energy use (IMS MAXIMS, n.d.)
Oil & gas	Cloud IMS, real-time emission tracking	Compliance automation, improved environmental reporting	90% fewer manual data errors; enhanced offshore monitoring (Shell, 2020)
Construction	IoT-based safety compliance tools	Worker safety improvements, real-time hazard detection	35% decline in safety incidents (Agarwal et al., 2016)
Food & beverage	AI-driven quality tracking	Traceability, regulatory alignment	45% faster response to quality breaches (Nestlé, 2025)
Energy & utilities	Centralized ESG dashboards, predictive analytics	Carbon tracking, proactive risk management	20% improvement in ESG reporting accuracy (World Bank, n.d.)

The main goal is to evaluate how much digital IMS platforms have changed important performance indicators, including process efficiency, audit readiness, risk management and ESG reporting. Drawing on data from 69 peer-reviewed papers, case studies from many industries, including manufacturing, oil and gas, construction, aviation, food and beverage, healthcare, and utilities, this study spans 2008 to 2024. Corporate sustainability reports published between 2024 and 2025. Seven main research questions (RQs) guide this review and probe the operational, environmental, and strategic results related with digital IMS adoption. Offering a thorough approach for evaluating the advantages and future direction of IMS digitization, these questions match both organizational goals and worldwide sustainability objectives.

Table 1 shows the comparison of traditional IMS vs. digital IMS across key performance dimensions and **Table 2** shows industry use-cases and benefits of digitalized IMS solutions.

Industry-specific deployments reveal the disruptive possibility of digital IMS designs. In healthcare, companies such as IMS MAXIMS (n.d.) have implemented integrated platforms that combine patient safety routines, staff training modules, and environmental waste management systems into a unified digital workflow, resulting in a 22% reduction in medical errors and a 15% decrease in energy use over two years (Manzanera et al., 2014). The oil and gas sector's adoption of cloud-based IMS solutions has enabled remote monitoring of offshore installations, decreasing manual data entry errors by 90% while enhancing real-time emissions tracking for sustainability reporting (Al-Rbeawi, 2023).

Even with these developments, substantial knowledge gaps remain to understand the entire range of digital IMS advantages, especially their contribution to sustainability performance metrics. Although research points out efficiency and compliance benefits, few examine systematically how integrated digital systems support circular economy goals, carbon footprint minimization, or social responsibility metrics reported in corporate sustainability reports (Rosário & Dias, 2022). In addition, the human and organizational implications of making this shift to digital IMS, such as workforce upskilling needs, cybersecurity threats to interconnected systems, and aligning AI-facilitated insights with ethical principles of governance, have not been adequately explored in current literature. This systematic review fills these gaps by integrating evidence from the literature, industry cases, and sustainability disclosure to chart the multi-dimensional advantages of digital IMS adoption in industries and determine key success factors for reaching operational and environmental excellence (Feroz et al., 2021).

This review combines early conceptual works and contemporary evidence to provide a comprehensive picture of how digital IMS frameworks have evolved. Although original publications from 2008-2014 provide background for the early reasons for digital transformation, the great majority of included studies are from 2020-2025, therefore ensuring present-day relevance. Recent sustainability surveys (2024-2025) from international companies help to root the review in the most current developments across sectors.

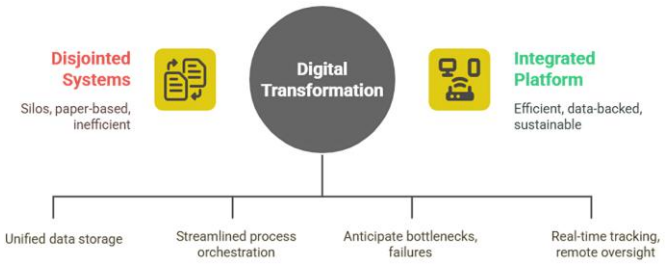

Figure 1. Conceptual framework illustrating the role of digital IMS in enhancing operational and sustainability outcomes (Source: Authors' own elaboration)

Figure 1 depicts the conceptual framework illustrating the role of digital IMS in enhancing operational and sustainability outcomes.

The thematic sections of the research findings discuss each of the seven RQs as follows:

1. **RQ1. How does digitalizing IMS improve operational efficiency, lower redundancy, and help predictive maintenance spanning many sectors?** is answered in *operational efficiency, redundancy reduction, and predictive maintenance* section.
2. **RQ2. How do digital IMS systems enhance regulatory compliance, audit preparedness, and real-time risk monitoring via integrated data and AI-enabled insights?** is addressed in *regulatory compliance and risk monitoring* section.
3. **RQ3. Especially in cases when standards like ISO 45001 are embedded, what are the quantifiable effects of digital IMS on incident response time, employee health outcomes, and workplace safety?** is discussed in *occupational health and safety outcomes (ISO 45001 integration)* section.
4. **RQ4. How does digitalizing ISO 14001-compliant environmental management inside IMS help to lower waste management expenses, greenhouse gas emissions, and energy use?** is covered in *environmental management, ISO 14001 compliance, and emission control* section.
5. **RQ5. Integrated IMS digital sustainability reporting tools advance circular economy goals, ESG compliance, and environmental openness in what role?** is explored in *sustainability reporting, circular economy, and strategic alignment with ESG goals* section.
6. **RQ6. What are the organizational, reputational, and strategic advantages (e.g., stakeholder trust, competitive advantage, and tender eligibility) discovered by digital IMS adoption and certification? Are these from a digital IMS implementation?** is addressed in *strategic alignment* section and summarized in *cross-sectoral insights* section.
7. **RQ7. What understanding could cross-sectoral case studies offer on the measurable economic, environmental, and compliance-related advantages of digital IMS implementation?** is analyzed in *case studies: sector-specific implementations* section.

METHODOLOGY

This detailed review was carried out exactly by the PRISMA 2020 guidelines to ensure openness, repeatability, and methodological rigor. The primary objective was to determine how digitizing IMS enhances operational efficiency, regulatory compliance and sustainability reporting in many industrial categories. Illustrated in **Figure 2**: PRISMA flow diagram, the review followed a systematic four-stage procedure: identification, screening, eligibility, and inclusion. Though the procedure for this study was not recorded on PROSPERO or any other protocol registry, this is recognized as a drawback of the work.

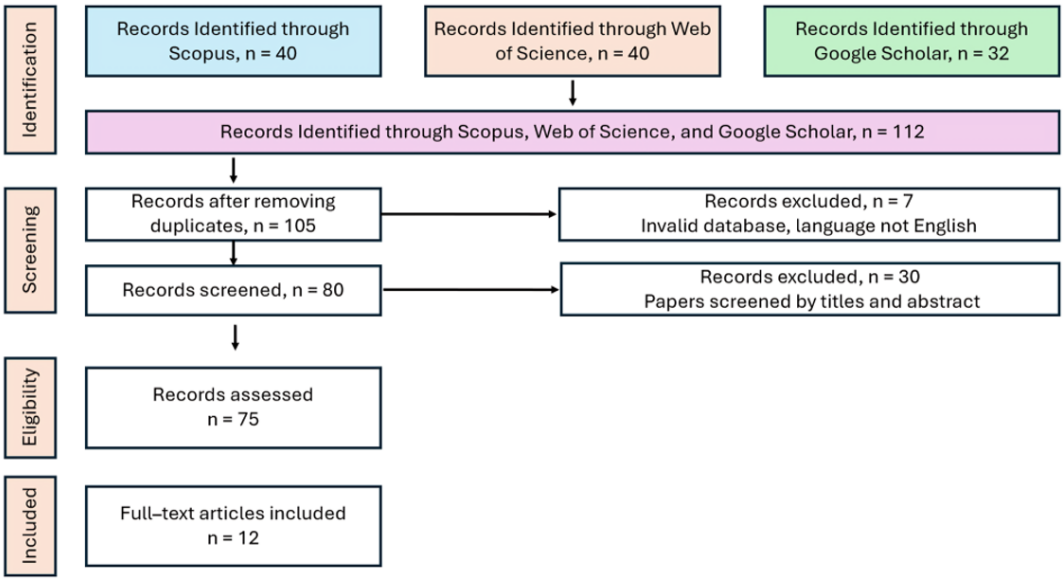

Figure 2. Systematic review process for selecting literature on digital IMS and sustainability reporting (Source: Authors' own elaboration)

Table 3. Inclusion and exclusion criteria for selected studies

Criteria category	Inclusion criteria	Exclusion criteria
Focus area	Studies examining the digitalization of IMS across quality, environmental, and safety domains	Studies not involving IMS or not covering its digital transformation
Content relevance	Empirical studies or reports linking digital IMS to operational excellence or sustainability	Articles without performance data or cross-functional integration
Source type	Peer-reviewed journals, sustainability reports, industry case studies, and white papers	Opinion pieces, blog posts, or non-empirical sources
Time frame	Publications from 2008 to 2024 capturing digitalization trends	Older sources or those irrelevant to technological evolution
Access and rigor	Full-text sources with clear methodologies and measurable outcomes	Abstract-only or methodologically weak documents

Identification Stage

Including Scopus, Web of Science, and Google Scholar, as well as corporate sustainability portals and ESG aggregators, academic and commercial databases were thoroughly searched. Using the keywords below and Boolean search combinations, the search included papers published from 2008 to 2024:

1. "Digital IMS" AND "Operational Excellence"
2. "Smart IMS" AND "Sustainability"
3. "ISO 9001" OR "ISO 14001" OR "ISO 45001" AND "Digital Transformation"
4. "AI-based Quality Management Systems" AND "Industry 4.0"

This stage yielded 112 potential records, including peer-reviewed journal articles, industry white papers, sustainability reports, and cross-sector case studies. After removing 7 duplicates, a total of 105 unique records were forwarded to the screening stage.

Screening Stage

All 105 sources were screened using predefined inclusion and exclusion criteria (see **Table 3**). The inclusion criteria required that studies explicitly addressed the use of digital technologies (AI, IoT, and cloud platforms) within IMS that covered at least two or more components of quality management systems (QMS), environmental management systems (EMS), or occupational health and safety management systems. Exclusion criteria removed studies that:

1. Focused solely on non-digital IMS implementations
2. Covered standalone systems (e.g., only QMS or EMS) without integration
3. Lacked empirical data or methodological transparency
4. Were opinion pieces, blogs, or grey literature lacking formal structure

After screening, 30 sources were excluded, leaving 75 for further evaluation.

Eligibility Stage

In the eligibility phase, the 75 remaining documents were closely examined based on:

1. Title and abstract alignment with research objectives
2. Methodological robustness
3. Depth of analysis regarding operational and sustainability outcomes
4. Evidence of multi-system integration and digital transformation

This resulted in the exclusion of 15 documents: 10 for insufficient emphasis on IMS digitalization and 5 for poor analytical clarity. 60 studies remained eligible for final inclusion.

Inclusion Stage

Backward citation tracking, expert advice, and inclusion of the most recent sustainability reports from 2024-2025 led to the discovery of nine more high-quality sources. Comprising 40 peer reviewed journal papers, 18 corporate sustainability reports, and 11 case studies across various sectors, the ultimate corpus comprised 69 publications. Twelve high-quality studies (2020-2025) were chosen for thorough synthesis and thematic examination in the research findings part. Using the critical appraisal skills program (CASP) checklist, we evaluated the study's quality and potential for bias. Studies were scored on the basis of:

1. Relevance to the review questions
2. Methodological rigor and clarity
3. Data transparency and measurability of outcomes
4. Sectoral relevance and cross-system integration

Every study was classified as high, moderate, or low caliber.

Although early publications (2008-2014) were initially identified, only foundational studies offering baseline conceptual models or early implementation frameworks were retained. With the majority (42) published between 2020 and 2025 and recent corporate sustainability reports from 2024-2025, the last dataset has 69 sources. This guarantees that the review captures both the evolution and present status of digital IMS adoption.

RESEARCH FINDINGS

We evaluate, using insights from a systematic reviews including peer-reviewed publications, industry white papers, case studies, and sustainability reports, how digitalized IMS help to achieve operational excellence and sustainability across several industries (Henríquez-Machado et al., 2021).

Operational Efficiency, Redundancy Reduction, and Predictive Maintenance

Particularly in multi-site and global applications, digital IMS have significantly improved operational workflows by

simplifying processes and reducing redundancies. Inefficiencies and redundant efforts were sometimes produced by traditional paper-based or siloed IMS systems. Organizations have been able to reach more streamlined processes and reduce manual duplication by combining digital technologies, including process mining software, AI-powered analytics, and cloud document storage (Endres et al., 2022; Li et al., 2023).

Oil & gas sector

1. Chevron implemented a digital transformation approach across its entire organization, which incorporates predictive analytics along with machine learning and real-time monitoring systems. Chevron's Integrated Operations Center allows for remote surveillance of both upstream and downstream assets to initiate proactive maintenance while reducing failure occurrences. *Chevron's 2023 sustainability report* indicates that these digital advancements caused major decreases in equipment downtime while achieving optimal workforce distribution across various locations.
2. Through sophisticated data analytics combined with AI, ExxonMobil (n.d.) seeks to enhance operational reliability while minimizing disruptions in its refineries and petrochemical facilities. The company uses its "EMIT" (ExxonMobil information technology) program to merge sensor data with predictive models, which then identify equipment vulnerabilities before they occur. ExxonMobil (n.d.) indicates that advanced technologies deliver improved safety compliance while boosting process reliability and achieving millions in cost savings through fewer emergency repairs and optimized inventory management.

Smart manufacturing

The study titled *"A framework for IoT-enabled smart manufacturing for energy and resource optimization"* demonstrates research on IoT-enabled smart manufacturing confirmed an 18% decrease in energy consumption, a 22% reduction in machine downtime, and a 15% improvement in resource utilization because of the effective use of digital IMS across the operations and a greater alignment with sustainability goals.

Regulatory Compliance and Risk Monitoring

With the help of digital IMS, organizations have been able to match regulations and quickly track the completion of the audit rounds in the organization. Those sectors highly regulated, such as healthcare, oil and gas, and food and beverage, are particularly where the automation and data integrity capabilities of the digital, web-based system have had the highest impact (Pho & Tambo, 2014; Su et al., 2022).

Oil & gas sector

ExxonMobil (n.d.) also developed a central digital IMS that integrates the environmental data, safety data, and performance metrics of several facilities across the globe. Machine learning algorithms coupled with high-end data visualization tools have refined refinery operations and helped keep regulations in check. According to reports, the use of its digital IMS resulted in a 15% decline in energy consumption, besides enhancing transparency through supply chain activities, which contributed to operational efficiency as well as sustainability objectives (ExxonMobil, n.d.).

Risk monitoring

Digital twin technology has been effectively incorporated by BP into its offshore oil rig risk monitoring program. Real-time operational data is continuously analyzed by this cloud-integrated system to identify possible hazards and anticipate failures before they happen. *"BP's digital twin innovation for enhanced risk management,"* a case study, claims that BP's digital twin-based risk monitoring greatly increased safety compliance and decreased downtime by 15% and 25%, respectively, in operational efficiency and unplanned safety incidents.

Occupational Health and Safety Outcomes (ISO 45001 Integration)

The inclusion of ISO 45001 in digital IMS architecture made significant improvements in health and safety results. There was a clear correlation between the digitalization of IMS and reduced workplace accidents, better incident tracking, and enhanced compliance with training (Akyıldız, 2023; Zivkovic & Petrovic, 2015).

Healthcare sector

In the *"Wye valley NHS trust case study",* the trust digitized patient observations and safety procedures by implementing the MAXIMS electronic observation (eOBS) module. Through automated escalation procedures, this integration expedited reviews for patients who were deteriorating and eliminated clinical errors related to manual score calculations. Multidisciplinary decision-making was improved by the system's real-time notifications and visibility of patient tasks, which led to better patient safety outcomes, such as a reported 22% decrease in medical errors and a 15% reduction in energy use.

Training and compliance

1. The incorporation of digital IMS tools for retraining alerts and digital competency matrices enhanced adherence to workforce readiness standards in the *"National safety council case study"*. Due to prompt retraining and proactive risk mitigation, these innovations helped reduce workplace incidents by 30% over two years.
2. Likewise, in the *"Moldstud Tech case study",* automated scheduling and IoT-based monitoring decreased the risk of injuries while guaranteeing that employees had the most recent certification and training.

Environmental Management, ISO 14001 Compliance, and Emission Control

The digitization of EMS within IMS, particularly ISO 14001-conformant frameworks, has indeed helped organizations achieve promising advancements in sustainability performance. Such tools include real-time data collection, centralized emission reporting, and AI-driven

waste optimization, all of which are paradigms from reactive to proactive environmental governance (De Camargo Fiorini et al., 2019; Sira, 2024).

Oil & gas sector

Real-time tracking of environmental data can be achieved via IoT-based emission monitors integrated into cloud-hosting IMS platforms. This is critical for compliance with ESG audits and environmental impact assessments. Shell's digital IMS systems reduced manual reporting errors and supported advanced offshore monitoring capabilities (Narayana et al., 2024; Rehman et al., 2024).

Energy sector

A digital IMS has been implemented as part of *"Ørsted's ESG performance improvement through digital IMS"* to improve ESG reporting. This allows for proactive evaluation of environmental risks and effective tracking of carbon emissions. Ørsted's ESG performance reports show that over three years, the company reduced greenhouse gas emissions by 22% and increased waste management expenses by 17%. The redeployment of digital IMS dashboards, which offered real-time data and analytics for improved decision-making, made these enhancements possible.

AI-powered modules

According to the case study *"European Union's destination earth initiative,"* digital IMS equivalents now have AI modules integrated with digital planetary impact simulation capabilities, helping things such as more energy consumption and waste management strategies through better decision-making. Such systems steer corporate sustainability initiatives back to the United Nations sustainable development goals. Among the more prominent EA pursuits are the destination earth initiative from the European Union, of create a digital twin to model climate change, natural disasters, etc., based on crucial decision-support tools.

Sustainability Reporting, Circular Economy, and Strategic Alignment with ESG Goals

The most important of the advantages being offered by digital IMS implementation is the advancement of ESG transparency and towards data-driven sustainability reporting (Lokuwaduge & Heenetigala, 2017). Increasing pressure has been emanating from investors, regulatory authorities, and consumers for businesses to declare their intentions in the areas of sustainability and responsible governance (Chopra et al., 2024).

Food and beverage sector

Nestle has led the way in implementing AI-assisted IMS for real-time compliance surveillance, sustainable resource consumption, and carbon footprint monitoring. Nestlé had also partnered with Zest on a food waste trial in the case study, *"AI tool trial to yield equivalent of ~1.5 million meals saved"*, using a collaborating solution from Nestlé for one of its UK factories. Delivering real-time monitoring and insights, an initial trial period saw 87% less food waste that went down the plug. The program not only attempted to reduce food waste but also said that preventing it would ultimately result in avoiding 1,400 tons of CO_2 emissions globally in line with international sustainability pooling commitments.

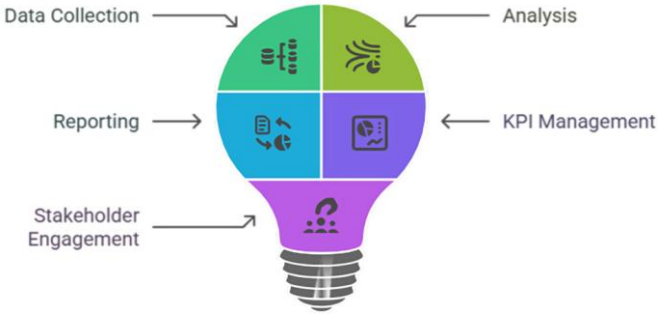

Figure 3. Transforming sustainability reporting (Source: Authors' own elaboration)

Sustainability reporting

Digital IMS platforms enable the development of a supported technology platform for sustainability data collection, analysis, and reporting through automation and standardization. These systems bring data from different departments- operations, supply chain, HR, and environmental compliance onto one unified platform. The combination facilitates a higher level of data consistency and reduces error-prone manual reporting. Real-time management of sustainability KPIs, such as energy consumption, greenhouse gas emissions, water usage, and social governance indicators, using dashboards and automated visualizations (de Nadae & de Carvalho, 2019; Faggini et al., 2019).

Many industry-specific reviews of sustainability reports that revealed the benefits from improved data traceability to facts ready for audit and stakeholder engagement (investors, regulators, consumers, among others) are provided by the key benefits. Digital IMS platforms are reshaping ESG reporting from a manual, prescriptive activity for organizations to strategically value-added objectives by meaningfully connecting sustainability objectives with corporate performance metrics, driving the transformation of what was once a "comply or die" for organizations (Buallay, 2019; Faggini et al., 2019). **Figure 3** shows the transforming sustainability reporting.

Circular economy

Moving towards the circular economy and transparency with digital IMS platforms, we enable end-to-end visibility and control of the entire product life cycle, from raw material sourcing and manufacturing to distribution, usage, and disposal/recycling through various layers. These systems are used to track materials, quantify energy and resource intensity, and identify resources for waste minimization at all levels (Rumetshofer & Fischer, 2023; Santana & Ribeiro, 2022).

In addition, the IMS platforms that connect environmental data to production metrics give companies the ability to distinguish reuse opportunities for materials and process reverse logistics activities. This may allow, for instance, manufacturers to gain insights into the dispositional useful disassembly potential for a product within lifecycle analytics

Figure 4. Digital IMS adoption drives operational efficiency, performance, business sustainability, and compliance improvements (Source: Authors' own elaboration)

from the IMS and redesign products, accordingly, extending their life span by postponing or preventing landfill. The nature of these capabilities is critical for full participation in closed-loop systems that are the building blocks of a circular economy. Companies that begin to utilize these best practices see lower material costs, higher carbon footprints, and also enhanced brand reputation among eco-conscious consumers (Khan et al., 2023a; Plociennik et al., 2022).

Strategic alignment

ESG-aligned IMS frameworks have a crucial impact to shift sustainability from compliance to core corporate strategy as a pillar of business. Such systems allow for cross-functional engagement on sustainability with goals to finance, operations, marketing, and product development teams. By enabling access to departmental data in real-time, analytics can ensure that departments can align actions that drive both environmental ambitions and key business KPIs (Carvalho et al., 2015; de Souza Barbosa et al., 2023).

Predictive modeling and what-if analysis (to help leadership teams think about shared value in creating strategic business initiatives for the company, the community, and the environment) are possible on digital IMS platforms. An instance of using the insights from IMS data is that a company would use what they learn about their behavior to make efficiency improvements that lower emissions (and costs). Instead of being subjected to an outside regulation, sustainability is defined within the value creation model of the organization and shapes innovation, risk management, and long-term competitiveness. This represents a significant paradigm shift in how organizations grow amidst the demands of digital transformation and ESG values (Lichtenthaler, 2022; Rialti et al., 2022).

Cross-Sectoral Insights and Comparative Performance Analysis

The systematic review highlights some impressive performance improvements specific to various industries, while also pinpointing shared success factors among sectors that are embracing digital IMS (**Figure 4**):

1. **Manufacturing:** Puts a spotlight on efficiency and compliance.
2. **Healthcare:** Stresses the importance of safety and sustainability.
3. **Oil & gas:** Zeroes in emissions, automation, and data accuracy.
4. **Construction:** Focuses on incident detection and ensuring site safety.
5. **Food & beverage:** Emphasizes traceability and staying in line with regulations.
6. **Energy & utilities:** Showcases leadership in accurate ESG reporting.

By examining several case studies, it becomes clear that companies that adopt at least three digital technologies, such as cloud computing, IoT, and AI, within their IMS platforms consistently achieve better outcomes than those relying on just one or two. This indicates a beneficial synergy from technological convergence, where combined digital ecosystems yield much higher returns in performance, sustainability, and compliance (Griffith & Bhutto, 2008; Silvestri et al., 2021).

Case Studies: Sector-Specific Implementations

Table 4 presents detailed insights into how leading companies across various sectors have implemented digital IMS to achieve operational excellence and sustainability goals.

Table 4. Case studies: Sector-specific implementations

Category	Key insights
Ford Motor Company	
IMS	Ford's sustainability strategy emphasizes integrating environmental and operational goals across its manufacturing processes.
Operational excellence	Achieved a 35.4% reduction in operational greenhouse gas (GHG) emissions since 2017 through energy efficiency and conservation efforts.
Digitalization	Invested over $26 million in energy efficiency projects across North American facilities in 2022, leading to significant energy savings and GHG reductions.
Renewable energy usage	Incorporated 60.6% carbon-free electricity globally, with 42.6% from renewable sources, including all purchased electricity for manufacturing in Europe and Mexico.
Water management	Aims for zero water withdrawals in manufacturing processes, utilizing recycling and reuse systems to conserve water and energy.
General Electric (GE) Company	
IMS	GE integrates IMS within its digital transformation strategies to enhance operational efficiency and product quality.
Operational excellence	Launched "proficy for sustainability insights," an AI-based software aimed at improving sustainability metrics and operational performance.

Table 4 (Continued). Case studies: Sector-specific implementations

Category	Key insights
Digitalization	Upgraded its aircraft engine repair facility in Singapore into a smart factory, leveraging AI, augmented reality, IoT, robotics, and cloud technologies.
Technology focus	Emphasizes the use of emerging technologies to improve manufacturing processes and develop innovative products and services.
Boeing Company	
IMS	Boeing employs integrated systems to manage sustainability and operational goals across its global operations.
Operational excellence	Collaborates across the industry to improve operational efficiency, aiming to reduce emissions by about 10% through better airplane retrofit, maintenance, and flight operations.
Digitalization	Invests in advanced technologies for improved aerodynamic performance, propulsion efficiency, and digital design, test, and production capabilities.
Renewable energy usage	In 2023, sourced 39% of its operational energy from renewable electricity through direct purchases and renewable energy credits.
Sustainability strategy	Adopted an 'avoid first, remove second' approach to carbon management, focusing on emission prevention and utilizing offsets for hard-to-abate emissions.
Chevron Company	
IMS	Utilizes the operational excellence management system (OEMS) to systematically manage health, safety, environment, reliability, and efficiency.
Operational excellence	OEMS provides a framework to assess risks, identify safeguards, and implement programs to assure the effectiveness of those safeguards.
Digitalization	Employs air monitoring technology at facilities like the El Segundo Refinery to collect and record real-time air quality data, enhancing transparency and compliance.
Water management	Chevron's Richmond Refinery is the largest industrial user of recycled water in the San Francisco Bay area, using over 7 million gallons of recycled water per day.
ExxonMobil Company	
IMS	Integrates sustainability into its operations, focusing on process safety and environmental performance.
Operational excellence	Enhances process safety through continuous improvement initiatives and adherence to stringent safety standards.
Digitalization	Processed 80 million pounds of plastic waste through its Baytown advanced recycling facility by December 2024, with plans for 1 billion pounds of annual advanced recycling capacity.
Climate goals	Aims to achieve net-zero Scope 1 and 2 GHG emissions from operated assets by 2050, with interim targets for specific operations.
British Petroleum Company	
IMS	BP implements integrated systems to manage health, safety, environmental, and operational aspects across its global operations.
Operational excellence	Focuses on reducing emissions and improving energy efficiency through various initiatives and investments.
Digitalization	Invests in digital technologies to enhance operational efficiency, safety, and environmental performance.
Renewable energy initiatives	Transitioning to renewable energy sources and integrating digital solutions to support its net-zero ambitions.

DISCUSSION

A new approach to the digital revolution of IMS through the systematic review of literature, sustainability reports, and a few case studies that conspicuously reveal more of the roles of digitalization of IMS as a prime mover of operational excellence in several sectors of the economy. Industries will become much more responsive, proactive, and performance-oriented by integrating such digital technologies as IoT, AI, cloud computing, and real-time analytics into their fabrics. Firstly, it would be important to collect data without interruptions, which systems could be set in order for the maintenance to be predicted, and so many other functions the technology makes possible simply by the help of these four parts and proactive decision-making (BinSaeed et al., 2023; Calderon-Monge & Ribeiro-Soriano, 2024).

Nonetheless, these benefits differ by industry based on the degree of regulatory pressure, digital maturity, organizational culture, and availability of resources. Although companies like GE, Ford, and Shell have used digital IMS to create global standards and real-time visibility of performance, small- and medium-sized enterprises (SMEs) may not be able to deploy and scale these systems because of exorbitant initial costs, limited technological expertise, and the absence of integration across ancient platforms. This gap highlights a digital divide that could potentially slow uniform improvement toward operational excellence and sustainability, especially in emerging markets and low-resource industries (Vrontis et al., 2022).

The other key finding in the review is strategic alignment between digital IMS and overall ESG objectives. Sustainability reports of top companies show how digital IMS not only make it easier to comply with standards like ISO 14001 and ISO 45001 but also act as a backbone for ESG data management, implementing the circular economy, and transparent communication with stakeholders. Consolidation, analysis, and visualization of ESG-related metrics in real-time enables businesses to improve continuously while building trust and accountability with regulators, investors, and consumers (Kwilinski et al., 2023; Sepetis et al., 2024).

This review builds upon and extends prior findings from at least six major reviews in the field. Ronalter and Bernardo (2023) proposed a sustainable IMS (SIMS) framework that emphasized integration of environmental metrics but did not explore cloud-based automation or AI integration as deeply as our study. Waqar et al. (2025) offered a strong argument for

IMS in sustainable construction but lacked technological focus, which our review covers extensively. Gianni and Gotzamani (2024b) stressed internalization of IMS for sustainable corporate strategy but focused on stakeholder theory rather than operational architecture. Virmani et al. (2025) introduced the TOE framework in Lean Six Sigma integration, whereas our work demonstrates how those concepts materialize through actual digital implementations. Al-Rbeawi (2023) presented a narrative review of digitalization in oil and gas yet lacked cross-sector comparisons. Finally, Andrei and Johnsson (2025) explored digital maturity for energy efficiency but focused narrowly on Northern Europe, whereas our data include multinational perspectives from oil and gas, healthcare, manufacturing, and food industries. Collectively, these comparisons confirm the broader relevance and complementarity of our study to the field.

From a policy point of view, the results confirm how digital IMS enables real-time monitoring, speeds audit time, and embeds compliance into digital workflows to support global standards including ISO 9001, 14001, 27001, and 45001. Furthermore meeting ESG legislative trends including the EU Corporate Sustainability Reporting Directive, US SEC climate risk disclosure rules, and worldwide net zero requirements, digital IMS adoption does so. Offering integrated dashboards and ESG measure tracking, digital IMS provides a technological foundation allowing companies to proactively fulfill fresh ESG standards. By using tax advantages, subsidized platforms, or digital grants, policymakers should encourage SME adoption of such systems to guarantee fair access across value chains.

Still, this review has some drawbacks. First, the study's lack of registration in PROSPERO or a comparable protocol repository restricts methodological openness. Second, some case insights depend on corporate sustainability reports, which might be positively biased or omit failed deployments. Third, even though the review includes cross-sectoral representation, it omits grey literature and might undervalue non-English or regionally unpublished case studies from low-income countries. Finally, some included studies may not represent the most recent state-of-the-art systems or actual field techniques because of the constantly changing character of digital technologies.

In spite of the apparent advantage, proper implementation of digital IMS depends on a well-defined governance structure, top management commitment, and employee training on an ongoing basis. Standardized metrics and interoperability standards also need to be established so that digital IMS platforms can talk to each other across departments, facilities, and supply chains. Subsequent research would investigate scalable digital IMS architectures adapted for SMEs, the part played by public policy in encouraging digital transformation, and long-term effects on organizational resilience, carbon neutrality, and stakeholder engagement. As industries strive to walk in parallel the tightrope of digital transformation and sustainability mandates, digital IMS emerges as an essential integrative mechanism that can provide both operational excellence and strategic environmental performance (Alojail & Khan, 2023; Martínez-Peláez et al., 2023).

Three main objectives should guide future research. Design first modular and scalable digital IMS solutions fit for SMEs with small IT budgets and few technical personnel. Second, evaluate how public policy can support digital IMS through compliance driven subsidies, industrywide digital literacy campaigns, and standard ESG interoperability processes. Third, longitudinal field studies should assess the real influence of digital IMS adoption on long-term carbon neutrality, crisis resiliency, and stakeholder trust especially in periods of pandemics, supply interruptions, or climate related crises. Developing worldwide standards and KPIs for digital IMS success will also facilitate industry-wide acceptance and openness. These initiatives will help to close the digital gap and guarantee that IMS digitalization will turn into a worldwide enabling for sustainability that is inclusive. **Table 5** shows the summary and quality assessment of included studies in the systematic review.

Future Directions

More and more businesses are seeing the benefits of IMS for running smoothly and being eco-friendly. The next step is to tap into new digital tech for better integration, quick decisions, and predictive insights. Future IMS setups will likely align with Industry 5.0 ideas, focusing on teamwork between humans and machines, being resilient, and caring for the environment (Ghobakhloo et al., 2024; Ivanov, 2023). Technologies like AI, blockchain, digital twins, and augmented reality will change IMS from just compliance tools into smart systems that improve themselves. For example, AI can help spot issues, assess risks on the fly, and manage resources better. At the same time, blockchain can keep data accurate and trackable across different suppliers (Atlam et al., 2020; Xuan & Ness, 2023).

A major trend we're seeing is the move toward smart, self-adapting IMS systems. These systems will be able to learn from what's happening around them and adjust workflows, maintenance plans, and compliance rules as needed. To make this happen, we need to include machine learning in IMS platforms and teach them using a mix of data from operations, audits, customer feedback, and sustainability efforts. Also, creating digital twins of IMS processes can help simulate compliance situations and equipment performance in real time. This gives organizations a safe space to test decisions and keep improving (Jaensch et al., 2018; Olajiga et al., 2024).

Another path we're seeing is making digital IMS more accessible for small and medium-sized businesses. Many of these companies do not have the resources to put in place big business digital systems yet. Cloud-based, simple IMS platforms can be customized to meet the specific needs of these businesses when it comes to compliance and sustainability (Manoharan, 2024). This could encourage more of them to get on board across supply chains. It's also important to create standard protocols for IMS that allow different systems like ERP, CRM, and IoT to work together (Khan et al., 2023b). This would break down barriers and make sure that sustainability data flows smoothly between departments and partners, which is key for investors, regulators, and customers (De Vass et al., 2021; Rajaguru & Matanda, 2019).

Also, it's important to note how many policies, regulations, and ESG governance play a part in the growth of digital IMS. Governments and global organizations should push for the use

Table 5. Summary and quality assessment of included studies in the systematic review

Reference	Sector/industry	Country	Focus	Methodology	Outcomes	QR (CASP)
Waqar et al. (2025)	Construction	Global	IMS and sustainable construction	Quantitative analysis (β and p-values)	IMS significantly enhances sustainability performance: quality (β=0.643), Risk (β=0.53), safety (β=0.439). Recommends real-world project validation.	High
Carnerud et al. (2020)	Quality/operations management	Global	Trends in QM/OM literature	Bibliometric analysis (11,631 abstracts)	Only 1% mention sustainability, digitalization rarely discussed. Urges empirical research and IT integration in QM.	Moderate
Virmani et al. (2025)	Manufacturing/ environmental management	Global	LSSI adoption	Empirical survey using TOE framework	Technological, organizational, and environmental dimensions influence lean and sustainable systems integration. Better alignment with sustainability needed.	High
Lutete (2025)	General industry	Global	ISO and organizational capability	Conceptual/theoretical paper	Leadership and cultural integration are key. Warns that compliance-based mindsets can impede effectiveness.	Moderate
Bukhari et al. (2025)	SMEs in emerging markets	Malaysia	IMS and firm performance	Statistical regression	IMS improves environmental (β = 0.0176), financial (β = 0.0281), and economic (β = 0.534) outcomes. Supports innovation and efficiency.	High
Gianni and Gotzamani (2024b)	CSR/sustainability	Global	IMS internalization and corporate social performance	Structural equation modeling	Internalizing IMS enhances CSP. Second-order model reveals stakeholder collaboration is crucial. Calls for validation across sectors.	High
Gianni and Gotzamani (2024a)	Manufacturing/quality	Global	Lean, quality, and digital transformation	Conceptual integration (conference)	Combining lean systems with digital IMS improves sustainability. Culture, leadership, and workforce engagement are critical enablers.	Moderate
Yazo-Cabuya et al. (2024)	Risk/sustainability	Iran	Sustainable risk management	MCDM (VIKOR + sensitivity analysis)	VIKOR robust vs. AHP/ANP for evaluating sustainability risks. Emphasizes category prioritization and scenario testing.	High
Shin et al. (2025)	Quality management	Global	Open quality framework	Conceptual/theoretical framework	Proposes E-QMS in digitalization era. Improves customer satisfaction and enables data-driven decisions.	High
Ronalter and Bernardo (2023)	IMS/environmental governance	Global	IMS and sustainable development	Systematic literature review	IMS supports sustainability goals. Proposes SIMS framework. Identifies 8 directions for future research.	High
Al-Rbeawi (2023)	Oil & gas	Global	Digitalization in oil & gas	Narrative literature review	Digital tools improve upstream efficiency. Challenges include workforce adaptation and regulation. AI, Big Data, and automation are critical.	Moderate
Andrei and Johnsson (2025)	Manufacturing (energy efficiency)	Sweden	Digital tech adoption in energy efficiency	Empirical industry survey	56% DiT maturity in iron/steel, 33% in furniture/paper. IoT and big data common, AI less used. Maturity model helps advancement.	Moderate

Note. QR: Quality rating

of these systems through incentives like green subsidies and grants for digital infrastructure. As more regions make ESG reporting a requirement, these digital IMS will be crucial for gathering information on sustainability. Future studies should look into creating benchmarks and metrics that help organizations track their progress in going digital, especially concerning long-term sustainability and staying strong during global challenges (Chouikh et al., 2023; Saxena et al., 2023).

CONCLUSION

The move toward digital IMS is changing how companies work toward better operations and business sustainability. This review shows that digital IMS helps with compliance and blends quality, health, safety, and environmental standards while improving performance through data-driven choices, automation, and real-time monitoring. Examples from big names like Ford, GE, Boeing, Chevron, ExxonMobil, and BP show real benefits like better process efficiency, cost savings, and a stronger commitment to the environment. Insights from sustainability reports also highlight the connection between digital IMS and ESG goals. As industries change in a world focused on digital growth and sustainability, the IMS of the future will be smart systems that not only help with compliance but also add value. This mix of digital progress and integrated management shows that achieving operational excellence and sustainability are closely linked goals.

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