

ISO management system standards in the light of corporate sustainability: a bibliometric analysis

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Abstract

Purpose – This work aims to present existing management system standards (MSSs) published by the International Organization for Standardization (ISO) through a bibliometric analysis, thereby outlining their academic research status and highlighting their relation to the Sustainable Development Goals (SDGs) as well as to environmental, social and governance (ESG) themes.

Design/methodology/approach – The study firstly retrieves a preliminary set of MSSs standards from ISO and filters it in accordance with certain exclusion/inclusion criteria. Secondly, a bibliometric search is performed in the database Scopus. Thirdly, performance analysis is conducted to quantitatively measure the scientific output in academia, and science mapping of co-occurrences of keywords is applied to identify related topics. Thereby, the standards' relationships to sustainability are outlined. Eventually, the work discusses future research opportunities.

Findings – The findings reveal that whereas research on MSSs focuses predominantly on only a few standards by now, there are actually numerous further standards that address sustainability-relevant topics, which are getting increasing attention among scholars as measured by the number of publications. Therefore, an action plan for future research is derived. Moreover, the findings support the argument of integrating MSSs to cover a broad range of corporate sustainability issues.

Originality/value – The paper connects the concepts of MSSs and sustainability, an upcoming research branch yet characterized by shortage of academic studies (given that research continues to focus on a few standards such as ISO 9001, ISO 14001 and ISO 45001). The work therefore opens up the line for more in-detail research on less known but nevertheless sustainability-relevant ISO MSSs.

Keywords Bibliometric analysis, Environmental, social, and governance (ESG), International Organization for Standardization (ISO), Management system standards, Sustainability, Sustainable Development Goals (SDGs)

Paper type Research paper



1. Introduction

Planet earth greatly suffers from increasing environmental destruction (e.g. [WWF, 2020](#)), and the responsible human race itself faces significant social as well as economic inequalities among its people (e.g. [UNDESA, 2020](#); [UNDP, 2019](#)). To tackle related challenges, in 2015 the United Nations (UN) launched a global agenda consisting of 17 Sustainable Development Goals (SDGs) and 169 related targets to be met by 2030 ([UNDESA, 2015](#)). Albeit this sustainability agenda was launched as call of action at the country-level, the ambitious goals can only be achieved by direct involvement of business enterprises ([Pizzi et al., 2020](#)) as many SDGs regard to corporate behavior and strategies ([Sachs, 2012](#)) [1].

But measuring a company's corporate sustainable performance (CSP) and SDG commitment is difficult, especially due to the huge differences between countries, industries and companies ([Pizzi et al., 2020](#)), and because it is highly complex to link some targets of the agenda to business corporations ([Schaltegger, 2018](#)). However, scholars have identified a positive linkage between corporations' environmental, social and governance (ESG) disclosure and their SDG footprint ([Antoncic et al., 2020](#); [Plastun et al., 2020](#)). Further, the level of SDG commitment and ESG outcomes are viewed as highly correlated (e.g. [Sasaki, 2020](#)), and researchers started to connect SDG targets and indicators to certain ESG variables (e.g. [Delgado-Ceballos et al., 2023](#)). In this spirit, ESG ratings evolved as a measurement tool for firms' CSP (e.g. [Avetisyan and Hockerts, 2017](#); [Rajesh and Rajendran, 2020](#)). In a nutshell, the SDGs are ambitious targets for global sustainability, and their achievement partially relies on firms fostering their CSP, which can be easier measured and standardized by applying ESG frameworks [2].

The ESG concept itself is linked to numerous stakeholders such as society, suppliers, employees and shareholders ([La Fuente et al., 2021](#); [Muñoz-Torres et al., 2019](#)), and in the organizational context firms often rely on management systems (MSs) to address particular needs of such stakeholders systematically ([Poltronieri et al., 2018](#)). Due to this relation, both concepts might share certain connections and synergies. The main elements of MSs are often described in management system standards (MSSs), which are voluntary guidelines and codes developed and published by national as well as international bodies. Regarding internationally applicable MSSs, the International Organization for Standardization (ISO) represents the most important standardization body. However, only few of its standards are widely diffused (as evidenced in [section 2.1](#)). In accordance with the diffusion numbers, academic literature mainly focuses on the largely adopted MSSs, while less common standards are yet nearly unresearched (as evidenced in [section 4](#)). Nonetheless, also these hardly researched standards might have great potential to positively impact the environmental, social and/or governance performance of firms and to eventually help achieving the SDGs, as indicated by ISO itself ([ISO, 2022d](#)).

Thus, this work is motivated to support achieving the SDGs, at least partially, from a corporate viewpoint and, in this context, argues that the application of MSSs can foster sustainability at firm level. Therefore, the research objective of this paper is to present existing ISO MSSs, thereby outlining their academic research status and highlighting their relation to the SDGs as well as to ESG themes. In this respect, the following research questions (RQs) are answered:

RQ1. How mature is academic research about existing ISO MSSs?

RQ2. To what extent are ISO MSSs related to the SDGs and certain ESG themes?

To answer these RQs, this work performs bibliometric performance analysis (directed at [RQ1](#)) and applies science mapping of co-occurrences of keywords (directed at [RQ2](#)) for a set of existing ISO MSSs. By doing so, the study sheds light on less diffused and researched MSSs that nevertheless reveal strong potential for being capable of empowering firms to enhance their CSP

in a language that is already common to their employees, suppliers and customers. Further, the work contributes to research on MSSs in the context of SDGs and ESG performance.

The paper continues in six sections. Section 2 provides extensive background information on the topic at hand. Section 3 explains the methodology applied. Section 4 presents the findings of the bibliometric analyses. Section 5 entails the discussion, which derives future research opportunities. Section 6 offers the conclusions.

2. Literature review

The literature review outlines the concept of MSSs, thereby focusing on the standards published by ISO. Further, a synthesis of previous studies about management systems and standards related to the SDGs and ESG performance is depicted.

2.1 ISO's management system standards

In general, MSSs are voluntary guidelines used by companies to formalize and systematize their managerial activities, and they govern the implementation of MSs (Boiral and Heras-Saizarbitoria, 2015) such as quality (QMS), environmental (EMS) or occupational health and safety (OHSMS) management systems, among others, depending on their objective (Jørgensen et al., 2006). Thus, MSSs describe the formal codes and MSs represent the outcome – i.e. the practical business tools that result when implementing these theoretical guidelines (Ronalter et al., 2022b). And these tools can promote comprehensive changes in organizations regarding value creation and sustainable development (e.g. Petros Sebhatu and Enquist, 2007).

Regarding internationally applicable MSSs, the International Organization for Standardization represents the most important standardization body. Based in Geneva, Switzerland, ISO acts as independent, non-governmental international organization with 167 national standards bodies as members, through which it brings together experts and develops voluntary international standards directed at supporting innovation and providing solutions to global challenges (ISO, 2022a). As of January 7th, 2023, 24'613 international standards are in existence, which cover nearly all aspects related to technology and manufacturing (ISO, 2022a) and are often related to sustainability-relevant issues. Table 1 shows the number of ISO standards that are directly applicable to the SDGs according to ISO itself (2022d).

SDGs	1	2	3	4	5	6	7	8
	No Poverty	Zero Hunger	Good Health and Well-Being	Quality Education	Gender Equality	Clean Water and Sanitation	Affordable and Clean Energy	Decent Work and Economic Growth
#ISO Standards	376	572	3'271	581	212	643	995	2'644
SDGs	9	10	11	12	13	14	15	16
	Industry, Innovation and Infrastructure	Reduced Inequalities	Sustainable Cities and Communities	Responsible Consumption and Production	Climate Action	Life Below Water	Life on Land	Peace, Justice and strong Institutions
#ISO Standards	13'662	590	2'612	2'921	1'284	345	1'140	199

Table 1. Number of ISO standards directly applicable to the SDGs according to ISO

Note(s): Goal 17 ('Partnerships for the Goals') has been excluded in the table since ISO only relates two standards to this goal

Source(s): Adapted from ISO, 2022d; as of January 7th, 2023

However, only a few of these ISO standards are MSSs, thus standards for formalizing and systematizing firms' managerial activities that eventually govern the implementation of MSs. In concrete, ISO provides a list of 93 documents/standards for MSSs on its webpage (ISO, 2022c; as of January 7th, 2023), see the Appendix. Companies compliant to such MSSs' core elements and requirements can receive corresponding certification, if the standard allows it (de Oliveira, 2013; Santos *et al.*, 2011). But only a handful of these standards are actually widely diffused and adopted, as can be seen in Table 2, which shows the number of valid certificates for certain MSSs as communicated by ISO (2022b). As visible, only the ISO standards for QMS, EMS and OHSMS achieved >60'000 valid certificates on a global scale (widely diffused) and a handful of MSSs exceed the threshold of 10'000 certificates (medium diffusion rate). However, most certifiable ISO MSSs are less widely diffused with <3'000 certificates worldwide.

This means that whereas there are formal codes for best practices covering a wide range of business topics, actually only a few of them are applied in firms, thus leaving behind huge potential for improvements and standardization – likely also in regard to CSP enhancements. In accordance with the diffusion numbers, academic literature mainly focuses on the largely adopted MSSs, while less common standards are yet nearly unresearched (as evidenced in section 4, which identifies the research maturity of ISO MSSs based on a set of bibliometric indicators). Nonetheless, this work is motivated by the authors' belief that even less researched standards might expose great potential to positively impact the ESG performance of firms and eventually support achieving the SDGs.

ISO management system standards		Certificates
ISO 9001	Quality management systems–Requirements	1'077'884
ISO 14001	Environmental management systems–Requirements with guidance for use	420'433
ISO 45001	Occupational health and safety management systems–Requirements with guidance for use	294'420
ISO/IEC 27001	Information technology–Security techniques–Information security management systems–Requirements	58'687
ISO 22000	Food safety management systems–Requirements for any organization in the food chain	36'124
ISO 13485	Medical devices–Quality management systems–Requirements for regulatory purposes	27'229
ISO 50001	Energy management systems–Requirements with guidance for use	21'907
ISO/IEC 20000–1	Information technology–Service management–Part 1: Service management system requirements	11'769
ISO 37001	Compliance management systems–Requirements with guidance for use	2'896
ISO 22301	Societal security–Business continuity management systems–Requirements	2'559
ISO 39001	Road traffic safety management systems–Requirements with guidance for use	1'285
ISO 28000	Specification for security management systems for the supply chain	584
ISO 55001	Asset management–Management systems–Requirements	488
ISO 20121	Event sustainability management systems–Requirements with guidance for use	253
ISO 29001	Petroleum, petrochemical and natural gas industries - Sector-specific quality management systems–Requirements for product and service supply organizations	157
ISO 44001	Collaborative business relationship management systems–Requirements and framework	136

Source(s): Adapted from ISO (2022b)

Table 2.
Total number of valid certificates for MSSs as covered by “The ISO survey of MSSs certifications – 2021”

2.2 Studies on management systems and standards related to SDGs and firms' ESG performance

Besides ISO mapping its own standards to the SDGs (refer to [Table 1](#)), few detailed research on management systems and standards in the context of SDGs is identified. For example, [Fonseca and Carvalho \(2019\)](#) reveal that companies with ISO 9001 (QMS), ISO 14001 (EMS) and OHSAS 18001/ISO 45001 (OHSMS) certifications especially report their business actions related to SDGs 8, 9, 12, 13 and 17. However, these authors restrict their empirical work to the issue of reporting, without assessing companies' actual performance in terms of SDG commitment. Regarding possible impacts of MSSs' adoption on the achievement of the 2030 agenda, current literature is mainly composed of conceptual papers. [Zhao et al. \(2020\)](#), for example, discuss the role of ISO standards regarding zero hunger (SDG 2), thereby highlighting the potential of ISO 22000 (QMS for food safety) and ISO 14001 (EMS) to pursue this particular goal. Further, they recommend performing comparable studies directed at the remaining SDGs. [Moschen et al. \(2019\)](#) compare the agenda with ISO 37120 (sustainable cities and communities), concluding that albeit the standard establishes mediation parameters for indicators, it lacks specification or encouragement about how cities/communities could be made ideal. [Horry et al. \(2022\)](#) map the benefits of ISO 14001 (EMS) implementation identified in existing literature against all SDGs, thereby showing that the strongest associations apply for the SDGs 4, 8, 12 and 13. In addition, [Dion et al. \(2022\)](#) conclude that ISO 50001 (energy management) adoption helps to achieve affordable and clean energy (SDG 7).

In sum, current research reveals a lack of empirical studies about measured SDG achievement. This might be due to the difficulty of actually quantifying SDG commitment, as outlined in the introduction. Therefore, empirical studies might use the ESG concept as proxy variable for CSP and, eventually, SDG achievement (refer to the introduction), as benefits of MSs implementation can be directly related to corporate sustainability issues mirrored in ESG frameworks [\[3\]](#).

In this context, most researchers focus however on single ESG-related benefits of MSSs/MSs so far. For example, QMSs (often based on ISO 9001) are capable of positively impacting environmental process innovations (e.g. [Ziegler, 2015](#)) (environmental pillar of the ESG concept), improving product and service quality (e.g. [Tari et al., 2012](#)) (social pillar) and increasing the commitment of management to best quality practices (e.g. [Arauz and Suzuki, 2004](#)) (governance pillar). Nonetheless, first scholars start overcoming such sole focus on particular adoption benefits, but instead take into account the relation between MSs and the ESG concept in a broader sense. [Ronalter et al. \(2022a\)](#), for example, sort the benefits of QMSs and EMSs (often based on ISO 14001) adoption by ESG theme and evidence through a cross-regional empirical study that both MSs represent suitable business tools to achieve enhanced ESG performance. However, this study does not make statements about specific underlying MSSs, but rather explores QMSs and EMSs in general. Other studies considering ESG ratings alongside MSs are [Broadstock et al. \(2021\)](#), who state that companies must perform well in EMS certification to achieve higher ratings in the environmental pillar, [Schmid et al. \(2017\)](#), who conclude that ESG themes may be anchored in QMSs, and [Chams et al. \(2021\)](#), who state that firms with QMSs are less reliant on financial capital to improve ESG ratings. In contrast to the SDG-related studies, the conclusions of the depicted ESG-focused works are based on empirical data. Further, they contain a stronger focus on performance issues. Nonetheless, they mainly concern major MSs.

Furthermore, it's noteworthy that albeit there are some academic discussions about how sophisticated MSSs for sustainability-related issues such as the circular economy (e.g. [Ronalter et al., 2022b](#)) or corporate sustainable development in general (e.g. [Asif and Searcy, 2014](#)) could be designed, there is apparently no ongoing discussion about creating

internationally applicable standards that guide companies in the complex issue of aligning business practices with the core principles of the SDGs or certain ESG frameworks.

Besides these publications on the application of MSs and their relation to ESG performance, the authors cannot identify any ESG-related studies with a sole focus on MSSs and their core elements in any major academic database. Therefore, this paper aims to provide pioneering work in this specific research branch by broadening up the research focus through presenting both well-known as well as niche MSSs and their relations to the SDGs and the ESG concept. The results are hopefully motivating fellow academics to engage in more detailed future studies about various MSSs and their impact on corporate sustainability. The main issues of the literature section are synthesized in [Figure 1](#).

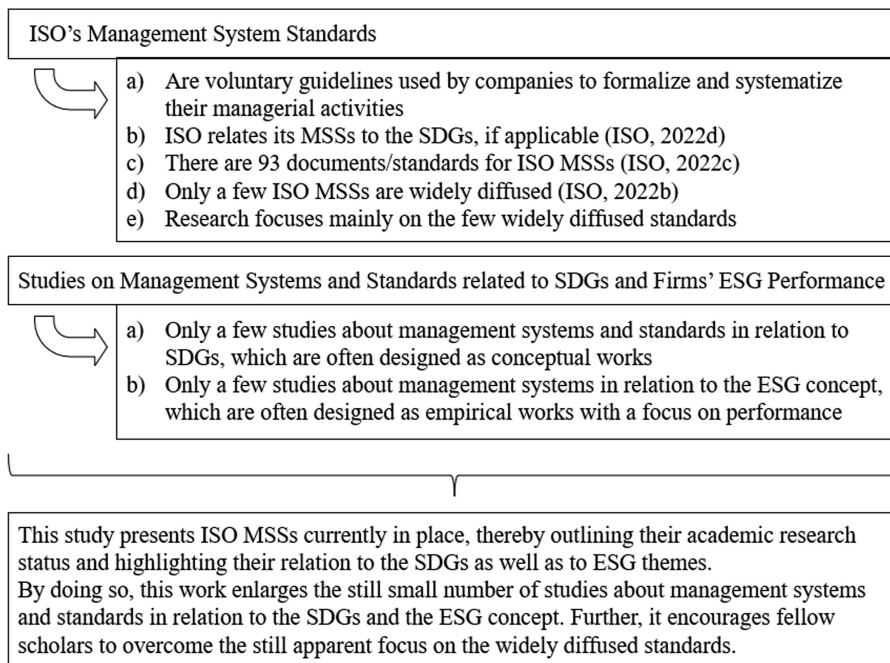


Figure 1.
Synthesis of the
literature review

Source(s): Own elaboration

3. Research method

The methodology follows the 3-steps-process visualized in [Figure 2](#). This section performs steps 1 and 2, and further outlines step 3, whose actual results are presented in [section 4](#). The bibliometric analysis eventually leads to the discussion of future research opportunities in [section 5](#).

3.1 Step 1 – identification of preliminary set of management system standards

The first step tackles the task to identify an initial, preliminary set of international applicable MSSs. Therefore, ISO's list of 93 MSSs is used as starting point (ISO, 2022c). In this list, ISO distinguishes between the stage of the document (published, being revised or under development), the document type (management standard, Type A MSS or Type B MSS) [4] and if the standard is only applicable for specific sectors (marked as

Step 1	Identification of Preliminary Set of Management System Standards	Section 3.1, incl. Appendix
↓	<ul style="list-style-type: none"> a) Retrieving list of ISO MSSs b) Applying inclusion/exclusion criteria 	
Step 2	Defining the Bibliometric Procedure	Section 3.2
↓	<ul style="list-style-type: none"> a) Outlining the aim and scope of the bibliometric study b) Choosing the techniques for the bibliometric analysis c) Collecting the data for the bibliometric analysis 	
Step 3	Performance Analysis and Science Mapping	Section 4
	<p>Performance Analysis RQ1</p> <ul style="list-style-type: none"> a) Using total publications as relevant publication-related metrics b) Depicting the development of publications, citation structure, subject areas, most cited articles, most influential authors and main countries of research <p>Science Mapping RQ2</p> <ul style="list-style-type: none"> a) Mapping of co-occurrences of keywords b) Highlighting identified relations to ESG themes and listing SDG connections 	
	Discussion: Relevance towards Future Research	Section 5
	<ul style="list-style-type: none"> a) Serving as a point of departure for future MSS-related research b) Pointing the finger on standards bearing the most sustainability-related potential c) Impacting research about integrated management systems (IMS) 	

Source(s): Own elaboration

Figure 2.
Applied research
methodology

“sect. appl.”) or related to any generic standard (certain Type B MSSs refer to a Type A MSS). Since this work intends to identify already existing MSSs that are broadly applicable, step 1 considers all document types that have been published or that are currently being revised (inclusion criteria). However, standards under development or that refer to a certain sector are excluded and, in addition, also a manual industry check is performed by the authors and Type B MSS that refer to any Type A MSS are filtered (exclusion criteria). The application of step 1 is depicted in the [Appendix](#) and leads to a preliminary set of 28 standards.

3.2 Step 2 – defining the bibliometric procedure

Bibliometrics basically describes a set of methods that can be used for quantitatively analyzing academic literature stored in big bibliographic databases and its changes over time (Cobo *et al.*, 2011; Gutiérrez-Salcedo *et al.*, 2017). Thus, it represents an academic science directed at assessing the research done in any field (Gutiérrez-Salcedo *et al.*, 2017). Since bibliometric procedures serve as objective evaluation criterion, they represent increasingly valued tools among scholars (Gutiérrez-Salcedo *et al.*, 2017; Moed *et al.*, 1995).

The two main bibliometric procedures existing are performance analysis and science mapping (Donthu *et al.*, 2021). Whereas performance analysis measures scientific output by using quality and quantity indicators (focus on *contributions* of research constituents), science mapping explores how authors, disciplines, fields, documents or specialties are related to one another (focus on *relationships* between research constituents) (Donthu *et al.*, 2021; Gutiérrez-Salcedo *et al.*, 2017). The main measurement indicators used in performance analysis, which is mainly descriptive in its nature (Donthu *et al.*, 2021), are production indicators (such as total number of papers published), impact indicators based on received citations (such as total citations or average number of citations per paper as well as different indices – e.g. h-index, g-index, etc.) and indicators based on the impact of the journal (such as the impact factor or scientific journal rankings) (Gutiérrez-Salcedo *et al.*, 2017). In science

mapping analysis, which retrieves structural connections among research constituents (Donthu *et al.*, 2021), the main kinds of bibliographics are collaboration networks (show how authors or institutions relate to others), conceptual networks (show relations between concepts or words) and publication citation networks (show relationships between publications) (Gutiérrez-Salcedo *et al.*, 2017).

As this work intends to explore the maturity of contributions about MSSs (RQ1) as well as the standards' relationships to sustainability (RQ2), both main bibliometric procedures will be applied. Thereby, the procedure proposed by Donthu *et al.* (2021) is followed. These authors propose (1) firstly to define the aim and scope of the bibliometric search, (2) secondly to choose techniques to be used for the analysis, (3) thirdly to collect the data and (4) fourthly to run the bibliometric analysis and report its findings (task 4 is done in step 3, which is depicted in the results section):

- (1) The scope of the bibliometric analysis concerns academic research (articles, conference papers, reviews) about the 28 MSSs preliminarily selected in step 1 (refer to the Appendix). The aim is to assess the maturity of research contributions for each MSS (RQ1) and to identify how research about MSSs relates to sustainability (RQ2) [5].
- (2) Regarding performance analysis (directed at RQ1), total publications and citations are used as relevant publication-related metrics, because “the comprehensibility of indicators based on publication and citation data is most attractive and objective” (Noyons *et al.*, 1999, p. 591). Regarding science mapping, a conceptual network based on the co-occurrence of keywords is created, because such networks help understanding the topics covered by the MSSs at hand and allow to identify existing or future relationships (Donthu *et al.*, 2021; Gutiérrez-Salcedo *et al.*, 2017).
- (3) For collecting data on academic research about the 28 MSSs (number of publications, publication details, citation stats, keywords), a string consisting of the name of the MSS is used (string 1). Further, a second string consisting of keywords related to the standard's topic – crafted after carefully reading the standard's title and abstract – is used (string 2) to identify differences in publication patterns about the MSS itself on the one hand and the MSS's underlying topic on the other hand. Scopus, the largest abstract and citation database with a focus on life sciences, social sciences, physical sciences and health sciences that contains more than 27'000 active serial titles from over 7'000 publishers (Elsevier, 2022), serves as database. The strings are searched in title, abstract and keywords. The data has been collected in January 2023.

3.3 Step 3 – preliminary explanations on performance analysis and science mapping

The performance analysis and science mapping are conducted in section 4, which contains descriptive analyses with graphical and tabular presentations. A figure is crafted for each of the 28 standards. On the left side of the figure, the development of publications [6], the general citation structure, the most cited articles, the most influential authors, the main countries of research as well as the differentiation by subject areas are depicted (directed at RQ1). Further, the content of the MSS and the applied search strings are outlined. On the right side, the mapping of co-occurrences of keywords is visualized – whereby the authors highlight the keywords related to the ESG concept in different colors, based on Thomson Reuters' (2017) ESG framework conception visualized in Table 3 – and ISO's (2022d) mapping of the standard's relation to the SDGs is shown (directed at RQ2). The programme used for the science mapping is VOSviewer, and the author keywords have to occur a certain number of times in order to be shown as cluster in the visualization [7]. In case there has been no or few research about a standard, which makes science mapping impossible/meaningless (≤ 3 clusters) and certain performance analysis indicators obsolete, a leaner version of the described figure is presented.

ESG pillar	ESG theme	Description
Environmental	Resource Use	Performance and capacity to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management
	Emissions	Commitment and effectiveness towards reducing environmental emission in the production and operational processes
	Environmental Innovation	Capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products
Social	Workforce	Effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities as well as development opportunities for its workforce
	Human Rights	Effectiveness towards respecting the fundamental human rights conventions
	Community	Commitment towards being a good citizen, protecting public health and respecting business ethics
	Product Responsibility	Capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy
Governance	Management	Commitment and effectiveness towards following best practice corporate governance principles
	Shareholders	Effectiveness towards equal treatment of shareholders and the use of anti-takeover devices
	CSR Strategy	Practices to communicate the integration of economic (financial), social and environmental dimensions into day-to-day decision-making processes

Table 3.
Thomson Reuters' ESG
framework conception

Source(s): Adapted from [Thomson Reuters \(2017\)](#)

4. Results

This section depicts the bibliographic figures crafted for each of the 28 MSSs and describes both their maturity in research contributions as well as their relationship to corporate sustainability. The order of presentation follows the selection shown in the [Appendix](#), which is ascending in its nature (based on the name of the ISO standard). Eventually, the results are shown and discussed in a consolidated way.

4.1 Individual results

4.1.1 ISO 9001. ISO 9001 is not only the most widely diffused ISO MSS (refer to [Table 2](#)), but also the oldest one with its first version being published in 1987. Research about the standard is well matured with about 3'351 publications, out of which 9.4% achieved at least 25 citations. The overview of the most influential authors and countries indicate a fairly broad research base. ISO states that the standard contributes to the SDGs 1, 9, 12 and 14. Further, the science mapping of keywords visualized in [Figure 3](#) reveals relations to all three ESG pillars. This observation aligns with empirical research on the impact of QMSs on ESG performance (e.g. [Ronalter et al., 2022a](#)).

4.1.2 ISO 10377. ISO's guidelines for consumer product safety have been published in 2013 and intend to guide suppliers in assessing and managing the safety of consumer products. Scopus does not list any publications that contain the MSS's denotation in the title, abstract or keywords (hence, no performance analysis or science mapping possible). Further, [Figure 4](#) indicates that the publications about the MSS's topic are decreasing. Although ISO does not state any contributions of the standard to the 2030 agenda, the issue of product safety does in general align with the ESG theme "product responsibility" in the social dimension of [Thomson Reuters' \(2017\) ESG framework conception](#) (refer to [Table 3](#)).

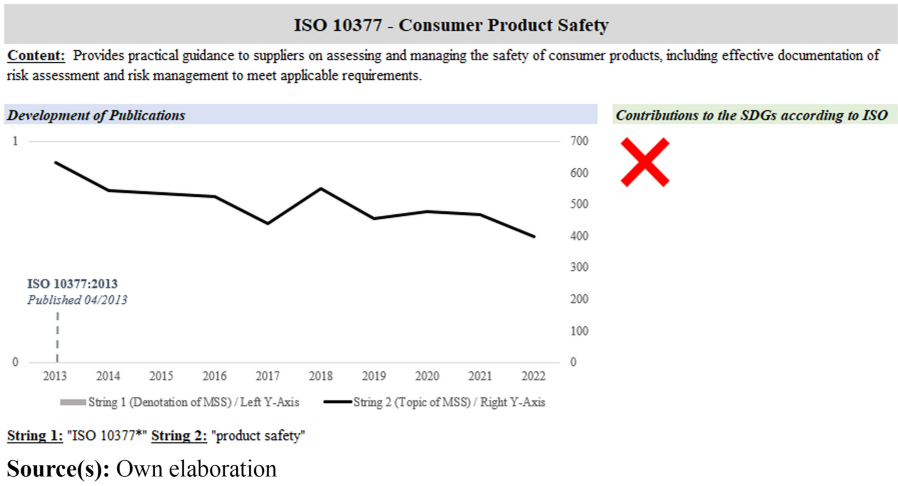


Figure 4.
Bibliometric overview
on ISO 10377

4.1.3 ISO 10393. This standard about consumer product recall has been published in 2013, and there has been no research about the standard yet. Figure 5 shows that also the topic in general only attracts minor interest from academics. Albeit ISO does not state any contributions to the SDGs, the issue of product safety can be related to the social issue of “product responsibility” (refer to Table 3).

4.1.4 ISO 14001. ISO 14001 concerns environmental management systems. The standard has been initially published in 1996 and represents the second most widely diffused ISO standard (refer to Table 2). In accordance, research maturity is high. The topic of environmental management shows increasing academic publications in the past 2 decades – as visualized in Figure 6. ISO connects the standard to 12 out of the 17 SDGs, and the science mapping indicates strong relations in the environmental pillar, while also revealing clusters among social issues such as “stakeholders” or “social responsibility” as well as governance

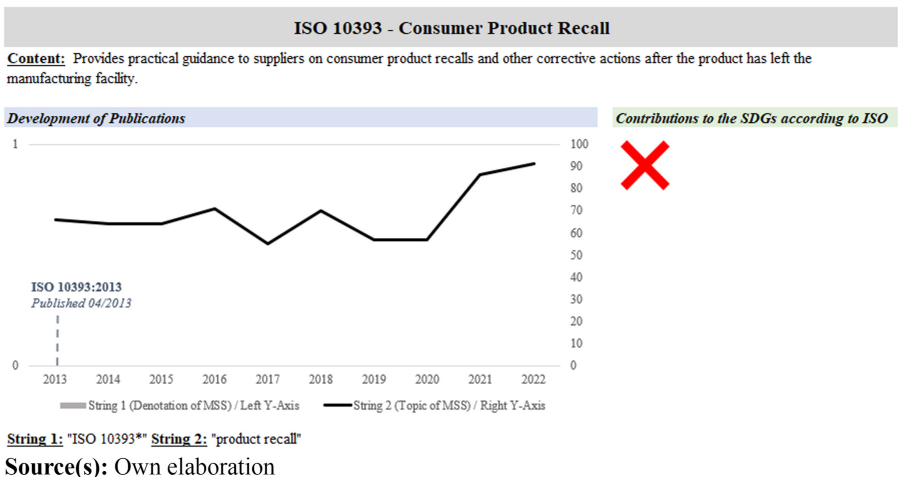


Figure 5.
Bibliometric overview
on ISO 10393

keywords like “integrated management systems” and “continuous improvement”. Empirical research on the impact of EMSs on ESG performance verifies the positive impacts on all three pillars (e.g. Ronalter *et al.*, 2022a).

4.1.5 ISO 16000–40. Despite the topic of indoor air quality shows growing publication numbers in academia according to Figure 7, the corresponding ISO standard from 2019 has not been researched yet. ISO relates the standard to good health and well-being (SDG 3), and the topic of indoor air quality is for sure an issue related to a healthy and safe workspace (refer to Table 3).

4.1.6 ISO 18788. The ISO 18788 standard deals with management systems for private security operations, a topic that only attracts very low to none research attention. The standard has been published in 2015, and Figure 8 shows that since then only one conference paper with zero citations included the standard in academic research. ISO relates the standard to peace, justice and strong institutions (SDG 16).

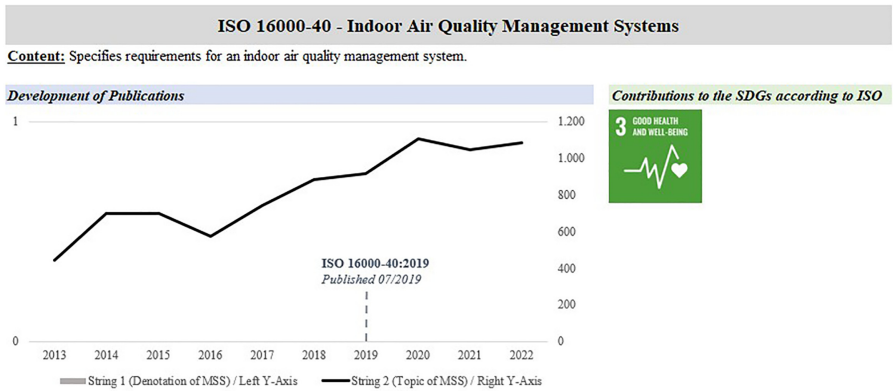
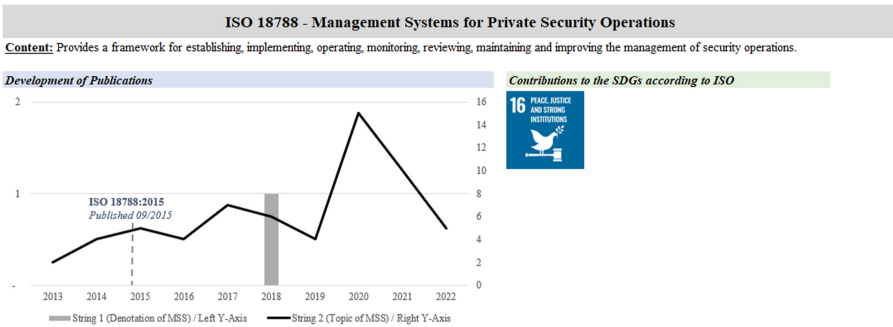


Figure 7.
Bibliometric overview
on ISO 16000-40

String 1: "ISO 16000-40" **String 2:** "indoor air quality"

Source(s): Own elaboration



String 1: "ISO 18788" **String 2:** ["private security operations" OR "professional security"]

Publication (String 1)			
Authors	Year	#Citations	Title
Kulashki, B., Nenova, M., Dukendjiev, G.	2018	0	Influence investigation of the illumination on the quality indicators of the signal security activity
			Journal: 7th Balkan Conference on Lightning, BalkanLight 2018 - Proceedings

Source(s): Own elaboration

Figure 8.
Bibliometric overview
on ISO 18788

4.1.7 ISO 19158. ISO 19158 provides a framework for quality assurance specific to geographic information. The topic only attracts very low interest among scholars. The standard exists since 2012, and since then only one publication with two citations investigated the standard as evidenced in Figure 9. ISO states that the standard is related to industry, innovation and infrastructure (SDG 9).

4.1.8 ISO/IEC 19770-1. This ISO standard about IT asset management is in existence since 2006. However, Figure 10 shows that only two conference papers have dealt with the standard yet. Besides this very low research maturity, ISO connects the standard with industry, innovation and infrastructure (SDG 9).

4.1.9 ISO/IEC 20000-1. ISO/IEC 20000-1 specifies requirements for IT service management systems, a topic with decreasing publications in the past ten years according to Figure 11. In accordance, also publications about the standard are decreasing. In general,

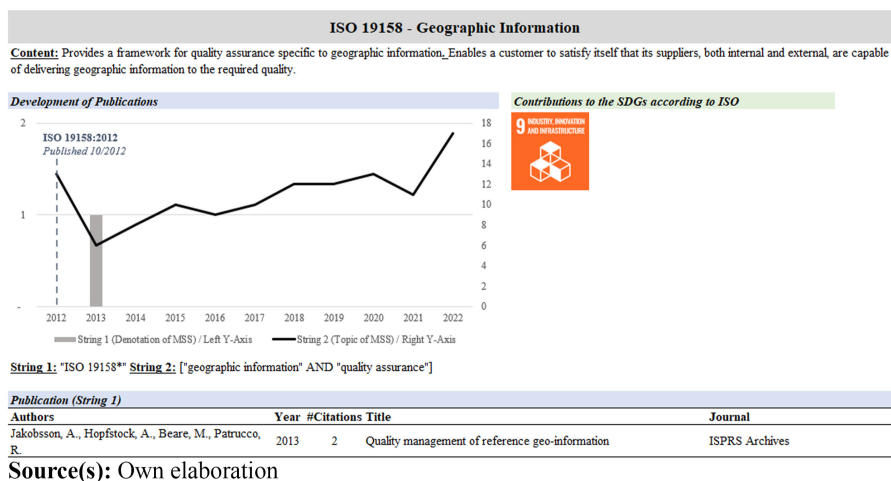


Figure 9.
Bibliometric overview
on ISO 19158

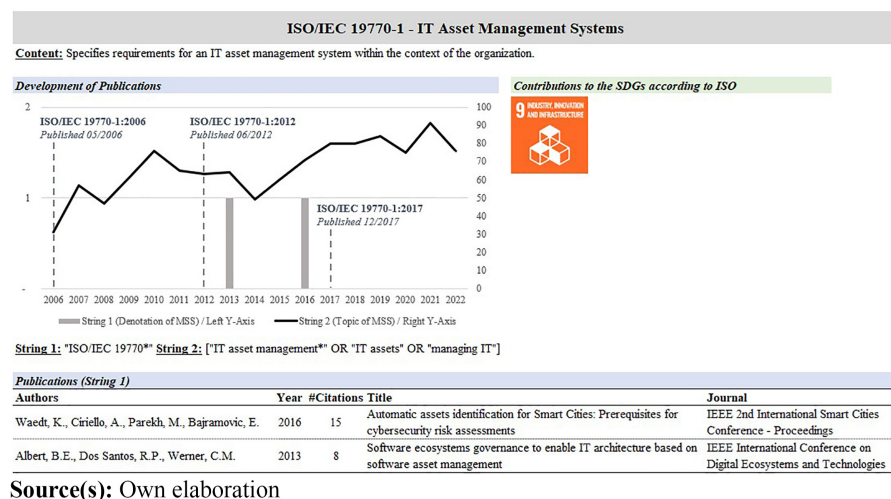
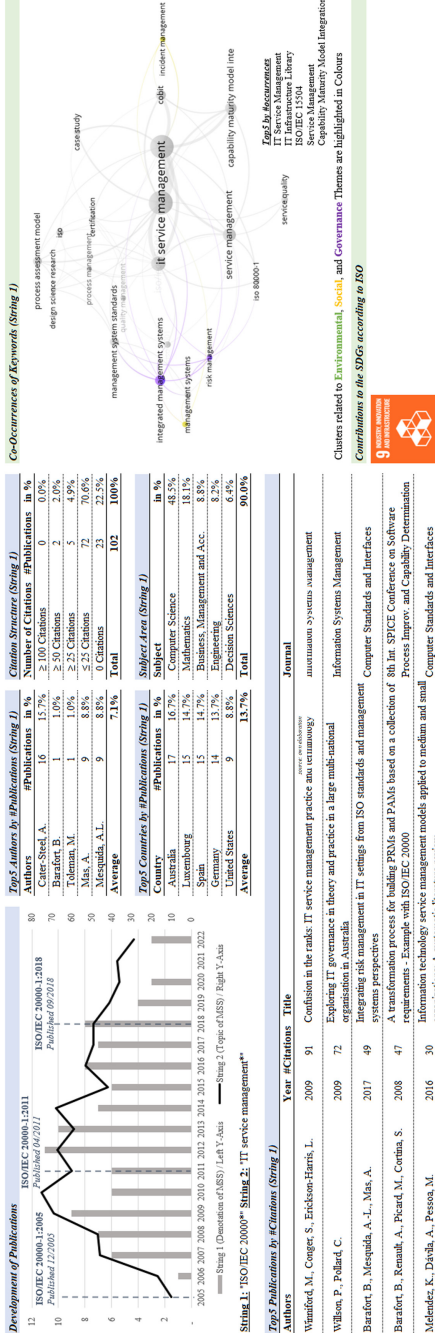


Figure 10.
Bibliometric overview
on ISO/IEC 19770-1

ISO/IEC 20000-1 - Information Technology Service Management Systems

Content: Specifies requirements for an organization to establish, implement, maintain and continually improve a service management system. The requirements specified in this document include the planning, design, transition, delivery and improvement of services to meet the service requirements and deliver value.



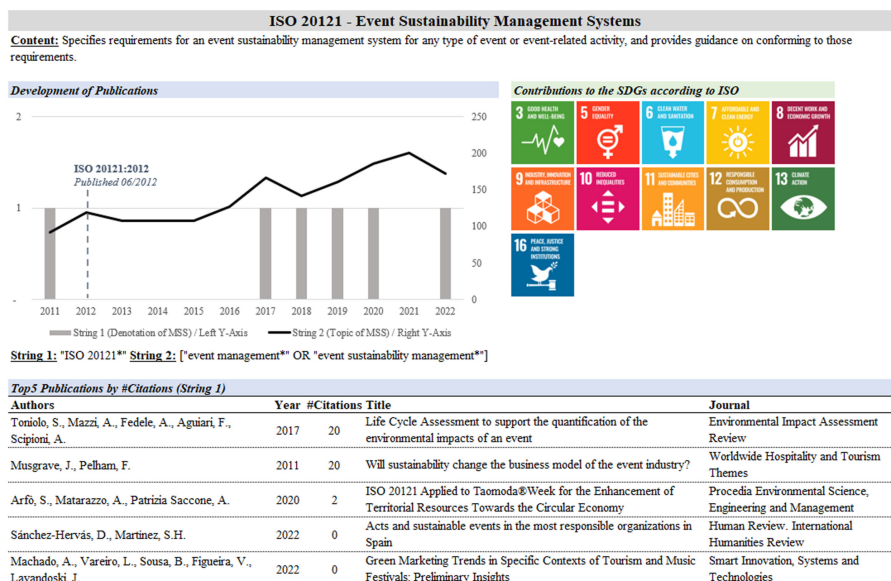
Source(s): Own elaboration

the research maturity is rather low (only 102 contributions since publication of the standard in 2005). ISO relates the standard with industry, innovation and infrastructure (SDG 9). The science mapping of keywords reveals only minor relations to social issues such as “incident management” and “information security management” as well as small governance clusters around “risk management” and “integrated management systems”.

4.1.10 ISO 20121. The standard about event sustainability management systems is related to eleven SDGs by ISO. However, research maturity is low in both research about the standard as well as about its topic. As visible in Figure 12, only six articles dealt with ISO 20121. In view of the apparent sustainability relation, fellow scholars should be encouraged to help increasing academic knowledge about the standard and its impact on sustainable development.

4.1.11 ISO 22301. The recent Covid-19 pandemic depicted clearly the importance of business continuity management as governance principle (e.g. Fabeil *et al.*, 2020; Le and van Nguyen, 2022). In the spirit of the pandemic, the ISO 22301 standard received increasing attention in 2020 and also the topic itself strongly raised academic interest since then – as shown in the timeline of Figure 13. ISO relates the standard to six different SDGs and the science mapping visualizes that the few research articles about the standard already indicate its strong governance relationship.

4.1.12 ISO 26000. ISO 26000 is a management system designed to support governance and leadership functions at all levels in regard to social responsibility. Albeit the issue of social responsibility represents a current public topic with strongly increasing numbers of publications in academia in the past 10 years, research about the standard appears to be stagnating – see Figure 14. With 224 publications about the standard since 2010, a medium research maturity can be derived. Further, the large number of related SDGs and



Notes(s): Since the most cited article was published in the year before the publication of the standard, the depicted timeline has been enlarged

Source(s): Own elaboration

Figure 12.
Bibliometric overview
on ISO 20121

the outcomes of the science mapping reveal a strong sustainability relationship of the standard.

4.1.13 ISO/IEC 27001. The ISO/IEC 27001 standard deals with information security and covers issues such as cybersecurity and privacy protection. As visible in [Figure 15](#), publications about the issues information and cyber security are strongly increasing, but academic research on the ISO standard nevertheless seems stagnating – with even a large drop in 2022. Further, string 1 publications have low numbers of citations, with only 3.1% of publications reaching more than 25 citations. Regarding corporate sustainability, ISO does not state contributions of the standard to the SDGs. However, the science mapping shows a strong relation to the social pillar as issues surrounding information security positively impact data privacy – an important aspect of “product responsibility” (see [Table 3](#)). Further, some governance-related keywords are shown in the science mapping such as “best practices” (see “management” theme in [Table 3](#)).

4.1.14 ISO 28000. ISO 28000 specifies requirements for a security management system, including aspects relevant to the supply chain. Research maturity is very low as evidenced in [Figure 16](#), albeit the standard is in existence since 2005. Only one out of the 13 contributions about the standard achieved more than 25 citations. According to ISO, the standard positively impacts three SDGs (8, 9 and 11). The science mapping only includes 4 keywords, out of which “risk assessment” can be interpreted as governance related.

4.1.15 ISO 30301. The standard has been introduced in 2011, and since then only six articles included research about ISO 30301 – mainly conference papers. As shown in [Figure 17](#), the standard can be related to industry, innovation and infrastructure (SDG 9).

4.1.16 ISO 30401. The topic of knowledge management attracted much, however stagnating academic attention in the past 10 years. The corresponding ISO 30401 has been published in 2018 and [Figure 18](#) shows that in 2022 there has been a strong increase in publications about the standard. However, the research maturity is still very low with less than 20 publications in total. ISO sees potential that the standard can positively impact quality education (SDG 4) as well as decent work and economic growth (SDG 8).

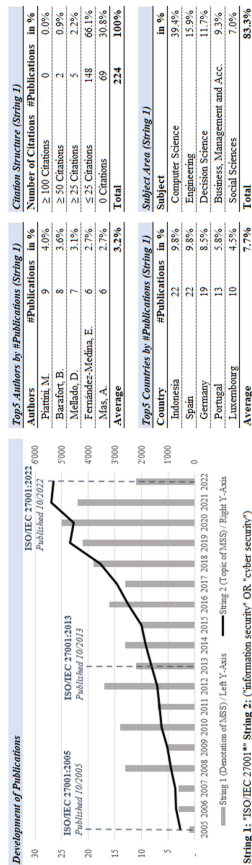
4.1.17 ISO 31000. Risk management represents an important governance issue, and science mapping also shows certain impacts in the environmental dimension (e.g. clusters around “climate change”, “sustainable development” and “sustainable manufacturing”) as well as the social pillar (e.g. clusters around “stakeholders”, “hazard analysis” and “safety management”). ISO supports the standards strong sustainability relation by connecting it to seven different SDGs. Nonetheless, [Figure 19](#) depicts that by now the standard only has been researched to a medium extent.

4.1.18 ISO 37001. In 2016, ISO published a standard about anti-bribery management system – a topic very relevant for governance structures in companies. By now, Scopus reveals only very low numbers of corresponding research about the standard. Nevertheless, ISO acknowledges its sustainability relationship by connecting the standards to three SDGs (8, 11 and 16). As shown in [Figure 20](#), the topic of bribery/corruption attracts more and more attention among scholars. Hereby, scholars in this field are encouraged to include the ISO standard in their research to evaluate if the MSS can act as an enabler of increased governance structures around anti-bribery.

4.1.19 ISO 37002. Closely related to the topic of bribery/corruption, ISO 37002 deals with the issue of whistleblowing. Despite [Figure 21](#) showing less academic attention for this issue, ISO relates the standard to the same SDGs as ISO 37001 (SDGs 8, 11 and 16) and the topic itself can clearly be related to the governance pillar.

ISO/IEC 27001 – Information Security Management Systems

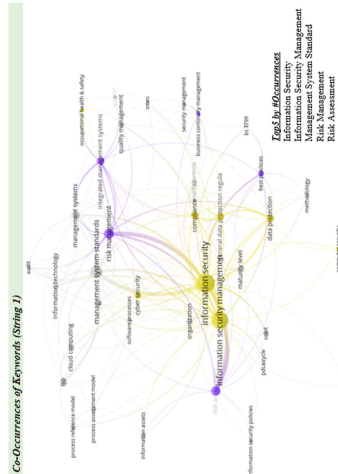
Content: Specifies the requirements for establishing, implementing, maintaining and continually improving an information security management system.



Top5 Authors by #Publications (String 1)		Top5 Countries by #Publications (String 1)	
Authors	#Publications	Country	#Publications
Pantti, M.	9	Indonesia	22
Barafat, B.	8	Spain	22
Metkalo, D.	7	Germany	19
Fernandez-Molina, E.	6	Portugal	13
Mas, A.	6	Luxembourg	10
Average	5.2%	Average	7.7%

Top5 Publications by #Citations (String 1)		Journal	
Publications	#Citations	Journal	#Citations
Security and control in the cloud	61	Information Security Journal	39.4%
Conception of a flexible integrator and lean model for integrated management systems	54	Total Quality Management and Business Excellence	15.9%
Integrating risk management in IT settings from ISO standards and interfaces systems perspectives	49	Computer Standards and Interfaces	11.7%
Information security verification by ontological mapping of the ISO/IEC 27001 standard	47	Proceedings - 15th Pacific Rim International Symposium on Dependable Computing	7.0%
Security requirements engineering framework for software product lines	35	Information and Software Technology	85.3%

Source(s): Own elaboration

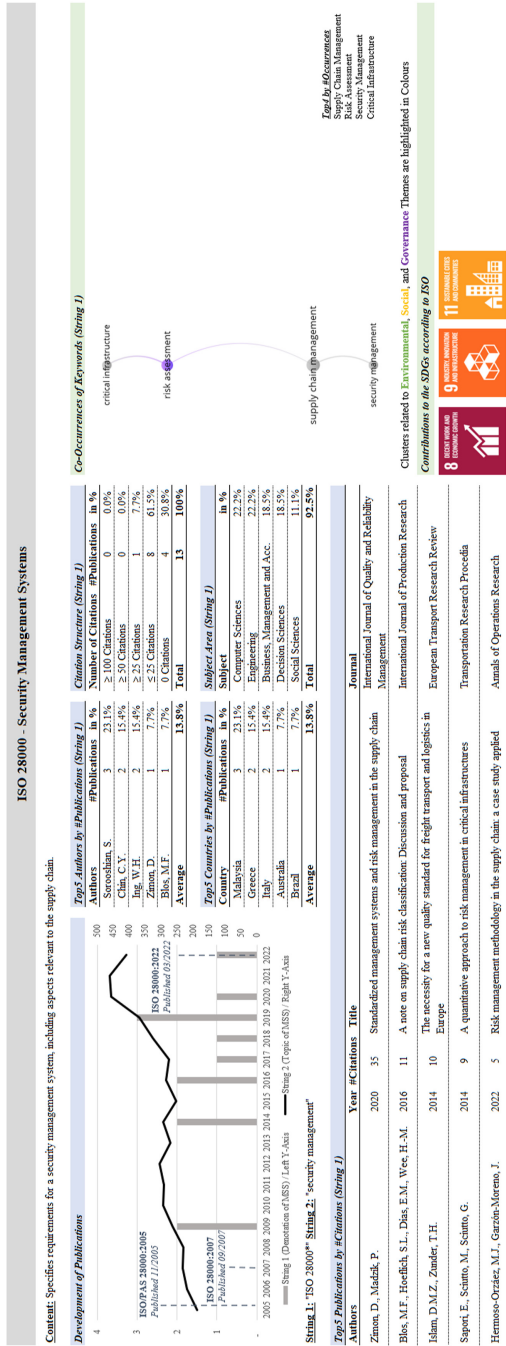


Clusters related to Environmental, Social, and Governance Themes are highlighted in Colours

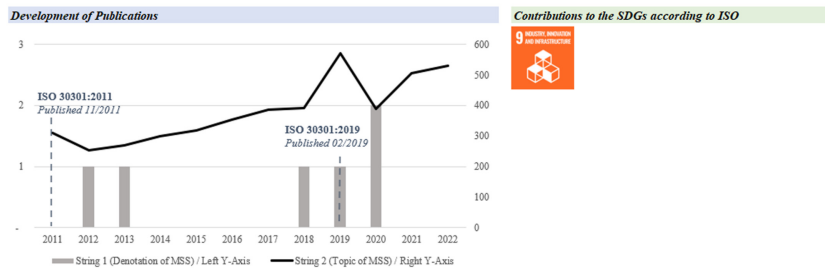
Contributions to the SDGs according to ISO

Figure 15. Bibliometric overview on ISO/IEC 27001

Figure 16.
Bibliometric overview
on ISO 28000



ISO 30301 - Management Systems for Records
Content: Specifies requirements to be met by a management system for records to support an organization in the achievement of its mandate, mission, strategy and goals. It addresses the development and implementation of a records policy and gives information on measuring and monitoring performance.



String 1: "ISO 30301" String 2: ["records policy" OR "records management" OR "documentation management"]

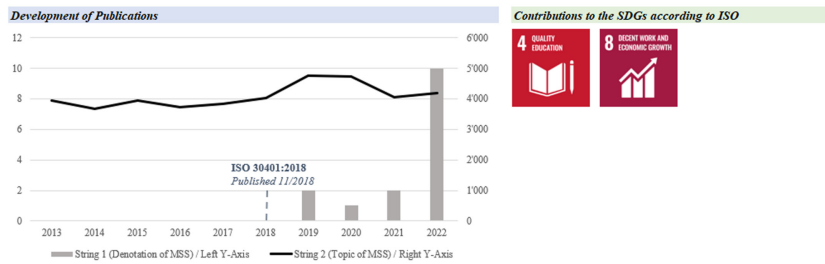
Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Hernad, J.M.C., Gaya, C.G.	2013	18	Methodology for implementing Document Management Systems to support ISO 9001:2008 Quality Management Systems	Procedia Engineering
Mora-Contreras, R.	2019	3	Integrated management systems on ISO 9001 and ISO 30301 standards in the Colombian notarial context	Estudios Gerenciales
Alsina, M.G.	2012	3	Contribution of ISO 30300 to the management of court records	Ibersid
Cabero, M.M., Pajares, P.R., Ocejo, Y.C.	2020	0	The value of the ISO 15489-1 and ISO30301 standards in laying the foundations for university archives	Comma
Wang, L., An, X., Xu, J., (...), Guo, M., Hu, J.	2020	0	Collaborative innovation community capacity building for electronic records security management	Proceedings of the Int. Conf. on Intellectual Capital, Knowledge

Source(s): Own elaboration

Figure 17. Bibliometric overview on ISO 30301

ISO 30401 - Knowledge Management Systems
Content: Sets requirements and provides guidelines for establishing, implementing, maintaining, reviewing and improving an effective management system for knowledge management in organizations.



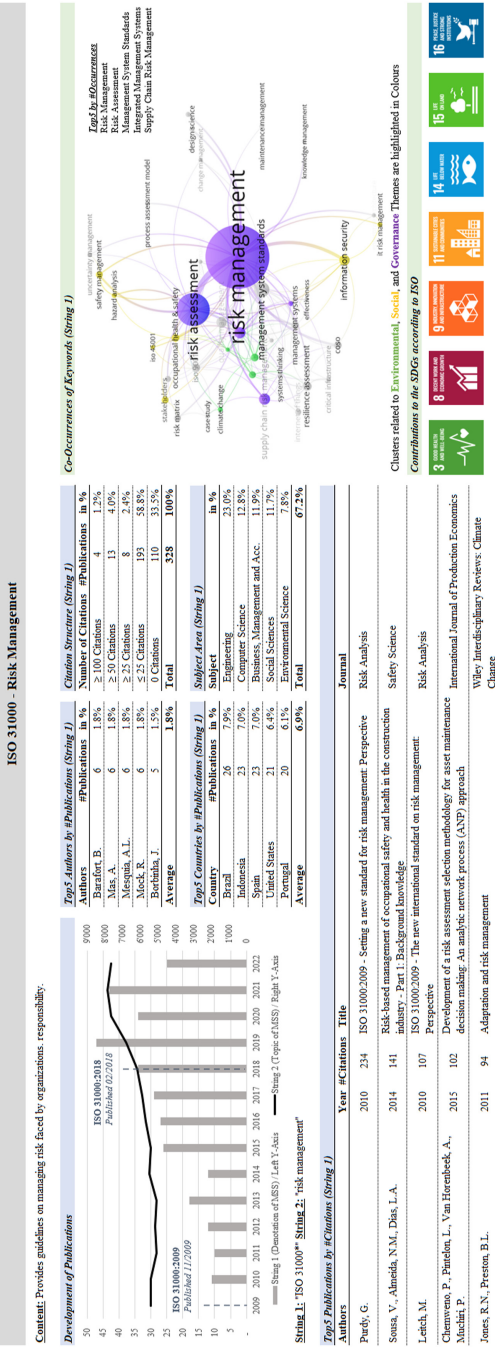
String 1: "ISO 30401" String 2: "knowledge management"

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Pawlovsky, P., Pflugfelder, N.S., Wagner, M.H.	2021	11	The ISO 30401 knowledge management systems standard – a new framework for value creation and research?	Journal of Intellectual Capital
Kudryavtsev, D., Sadykova, D.	2019	9	Towards architecting a knowledge management system: Requirements for an iso compliant framework	Lecture Notes in Business Information Processing
Bornemann, M., Alwert, K., Will, M.	2021	6	Lessons learned in intellectual capital management in Germany between 2000 and 2020 – History, applications, outlook	Journal of Intellectual Capital
Schmitt, U.	2022	2	Validating and documenting a new knowledge management system philosophy: a case based on the ISO 30401:2018-KMS standard	Knowledge Management Research and Practice
Boonchan, G., Sinthamrongruk, T., Khamakorn, A.	2022	1	Knowledge Management in the Royal Thai Army: ISO30401: 2018 Knowledge Management Systems Perspective	7th International Conference on Digital Arts, Media and Technology

Source(s): Own elaboration

Figure 18. Bibliometric overview on ISO 30401



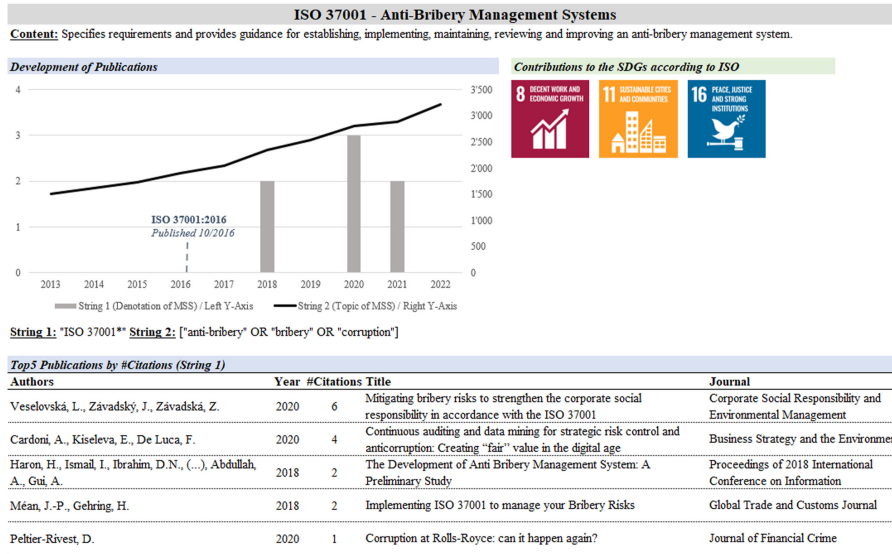


Figure 20.
Bibliometric overview
on ISO 37001

Source(s): Own elaboration

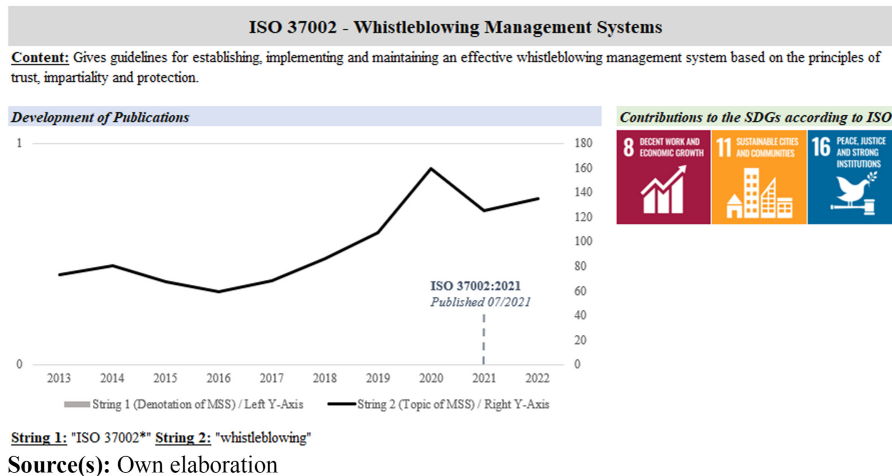


Figure 21.
Bibliometric overview
on ISO 37002

4.1.20 ISO 37101. ISO 37101 is titled “management system for sustainable development” and aims to establish requirements for MSS for sustainable development in communities, including cities. ISO sees strong sustainability-potential in the standard and, therefore, relates it to 16 out of the 17 SDGs. As visualized in Figure 22, the topic itself receives an increasing number of publications, but the standard has not been research yet since its publication in 2016.

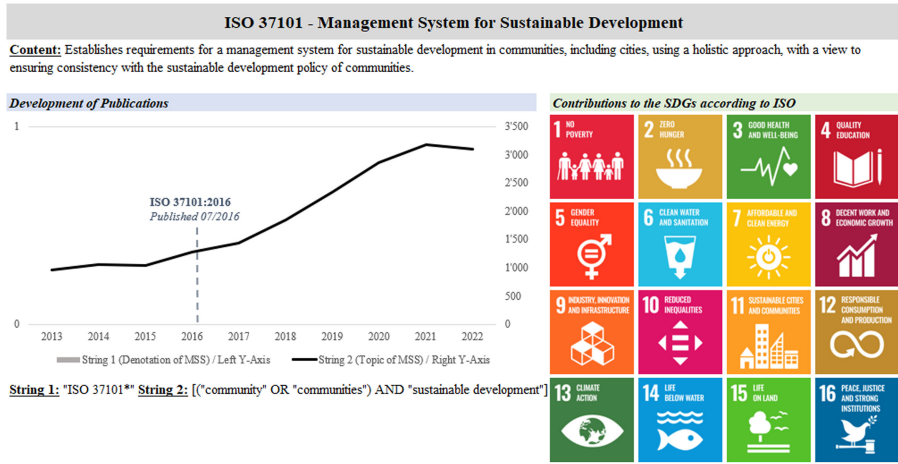


Figure 22.
Bibliometric overview on ISO 37101

Source(s): Own elaboration

4.1.21 *ISO 37301*. The standard deals with the governance-issue of compliance management systems. As visible in [Figure 23](#), ISO relates the standard to decent work and economic growth (SDG 8), sustainable cities and communities (SDG 11) as well as to peace, justice and strong institutions (SDG 16). However, both the topic and the standard reveal very low research maturities, thus there is much room left for further investigations in this direction.

4.1.22 *ISO 41001*. ISO considers ISO 41001 about facility management to be related to eight SDGs. The standard has been published in 2018 and Scopus only lists three publications since then – see [Figure 24](#).

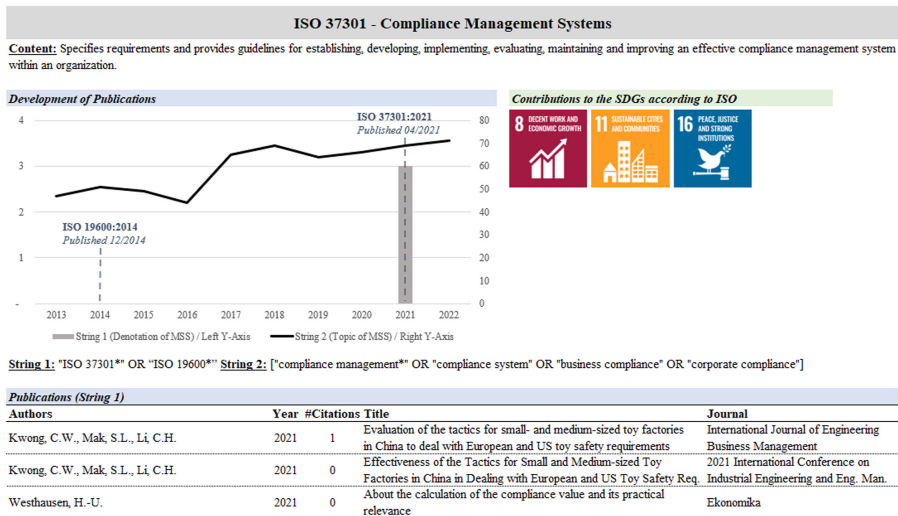


Figure 23.
Bibliometric overview on ISO 37301

Source(s): Own elaboration

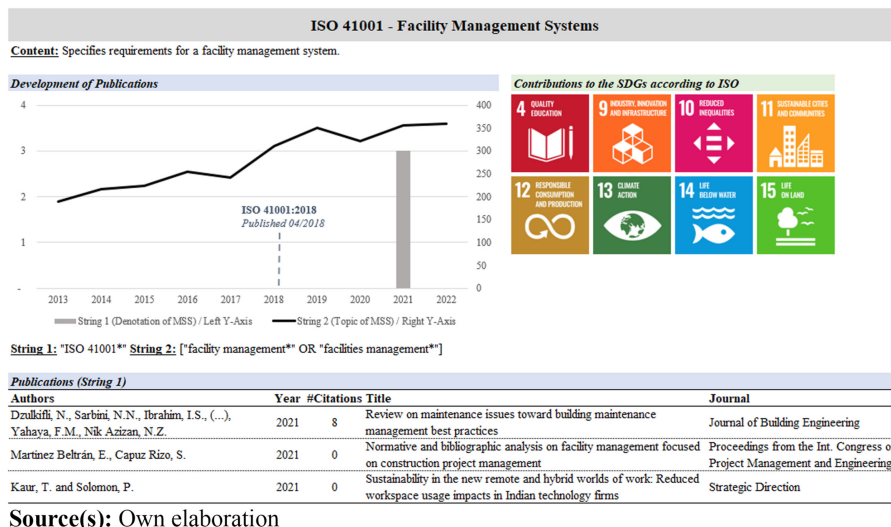


Figure 24.
Bibliometric overview
on ISO 41001

4.1.23 ISO 44001. ISO 44001 about collaborative business relationship management systems has only been considered in one publication listed in Scopus – see Figure 25. The topic itself appears to be outside the focus of scholars. Nonetheless, ISO relates the standard to four SDGs (8, 9, 10 and 17). In this context, it is noteworthy that ISO 44001 is the only MSSs and, further, just one out of two ISO standards in total, that relates to the SDG of “partnerships for the goals” (refer to the note in Table 1).

4.1.24 ISO 45001. The ISO standard about occupational health and safety management shows relations to all ESG pillars in the science mapping. In this context, the strongest connection appears to be in the social pillar, while the governance and environmental dimensions reveal lesser connections. ISO connects the standard to seven SDGs (3, 5, 8, 9, 10, 11 and 16). The timeline and search string in Figure 26 include the non-ISO-MSS (BS OHSAS

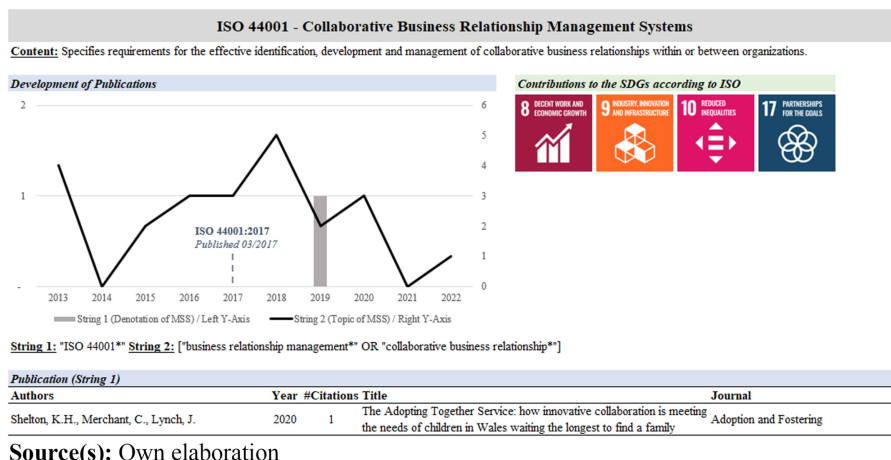


Figure 25.
Bibliometric overview
on ISO 44001

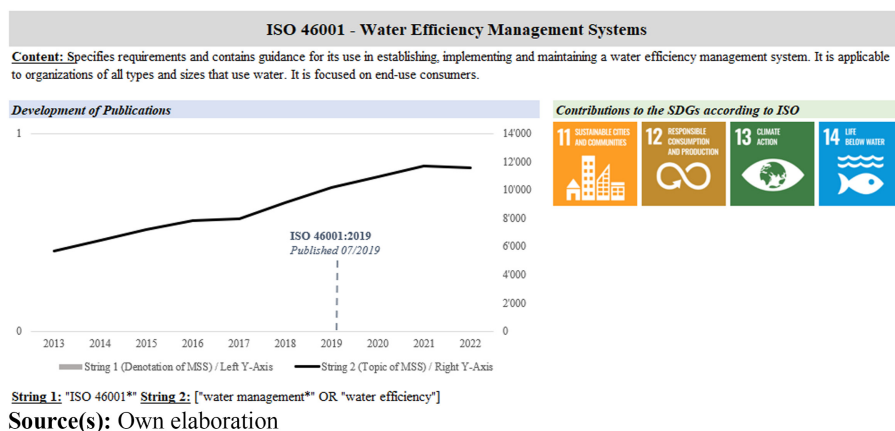


Figure 27.
Bibliometric overview
on ISO 46001

18001) due to its worldwide diffusion and its structural comparability to ISO MSSs. As visible, research maturity can be considered to be at a medium extent.

4.1.25 *ISO 46001*. Scopus lists a very large amount of publication dealing with water management and water efficiency – with a continuously increasing degree of interest among scholars as visible in Figure 27. Nonetheless, the corresponding ISO standard from 2019 has not been researched at all yet. Considering ISO's declared relationships of the standard with four SDGs (11–14), this standard should be in the focus of future research studies.

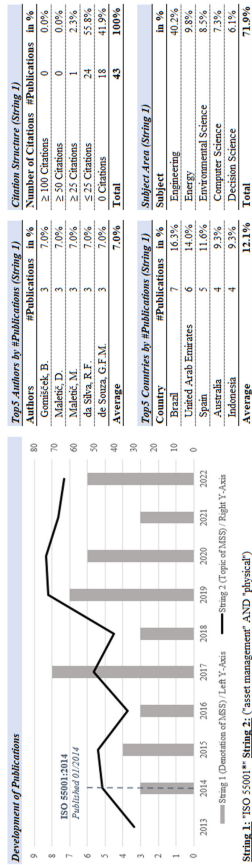
4.1.26 *ISO 50001*. Energy management and related issues such as energy efficiency, performance, saving and planning are important environmental issues – thus, the science mapping in Figure 28 depicts a strong relation to the environmental dimension. However, the ISO 50001 with a medium research maturity also shows some relation to governance issues like “risk assessment” and “strategic planning”. ISO relates the standard to four SDGs (7, 11, 12 and 13).

4.1.27 *ISO 55001*. The ISO 55001 standard deals with the management of physical assets of firms and respective research only reaches 43 academic contributions since the standard's publishing date in 2014. As shown in Figure 29, only one publication about the ISO 55001 achieved more than 25 citations. Regarding the mapping of co-occurrences of keywords, no strong ESG relations are detected. Nonetheless, ISO states that the standard can contribute to the achievement of the SDGs 6, 7, 8, 11, 12 and 13. Therefore, fellow scholars should be motivated to research these links.

4.1.28 *ISO 56002*. Innovation is a crucial issue regarding the achievement of more sustainability in our world (see, e.g. Adams *et al.*, 2016). ISO sees potential that the standard ISO 56002 about innovation management systems can positively impact quality education (SDG 4), decent work and economic growth (SDGs 8) and industry, innovation and infrastructure (SDG 9). Nonetheless, the standard published in 2019 has yet not achieved to attract much attention among scholars - as visible in Figure 30.

ISO 55001 - Asset Management Systems

Content: Specifies requirements for an asset management system within the context of the organization. The standard can be applied to all types of assets and by all types and sizes of organizations



Top 5 Occurrences

- Asset Management
- Asset Management
- Risk Assessment
- Life Cycle Planning

Top 5 Publications by #Citations (String 1)

Author	Year	#Citations	Title	Journal
Malešič, D., Malešič, M., Al-Najjar, B., Gumišek, B.	2018	27	Development of a model linking physical asset management to sustainability performance: An empirical research	Sustainability (Switzerland)
Malešič, D., Malešič, M., Al-Najjar, B., Gumišek, B.	2020	14	An analysis of physical asset management core practices and their influence on operational performance	Sustainability (Switzerland)
Hodžičević, M.R.	2015	13	The development of ISO 55000 series standards	Lecture Notes in Mechanical Engineering
Pak, E., Farinha, J.T., Cardoso, A.J.M., Raposo, H.	2020	7	Optimizing the life cycle of physical assets – A review	WSEAS Transactions on Systems and Control
Wipaa, Y., de Croon, J.	2015	7	The asset management process reference model for infrastructures	Lecture Notes in Mechanical Engineering

Source(s): Own elaboration



Clusters related to Environmental, Social, and Governance Themes are highlighted in Colours

Figure 29. Bibliometric Overview on ISO 55001

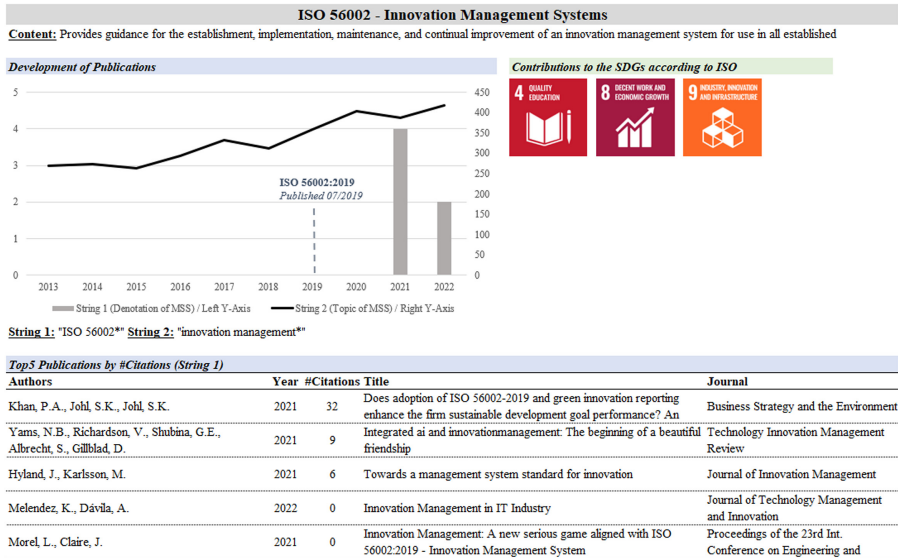


Figure 30.
Bibliometric overview
on ISO 56002

Source(s): Own elaboration

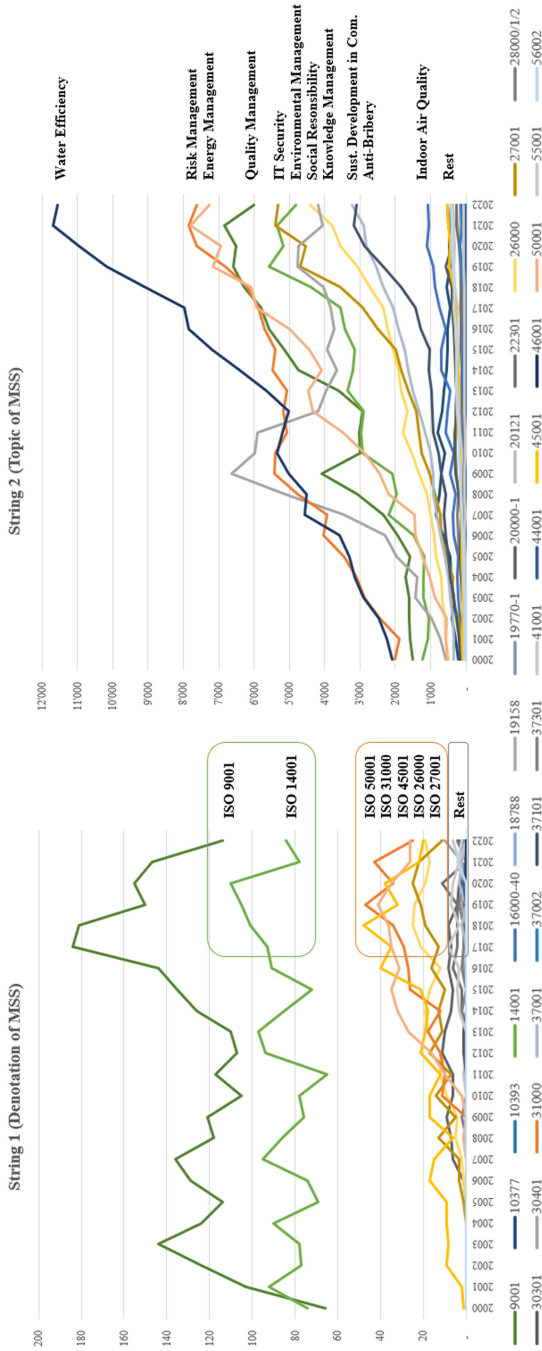
4.2 Consolidated results

The consolidated look at the development of publications about the standards since the start of the century in Figure 31 (left side) visualizes three clusters regarding the research maturity:

- (1) **High (7.1% of standards):** Most research focuses on ISO 9001 and ISO 14001 with an average of ≥ 95 publications in the past five years. This seems reasonable when considering the large diffusion numbers of these MSSs (refer to Table 2) as well as the fact that these two standards are the first types of MSSs ever published by ISO – ISO 9001:1987 was published in March 1987 and ISO 14001:1996 in September 1996, respectively (ISO, 2022a).
- (2) **Medium (17.9%):** There appears to be certain academic interest in ISO 50001, ISO 31000, ISO 45001 (replaced BS OHSAS 18001), ISO 26000 and ISO/IEC 27001 with an average of ≥ 20 publications per year in the past five years – three of these standards are listed among the Top7 most diffused ones with $>20'000$ valid certificates worldwide (refer to Table 2).
- (3) **Low/Very Low/Not Existent (75.0%):** The remaining 21 MSSs evidently only attract minor or even no interest in literature (≤ 6 yearly publications on average since 2018).

These clusters are confirmed by the performance analyses shown in the MSSs' individual Figures 3–30. Table 4 (left side) derives the degree of research maturity (not existent, very low, low, medium, high) for each MSS based on the bibliometric indicators elaborated in section 4.1.

Hence, RQ1 about research maturity of ISO standards is answered as follows: The maturity of academic research about ISO MSSs must be evaluated on an individual



Note(s): X-axes = years, y-axes = number of publications. The legend uses the document number of the standard and string 1 as well as string 2 have the same color for the same standard
Source(s): Own elaboration

Figure 31.
 Number of publications for string 1 (denotation of MSS) and string 2 (topic of MSS) for all management system standards from step 1 between 2000 and 2022

Table 4.
Synthesis of
bibliometric analysis

ISO standard	Year of publication	#Publications since publication				Selected indicators of research maturity				Sustainability relationships			
		String 1		String 2		Top5 (string 1) Countries (average)		Authors (average)	≥25 cit. (in %)	Identified research maturity (RQ1)	Related SDGs (ISO, 2022d)	Related ESG pillars (science mapping) ¹	Identified sustainability relation (RQ2)
		String 1	String 2	String 1	String 2	String 1	String 2						
ISO 9001	1987	3,351	99,145	2.1%	22.8%	0.8%	6.4%	9.4%	High	1, 9, 12, 14	E, S (-), G	Medium	
ISO 10377	2013	0	5,018	-/-	-10.9%	-/-	-/-	-/-	Not existent	-/-	-/-	Theoretically yes	
ISO 10393	2013	0	681	-/-	21.1%	-/-	-/-	-/-	Not existent	-/-	-/-	Theoretically yes	
ISO 14001	1996	2,180	68,951	-14.3%	56.2%	0.9%	8.1%	20.9%	High	1-4, 6-9, 12-15	E (+), S, G	Strong	
ISO 16000-40	2019	0	4,155	-/-	82.9%	-/-	-/-	-/-	Not existent	3	-/-	Low	
ISO 18788	2015	1	561	-/-	150.0%	-/-	-/-	0%	Very low	16	-/-	Low	
ISO 19158	2012	1	1,121	-/-	22.2%	-/-	-/-	0%	Very low	9	-/-	Low	
ISO/IEC 19770-1	2006	2	1,130	-/-	28.2%	-/-	-/-	0%	Very low	9	-/-	Low	
ISO/IEC 20000-1	2005	102	854	-100%	-30.2%	7.1%	13.7%	6.9%	Low	9	S (-), G (-)	Low	
ISO 20121	2012	6 ²	16,90 ²	0%	58.3%	16.7%	20.0%	0%	Very low	3, 5-13, 16	-/-	Strong	
ISO 22301	2012	37	1,830	-100%	101.5%	5.9%	8.6%	0%	Low	6-9, 11, 16	G (+)	Strong	
ISO 26000	2010	224	32,874	41.7%	71.5%	2.8%	7.1%	23.2%	Medium	1-16	E (-), S (+), G (-)	Strong	
ISO/IEC 27001	2005	224	42,222	37.5%	117.4%	3.2%	7.7%	3.1%	Medium	-/-	S (+), G	Medium	
ISO 28000	2005	13	5,410	-100%	62.0%	13.8%	13.8%	0%	Very low	8, 9, 11	G (-)	Medium	
ISO 30301	2011	6	4,579	-/-	43.1%	16.7%	20.0%	0%	Very low	9	-/-	Low	
ISO 30401	2018	15	21,765	-/-	8.9%	9.3%	13.3%	0%	Very low	4, 8	-/-	Low	
ISO 31000	2009	328	84,608	59.3%	37.4%	1.8%	6.9%	7.6%	Medium	3, 8, 9, 11, 14-16	E (-), S (-), G (+)	Strong	
ISO 37001	2016	7	17,761	-/-	51.5%	14.3%	17.1%	0%	Very low	8, 11, 16	-/-	Medium	
ISO 37002	2021	0	260	-/-	111.9%	-/-	-/-	-/-	Not existent	4, 8	-/-	Low	
ISO 37101	2016	0	16,022	-/-	149.5%	-/-	-/-	-/-	Not existent	3, 8, 9, 11, 14-16	E (-), S (-), G (+)	Strong	
ISO 37301	2014	3	548	-/-	56.8%	-/-	-/-	0%	Very low	1-16	-/-	Medium	
ISO 41001	2018	3	1,698	-/-	39.8%	-/-	-/-	0%	Very low	8, 11, 16	-/-	Medium	
ISO 44001	2017	1	14	-/-	-100%	-/-	-/-	0%	Very low	4, 9-15	-/-	Medium	
ISO 45001 ³	1999	436	5,529	-45%	60.9%	1.8%	6.9%	14.2%	Medium	3, 5, 8-11, 16	E (-), S (+), G	Strong	
ISO 46001	2019	0	44,387	-/-	48.9%	1.7%	9.4%	7.7%	Medium	11-14	-/-	Strong	
ISO 50001	2011	350	66,990	-16.1%	56.3%	1.7%	9.4%	7.7%	Medium	7, 11-13	E (+), G (-)	Strong	
ISO 55001	2014	43	497	0.0%	106.1%	7.0%	12.1%	2.3%	Low	6-9, 11-13	E (-), G (-)	Medium	
ISO 56002	2019	6	1,568	-/-	31.6%	16.7%	20.0%	16.7%	Very Low	4, 8, 9	-/-	Medium	

Note(s): [1] To better express the identified intensity of relations in the science mapping, small amounts of colored clusters are marked with (-) and a large number of keywords in a certain pillar is marked with (+)

[2] Since the most cited article was published in the year before the publication of the standard, the depicted timeline has been enlarged (starting in 2011)

[3] The timeline and search string include a non-ISO-MSS (BS OHSAS 18001), due to its worldwide diffusion and its structural comparability to ISO MSSs

Source(s): Own elaboration

case-by-case basis. In sum, only few standards have received medium to strong academic attention yet (25%), while most management system standards reveal low or even null research contributions (75%).

Regarding standards' relationships to sustainability, Figures 3–30 showed varying applicability towards the SDGs and the science mapping revealed varying connections to different ESG themes – always depending on the MSSs focus and function. The right side of Table 4 summarizes these results and derives the extent of the relationship to sustainability (theoretically, low, medium, strong).

Consequently, RQ2 about the relation of ISO MSSs to the SDGs and ESG themes is answered as follows: The relationship of an ISO standard to corporate sustainability must be evaluated on an individual case-by-case basis. In total, 19 out of 28 standards (68%) reveal medium to strong connections to sustainability. The remaining standards (32%) show low (or even only theoretical) relations.

To summarize, this work reveals that most MSSs did not yet receive much attention by scholars (RQ1), and the majority of standards shows medium to strong relationships to sustainability (RQ2). When combining these two novel insights, it can be derived that there are numerous standards with low/no research contributions that actually bear the potential of positively impacting firms' CSP. Such as ISO 46001 (water management) or ISO 37001 (anti-bribery management) for example: Despite their strong to medium relationships to sustainability and the fact that their underlying topics receive increasing attention by fellow scholars (refer to the right side of Figure 31), Scopus does not list any contributions that focus on these MSSs.

With these conclusions in mind, the depicted outcomes of the bibliometric analysis are converted into an action plan for future research about MSSs in the light of corporate sustainability. Figure 32 sorts the 28 MSSs along their identified research maturity (RQ1; x-axis) as well as their identified strength of sustainability relationship (RQ2; y-axis) and results in four-quarters with varying importance: The urgent-agent zone, the adequate zone, the “nothing to do” zone as well as the excess zone.



Source(s): Own elaboration

Figure 32. Action plan for research about management system standards in the light of corporate sustainability

5. Discussion

This work deals with MSSs in view of corporate sustainability and tries to provide a novel viewpoint: Instead of focusing on a single standard and/or single sustainability-issue, this study aims to present the currently existing broad range of MSSs published by the International Organization for Standardization and outlines each standard's relationship to sustainability.

Bibliometric analysis is used as approach to successfully achieve this research objective. Performance analysis puts the focus on the contributions of research constituents and draws a picture of the research maturity of each standard (RQ1), and science mapping focuses on relationships between research constituents and outlines the extent to which the MSSs are related to certain ESG themes and SDGs (RQ2). The results are shown on an individual (Figures 3–30) as well as on a consolidated (Table 4, Figures 31 and 32) basis and show great relevance for the research field of MSSs and sustainability – especially in view of future research.

Firstly, such detailed overview on ISO MSSs has been absent in the literature. Therefore, on the one hand, the study sheds light on numerous MSSs yet outside the scope of scholars (75% of the standards revealed low to none research contributions) – albeit the standards' topics themselves might already be of great interest to academics in other areas. Looking at Figure 31, discrepancies get obviously. For example, while the issues of water efficiency and sustainable development in communities are of raising interest in academia, the corresponding MSSs ISO 46001 and ISO 37101 are yet nearly unresearched – despite their potential to standardize and formalize aligning business practices in firms. On the other hand, the bibliometrics provide information on publications and research patterns, which gives academics orientation for research on specific MSSs. In sum, the results of this work function as point of departure for scholars.

Secondly, the derived action plan seeks to guide fellow scholars' attention and priorities to certain standards – especially towards MSSs located in the urgent-action zone, which is characterized by a medium/strong sustainability-relationship but no/low/medium academic contributions yet. These standards often require a kickstart in research. In this context, especially the standards ISO 20121 (event sustainability), ISO 22301 (business continuity), ISO 37101 (sustainable development) and ISO 46001 (water efficiency) are identified as standards with promising impact on CSP and a great shortage of research contributions. Moreover, the action plan implies that studies on more saturated MSSs from the adequate zone should focus on specific details in order to detect further novelties and advance existing knowledge. Thus, this study points the finger on standards bearing the most sustainability-related potential.

Thirdly, the results impact research about integrated management systems (IMS). As visible in the bibliometric figures, IMS represents a very popular keyword in the science mapping of multiple MSSs (e.g. Figures 3 and 6, or 11). In fact, integrating MSs is considered to be the best management practice for organizations having multiple MSs in place (Bernardo, 2014), which makes it an important governance issue. A recent systematic literature review about IMS and sustainability proposed the research question of elaborating which MSSs should be incorporated into an IMS to enhance its ability of fostering sustainability (Ronalter and Bernardo, 2023). The outcomes of this study give an answer to this question by showing the SDGs and ESG themes covered by existing ISO MSSs. Further, since companies that adopt multiple MSSs often integrate their MSs (e.g. Karapetrovic and Casadesús, 2009; To *et al.*, 2012) into an IMS to reduce redundancies and to use possible synergy effects (e.g. Karapetrovic, 2002; Wilkinson and Dale, 1999), the outcomes of this study imply that investigations are needed to explore how the highlighted standards besides QMS, EMS and OHSMS – the current focus of IMS-research – can be integrated. In this context, more sophisticated research providing generic models for integration (e.g. Rebelo *et al.*, 2014) and discussing the order and level of management standards implementation

(e.g. Kafel and Casadesus, 2016) is needed – which should take into account the broad range of MSSs presented in this work.

6. Conclusions

This work presented existing ISO MSSs and highlighted their academic research maturity as well as their relation to corporate sustainability. The performance analysis revealed that research on MSSs focuses predominantly on only a few standards. In fact, most standards did not yet receive any serious academic attention (RQ1). Furthermore, the science mapping visualized how scholars relate the MSSs at hand to ESG themes. Together with ISO's (2022d) mapping of how their MSSs relate to certain Sustainable Development Goals, the standards' individual extent to sustainability could be concluded (RQ2). The answers to both RQs resulted in an action plan for research about MSSs in the light of corporate sustainability.

6.1 Practical implications

This work illustrates executive managers that there are numerous MSSs directed at important sustainability-related issues besides the commonly known, largely diffused ones – which relate to QMS, EMS and OHSMS. Hence, organizations should be open for adopting additional MSSs related to several ESG themes in order to increase their CSP. Thereby, firms should also consider the advantages of MSSs integration when adopting multiple additional standards directed at improving the level of corporate sustainability.

In addition, the findings of this work might also impact other players besides individual firms. Governments could stimulate the use and implementation of several MSSs in order to promote their own most important SDGs and their ESG agenda. The same accounts for research funding agencies. In addition, associations and sector entities of industry could collaborate to discover what MSSs would match better demand, needs and opportunities for the companies to be more sustainable – thereby providing special conditions for associate companies to use and implement the right MSSs. And International Organizations (IOs) such as UN, WEF, EC and so on could establish international programs to foster research and practical initiatives seeking to use the MSSs as real artefacts to achieve SDGs and ESG agenda.

6.2 Research implications

As discussed in section 5, this study shows great relevance towards future research. Firstly, the results serve as a point of departure for future MSS-related research as they provide information on publications and research patterns, while also shedding light on less known standards. Secondly, the study points the finger on standards that bear the most sustainability-related potential. In regard to academic implications, this opens up the line for research on MSSs besides dominant standards such as ISO 9001 or ISO 14001. After showing that the required increase in CSP for achieving the SDGs could be fostered by many less researched MSSs, these MSSs hopefully attract more interest by fellow researchers in the future. In this context, the action plan seeks to provide corresponding guidance. Thirdly, the outcomes of this study impact research about integrated management systems. On the one hand, the study answers which MSSs to integrate into an IMS to enhance its ability of fostering sustainability (refer to Ronalter and Bernardo, 2023). On the other hand, this study implies that IMS-models and considerations have to be enlarged in order to also take into account the less researched MSSs presented in this study.

6.3 Limitations

The limitations of this study are especially related to the applied methodology. In fact, the standardization body investigated (ISO), the database used (Scopus), the inclusion/

exclusion criteria for the MSSs selection (existing and broadly applicable), the developed search strings (for MSSs' denotation and topic) as well as the ESG framework used for the science mapping coloring (Thomson Reuters) influenced the results. Future work should try to overcome these limitations by introducing certain corrective factors and enlarging the research scope.

6.4 Future research

Despite research capable of overcoming this study's limitations (refer to section 6.2), future research should consider three rationales. Firstly, in alignment with the proposed action plan fellow scholars are encouraged to perform studies on the standards with identified (very) low or non-existing maturity and medium to strong relationships to sustainability. Secondly, based on the literature at hand (refer to [section 2.2](#)) empirical studies are needed to measure MSSs' impact on SDG achievement and ESG performance – also in view of confirming/negating the degree of sustainability relation identified in the course of this work. Thirdly, the issue of how to integrate standards into an IMS that covers either a broad or firm-individual range of sustainability needs represents an interesting issue for future investigations.

Notes

1. The crucial role of the private sector is even acknowledged by the UN itself, which underlined that “the new sustainable development agenda cannot be achieved without business” ([UN News Centre, 2015](#)).
2. The [UNCTAD \(2018\)](#) published the research paper “Reporting on the Sustainable Development Goals: A Survey of Reporting Indicators”, in which the UN connects SDG measurement with the concept of ESG reporting and declares that the 2030 agenda offers “a reference for the interpretation of the content of ESG reporting” (p. 4).
3. In this spirit, it should be well noted that different combinations of MSs can lead to different levels of performance ([To et al., 2012](#)).
4. “A Type A MSS contains requirements against which an organization can claim conformance, whereas a Type B MSS does not. (...) Management Standards (MS) support governance and leadership functions, at all levels” ([ISO, 2022c](#)).
5. During their lifetime, MSSs might face relevant revisions and updates (e.g. ISO 9001:1987, ISO 9001:1994, ISO 9001:2000, ISO 9001:2008 and ISO 9001:2015). While the different versions reveal inequalities in their specific content, they nevertheless continuously focus on the same main topic (e.g. the listed ISO 9001 versions all deal with quality management). Therefore, the bibliometric analysis does not distinguish between different versions of the same MSSs. Nevertheless, the time periods of different versions will be visualized in the results section.
6. The timeline of investigation for each MSSs starts with the year of the standard's initial publication or depicts a minimum of 10 years, respectively (in case the standard has been published after 2013). Any exceptions are mentioned below the corresponding figure.
7. For the two most widely researched standards ISO 9001 and ISO 14001 keywords must occur at least 5 times to be visualized, for the remaining MSSs the threshold is reduced to 3. Different variances of a keywords are merged and in the visualization the denotation of the MSS itself is excluded.

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ISO Standard	Stage	Document Type	Sect. Appl.	Related Generic MSS	Manual Check by Authors	Selection for Bibliometric Analysis
ISO IWA 31	Published	MS		31001		
ISO 4450	Published	Type B	Sect. Appl.	9001		
ISO 7101	Under development	Type A		9001		
ISO 9001	Published	Type A				Yes
ISO 9002	Published	Type B		9001		
ISO 10004	Published	Type B		9001		
ISO 10006	Published	Type B	Sect. Appl.	9001		
ISO 10012	Published	Type A			Industry specific	
ISO 10377	Published	Type B				Yes
ISO 10393	Published	Type B				Yes
ISO 13485	Published	Type A			Industry specific	
ISO 14001	Published	Type A				Yes
ISO 14002-1	Published	Type B		14001		
ISO 14002-2	Under development	Type B		14001		
ISO 14004	Published	Type B		14001		
ISO 14005	Published	Type B		14001		
ISO 14006	Published	Type B		14001		
ISO 14009	Under development	Type B		14001		
ISO 14298	Published	Type A			Industry specific	
ISO 15378	Published	Type A	Sect. Appl.	9001		
ISO 16000-40	Published	Type A				Yes
ISO 16106	Published	Type B	Sect. Appl.	9001		
ISO 18091	Published	Type B	Sect. Appl.	9001		
ISO 18255	Under development	Type B	Sect. Appl.	55002		
ISO 18788	Published	Type A				Yes
ISO 19158	Published	Type B				Yes
ISO 19443	Published	Type A	Sect. Appl.	9001		
ISO/IEC 19770-1	Published	Type A				Yes
ISO/IEC 20000-1	Published	Type A				Yes
ISO 20000-2	Published	Type B			Refers to 20000-1	
ISO 20121	Published	Type A				Yes
ISO 21001	Being revised	Type A			Industry specific	
ISO 21101	Published	Type A			Industry specific	
ISO 21401	Published	Type A			Industry specific	
ISO 22000	Published	Type A			Industry specific	
ISO 22006	Published	Type B	Sect. Appl.	9001		
ISO 22163	Being revised	Type A	Sect. Appl.	9001		
ISO 22301	Published	Type A				Yes
ISO 22313	Published	Type B		22301		
ISO 23894	Under development	MS	Sect. Appl.	31000		
ISO 24518	Published	Type B			Industry specific	
ISO 25424	Published	Type A			Industry specific	
ISO 26000	Published	MS				Yes
ISO/IEC 27001	Published	Type A				Yes
ISO 27003	Published	Type B		27001		
ISO 27005	Published	MS	Sect. Appl.	31000		
ISO 27010	Published	Type B		27001		
ISO 27013	Published	Type B		27001		
ISO 27014	Published	Type B		27001		
ISO 27701	Published	Type A	Sect. Appl.	27001		
ISO 28000	Published	Type A				Yes
ISO 28001	Published	Type A			Refers to 28000	
ISO 28002	Published	Type A			Refers to 28000	
ISO 28004-1	Published	Type B		28000		
ISO 28004-2	Published	Type B		28000		
ISO 28004-3	Published	Type B		28000		
ISO 28004-4	Published	Type B		28000		
ISO 28007-1	Published	Type A	Sect. Appl.	28000		
ISO 29001	Published	Type A	Sect. Appl.	9001		

(continued)

Table A1.
The appendix shows
“step 1 – identification
of preliminary set of
management system
standards”

ISO 30000	Published	Type A		Industry specific	
ISO 30004	Published	Type B		Industry specific	
ISO 30301	Published	Type A			Yes
ISO 30302	Being revised	Type B	30301		
ISO 30401	Published	Type A			Yes
ISO 31000	Published	MS			Yes
ISO 31101	Under development	Type A			
ISO 34101-1	Published	Type A		Industry specific	
ISO 34700	Published	Type A		Industry specific	
ISO 35001	Published	Type A		Industry specific	
ISO 37001	Published	Type A			Yes
ISO 37002	Published	Type B			Yes
ISO 37101	Published	Type A			Yes
ISO 37301	Published	Type A			Yes
ISO 39001	Published	Type A		Industry specific	
ISO 41001	Published	Type A			Yes
ISO 42001	Under development	Type A			
ISO 44001	Published	Type A			Yes
ISO 44002	Published	Type B	44001		
ISO 45001	Published	Type A			Yes
ISO 45002	Under development	Type B	45001		
ISO 46001	Published	Type A			Yes
ISO 50001	Published	Type A			Yes
ISO 50004	Published	Type B	50001		
ISO 50005	Under development	Type B	50001		
ISO 50009	Under development	Type B	50001		
ISO 54001	Published	Type A	Sect. Appl. 9001		
ISO 55001	Published	Type A			Yes
ISO 55002	Published	Type B	55001		
ISO 56001	Under development	Type A			
ISO 56002	Published	Type B			Yes
ISO 80079-34	Published	Type A	Sect. Appl. 9001		
ISO 90003	Published	Type B	Sect. Appl. 9001		
X (Inland Waterways)	Under development	Type A			

Note(s): The table has been downloaded from ISO (2022c). Only columns ‘Manual Check by Authors’ and ‘Selection for Bibliometric Analysis’ have been added by the authors for step 1. MSSs selected in step 1 are marked in light grey, exclusion criteria leading to the not-selection of any standard are highlighted in dark grey. Inclusion criteria: All document types, MSSs published or being revised. Exclusion criteria: MSSs under development, MSSs that are sector or industry specific, MSSs that relate to any generic Type A MSS

Source(s): Adapted from ISO, 2022c

Table A1.

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