UNIVERSITAT DE BARCELONA

Essays on the Relationship between the Integration of Management Systems and Sustainability

Louis Maximilian Ronalter

PhD in Business

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2023

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Thesis title:

Essays on the Relationship between the Integration of Management Systems and Sustainability

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Date:

September 2023

UNIVERSITAT DE BARCELONA

Vielen Dank an meine Eltern. Für alles.

Many thanks to my parents. For everything.

Wir müssen mit den Realitäten wirtschaften und nicht mit Fiktionen.

We have to deal with realities and not with fictions.

Otto von Bismarck

ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere gratitude to the individuals who have contributed to the successful completion of my PhD thesis. Their unwavering support, guidance, and encouragement have been invaluable throughout this challenging journey.

First and foremost, I extend my deepest appreciation to my esteemed supervisors, Mercè Bernardo Vilamitjana and Javier Manuel Romaní Fernandez. Their expertise, insightful feedback, and continuous advice have been instrumental in shaping the direction and quality of this research. I am truly thankful for their commitment and dedication to my academic development. Moreover, I am much obliged to Mateus Cecilio Gerolamo, Camila Fabrício Poltronieri, and Alfonso Antonio Hernández-Vivanco, who collaborated with me on some of the projects undertaken during my PhD. Their competence and skills have significantly enriched the scope and depth of my research. I am immensely grateful for their valuable contributions and the fruitful discussions we have had.

Also, I would like to give my heartfelt appreciation to Jordi Roca for his administrative support and prompt assistance whenever I faced challenges or had queries related to the PhD journey. His assistance and organisational skills have been instrumental in ensuring a smooth research experience. In addition, many thanks to the Organizational Development Research Group (2017SGR1641) and the Department of Business of the University of Barcelona for granting me access to the Refinitiv Eikon database.

Furthermore, I would like to express my profound gratitude to my parents for their support, love, and belief in me. Their constant encouragement and understanding have provided me with the mental strength and motivation to overcome any obstacles and pursue my goals.

Finally, I would like to thank all further individuals who have provided their support and advice along the way, including my friends and colleagues. Their presence and assistance have been vital in making this journey enjoyable and memorable. Thank you all very much.

SUMMARY

This thesis explores the intersection of (integrated) management systems (MSs) and sustainability, aiming to provide insights into how organisations can foster their corporate sustainability performance (CSP). It begins by investigating the relationship between integrated management systems (IMS) and sustainability through a systematic literature review (SLR), highlighting the need for more detailed studies to address multiple existing knowledge gaps. Thereby, the thesis argues in favour of a reciprocal relationship between both concepts, offering a new perspective for both practitioners and academics.

Through a cross-regional empirical study, the impact of quality management systems (QMS) and environmental management systems (EMS) on environmental, social, and governance (ESG) performance is examined. The findings reveal that companies implementing QMS and/or EMS demonstrate significantly higher ESG scores compared to those without such MSs. Additionally, the analysis emphasises the benefits of combining QMS and EMS for further enhancing environmental and social performance, while the governance dimension is primarily influenced by the adoption of EMS alone.

The thesis continues with a panel data analysis covering financial data of firms throughout the 2010 to 2019 decade, investigating the impact of operating with ISO 9001 certified QMS, ISO 14001 certified EMS, and/or ISO 45001 certified organisational health and safety management systems (OHSMS) on shareholder wealth, as measured by the return on equity (ROE) and dividend per share yield (DY). The results neglect any significant relation between single certifications and firm financial performance (FFP). However, ROE is positively impacted by double certifications that include ISO 9001, and DY reveals positive relationships in the context of any possible combination (double as well as triple certifications).

A bibliometric analysis is conducted to examine the existing management system standards (MSSs) published by the International Organization for Standardization (ISO). The study shows that while research primarily focuses on a few standards, there are numerous other MSSs that address sustainability-related topics, which are gaining increasing attention in academia. Eventually, the work proposes to combine and integrate multiple MSSs for covering a broader range of corporate sustainability (CS) issues.

Lastly, this work explores the role of IMS in promoting the adoption of circular economy (CE) principles at the corporate level. Through a SLR, it synthesises the current academic knowledge at hand and emphasises how IMS can facilitate the implementation of the CE. The thesis thereby highlights the importance of institutional intervention in transitioning from a linear to a circular economy and formulates a research agenda for further academic studies.

Overall, this doctoral thesis provides a comprehensive overview of the relationship between (integrated) management systems and sustainability. It offers practical insights for managers on implementing IMS to enhance corporate sustainability and addresses different knowledge gaps in academia. By examining various aspects such as ESG performance, shareholder wealth, and circular economy adoption, it contributes to the understanding of how organisations can align their practices with the United Nations' (UN) sustainable development goals (SDGs) and strive towards more sustainable development (SD). The main contributions relate to (1) motivated research scope expansion, which urges fellow scholars to broaden their view beyond QMS, EMS, and OHSMS, to (2) conceptual advancements in the field, as well as to (3) empirical proofs related to economic, environmental, and social impacts of MSs adoption at the corporate level.

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LIST OF ABBREVIATIONS

CE	Circular Economy
CEMS	Circular Economy Management System
CP	Cleaner Production
CS	Corporate Sustainability
CSF	Critical Success Factor
CSP	Corporate Sustainability Performance
CSR	Corporate Social Responsibility
CV	Control Variable
DEMATEL	Decision-Making Trial and Evaluation Laboratory
DV	Dependent Variable
DY	Dividend Yield
EnMS	Energy Management System
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
ESG	Environment, Social, and Governance
EV	Explanatory Variable
FFP	Firm Financial Performance
FRQ	Future Research Question

GMM	Generalised-Method-of-Moments
H	Hypothesis
HLS	High Level Structure
IMS	Integrated Management System
ISO	International Organization for Standardization
ITSM	IT Service Management
IV	Instrumental Variable
LR	Literature Review
MDGs	Millennium Development Goals
MS	Management System
MSS	Management System Standard
OHSAS	Occupational Health and Safety Assessment Series
OHSMS	Organisational Health and Safety Management System
OLS	Ordinary Least Squares
PDCA	Plan-Do-Check-Act
PLS	Partial Least Squares
QMS	Quality Management System
ROA	Return on Assets
ROE	Return on Equity
RQ	Research Question

SCP	Sustainable Consumption and Production
SD	Sustainable Development
SDGs	Sustainable Development Goals
SIMS	Sustainable Integrated Management System
SLR	Systematic Literature Review
SMEs	Small and Medium-Sized Enterprises
SRMS	Social Responsibility Management System
TBL	Triple Bottom Line
TQM	Total Quality Management
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
UNWCED	United Nations World Commission on Environment and Development
V	Variable
2SLS	Two-Stage Least Squares

CHAPTER 1. INTRODUCTION

Sustainability – a keyword virtually omnipresent in our news landscape, political discussions, and societal debates. And rightly so: Our human behaviour and consumption exceeds the planet's reproducing capabilities by far (Global Footprint Network, 2021; Victor, 2023) and causes tremendous environmental as well as social changes with negative impacts for life on earth (UNDESA, 2020; WWF, 2020, 2022). Further, the global demographic outlook – with expected 10.4 billion humans on earth by 2100, equalling an increase of approx. +30% in global population (UNDESA, 2022) – combined with all nations' common desire of increasing domestic living standards projects even more production and consumption in the future (OECD, 2018). Having this in mind, mankind's urge to become more sustainable appears both obvious as well as necessary.

In order to thrive towards more sustainability, the United Nations (UN) with its 193 member states published studies and reports on the topic of sustainability, defined appropriate measures and guidelines to avoid future collapse of the biological system(s), and eventually ratified multiple keystone international treaties in the past decades. The concepts, keywords, and objectives defined by the UN have become important terms in academic research. In the following are some of the most influential pieces.

- **Brundtland Report, 1987:** The report *"Our Common Future"* was published by the United Nations World Commission on Environment and Development (UNWCED) in 1987 and defined the concept of sustainable development (SD) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 54). The Brundtland report emphasised the need to balance environmental, social, and economic considerations – a concept that became known as the triple bottom line (TBL) after its academic promotion by John Elkington in his book *"Cannibals with Forks: The Triple Bottom Line of 21st Century Business"* (1997).

- **Kyoto Protocol, 1997:** This international treaty under the United Nations Framework Convention on Climate Change (UNFCCC) entered into force in 2005 and aimed to reduce greenhouse gas emissions to combat climate change. It represented a legally binding framework that established emission reduction targets for industrialised countries for the period 2008-2012.

- **Millennium Development Goals (MDGs), 2000:** Adopted in 2000 by the UN, the MDGs were a set of eight goals addressing poverty, education, gender equality, health, and environmental sustainability, amongst others. They provided a framework for global development efforts until 2015.

- **Sustainable Development Goals (SDGs), 2015:** Following the MDGs, the SDGs were adopted. They consist of 17 interconnected goals addressing a wide range of issues, including poverty eradication, quality education, gender equality, climate action, and sustainable cities and communities. They aim to achieve a balanced and integrated approach to economic, social, and environmental sustainability with the ultimate goal of creating a more inclusive, equitable, and sustainable world by 2030. The SDGs provide a framework for governments, organisations, and individuals to guide their actions and policies towards achieving sustainable development and creating a better future for all.

- **Paris Agreement, 2015:** This landmark agreement under the UNFCCC aims to combat climate change by limiting global warming to well below 2 degrees Celsius above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius. It sets out a hybrid framework that combines legally binding and non-binding elements for countries to submit and enhance their climate action plans. Whereas the Kyoto Protocol had limited participation (as it was primarily focused on industrialised countries), the Paris Agreement has a broader participation base as it aims to involve all countries in global climate action.

- **UN's Decade on Ecosystem Restoration, 2021:** Initiated in 2021 and spanning till 2030, the so-called *"Decade on Ecosystem Restoration"* responds to escalating ecosystem degradation. Targeting a restoration of 350 million hectares by 2030, this global effort aims to counteract the damage done to vital ecosystems like forests and oceans. Through policy shifts, community participation, and scientific advancements, the programme seeks to mend ecosystems vital for biodiversity and climate change mitigation. By doing so, it endeavours to create a more sustainable and resilient planet.

- **Biodiversity Beyond 2020, 2022:** With a focus on addressing biodiversity loss, the UN convention on biological diversity held in December 2022 saw the adoption of the *“Kunming-Montreal Global Biodiversity Framework”*, which sets ambitious targets for conserving and restoring ecosystems and species, aiming to halt extinction rates, expand protected areas, and promote sustainable resource management. Labelled as *“Biodiversity Beyond 2022”*, the framework emphasises fair benefit-sharing and financial support for biodiversity conservation. By endorsing this framework, the international community strives to protect Earth's diverse ecosystems for a harmonious coexistence between humanity and nature.

This short list displays the wide range of issues, topics, and considerations covered by the term sustainability, which eventually represents a guiding model at the societal level.

To achieve sustainability at global scale, this societal guiding model must also be internalised and implemented at the corporate level. Firms play a crucial role in fostering worldwide sustainable development due to their significant influence and impact on various aspects of society and the environment. The UN itself highlighted that, for example, the SDGs cannot be achieved without firms’ participation in sustainable action (UN News Centre, 2015). In fact, organisations have the resources, expertise, and reach to drive change at scale. By adopting sustainable approaches, these entities can minimise their environmental footprint, reduce resource consumption, promote social responsibility, and contribute to the overall well-being of communities, among other positive impacts (see e.g., Franco & Rodrigues, 2021; Krishnan et al., 2020; Latapí Agudelo et al., 2019). Further, such corporate sustainable action might spill-over to the private life (see e.g., Gadeikienė et al., 2019; Rashid & Mohammad, 2011) – resulting in corporate sustainability (CS) enhancements being capable of driving sustainability at a larger societal level.

Based on the importance of organisations to achieve SD, **this doctoral thesis aims to contribute novel knowledge about how formalising and systematising managerial activities in the form of management systems (MSs) fosters CS.** Thereby, focus is put on the impact of integrating multiple objective-specific MSs into a single integrated management system (IMS).

In a nutshell, MSs are a set of procedures to be followed in order to achieve stakeholder satisfaction for a specific demand. Hence, a "process of systemising how things are done" (Mahesh & Kumar, 2016, p. 578). Such MSs are objective-specific, and the most widely diffused ones are quality management systems (QMS), environmental management systems (EMS), and organisational health and safety management systems (OHSMS) (see e.g., ISO, 2022b). The proliferation of numerous different MSs within a firm creates the need to integrate them into an IMS for reducing redundancies and using possible synergy effects (Karapetrovic, 2002). The functioning of MSs, the underlying management system standards (MSSs), as well as their integration are described in more detail in the following chapters.

1.1 Thesis Structure and Objectives

Chapters 2 through 6 represent five stand-alone scientific projects written in the format of journal articles. Each project is directed at one specific thesis objective, as visualised in Table 1. Despite their individual characters, all articles follow a common thread as outlined in the following. To give the reader a comprehensive overview, Table 1 already states all research questions (RQ) that will be proposed, analysed, and answered throughout this academic work. Eventually, chapter 7 entails the conclusions.

Table 1. Thesis Objectives and related Research Questions

	Thesis Objectives	Related Research Questions	Chapter
1	To synthesise identified links between the integration of MSs and sustainability, to identify existing knowledge gaps, and, eventually, to put the links between both concepts into a justified relationship context.	RQ1: How far advanced is research that links the integration of MSs to the incorporation of the TBL approach in organisational management? RQ2: In regard to research that links the integration of MSs to the incorporation of the TBL approach in organisational management, which knowledge gaps still exist that should be investigated in future research? RQ3: Is IMS simply an antecedent of sustainability, or is there a vice-versa relationship between both concepts?	2
2	To prove through a cross-regional empirical study that QMS and EMS represent powerful business tools to achieve enhanced ESG performance.	RQ4: Do companies that operate QMSs and/or EMSs achieve statistically significant higher ESG scores than firms without such MSs? RQ5: Which ESG issues are positively impacted by the implementation of QMSs and/or EMSs? RQ6: Do companies that apply both QMSs and EMSs simultaneously achieve higher ESG performance than firms that operate with only one of these MSs?	3
3	To determine whether companies operating with certified ISO 9001 QMS, ISO 14001 EMS, and/or ISO 45001 OHSMS create statistically significant higher financial benefits for shareholders.	RQ7: Do shareholders of companies that operate either ISO-certified QMS, EMS, or OHSMS enjoy statistically significant higher financial benefits? RQ8: Does the combination of ISO-certified QMS, EMS, and/or OHSMS lead to statistically significant higher financial benefits for shareholders?	4
4	To present existing MSSs published by ISO, thereby outlining their academic research status and highlighting their relation to the SDGs as well as to ESG themes.	RQ9: How mature is academic research about existing ISO MSSs? RQ10: To what extent are ISO MSSs related to the SDGs and certain ESG themes?	5
5	To explore how IMS as business tool can contribute to the adoption of CE principles at the corporate level and to identify existing knowledge gaps.	RQ11: How far advanced is research about IMS' contribution to CE implementation? RQ12: In regard to research about IMS' contribution to CE implementation, which knowledge gaps still exist that should be investigated in future research?	6

Source: Own elaboration.

Chapter 2 introduces the concepts of (integrated) management systems and sustainability and, further, outlines the development as well as outcomes of previous academic contributions in this research stream. Thus, the chapter equips the reader with a sound knowledge foundation regarding the background of MSSs, MSs, as well as their integration – including aspects such as the integration process, integration benefits, and integration difficulties.

Moreover, the chapter establishes that this thesis defines sustainability in alignment with the TBL approach (Elkington, 1997). As suggested in the Brundtland report (UNWCED, 1987), the TBL approach recognises that sustainable business practices should not only consider financial performance but also evaluate social and environmental impacts – both positive and negative ones (Elkington, 1997, 1998). Thus, it encourages organisations to pursue a balance between these three dimensions, eventually aiming for long-term sustainability and a positive overall impact on society and the planet.

Besides introducing IMS and CS, synthesising identified links between both concepts, and eventually putting these links into a justified relationship context, chapter 2 also pursues the objective of identifying still existing knowledge gaps. Through a systematic literate review (SLR), four major knowledge gaps are derived: (1) unfolding conceptually derived models in practice, (2) producing large-scale and cross-regional studies that focus on the impact of IMS on each TBL pillar, (3) exploring IMS components beyond QMS, EMS, and OHSMS that contribute to corporate sustainability enhancements, and (4) investigating how IMS helps organisations to incorporate fundamentals of economic-level sustainability concepts.

In course of the conceptual and analytical character of this thesis, chapters 3 to 6 aim to advance scientific knowledge within the depicted knowledge gaps (2) to (4). In other words, the research agenda elaborated in chapter 2 shapes the structure of the doctoral thesis. Figure 1 depicts this structure and states the methodological category of each chapter (in sum, two theoretical literature reviews, one bibliometric approach, and two statistical analyses based on empirical data).

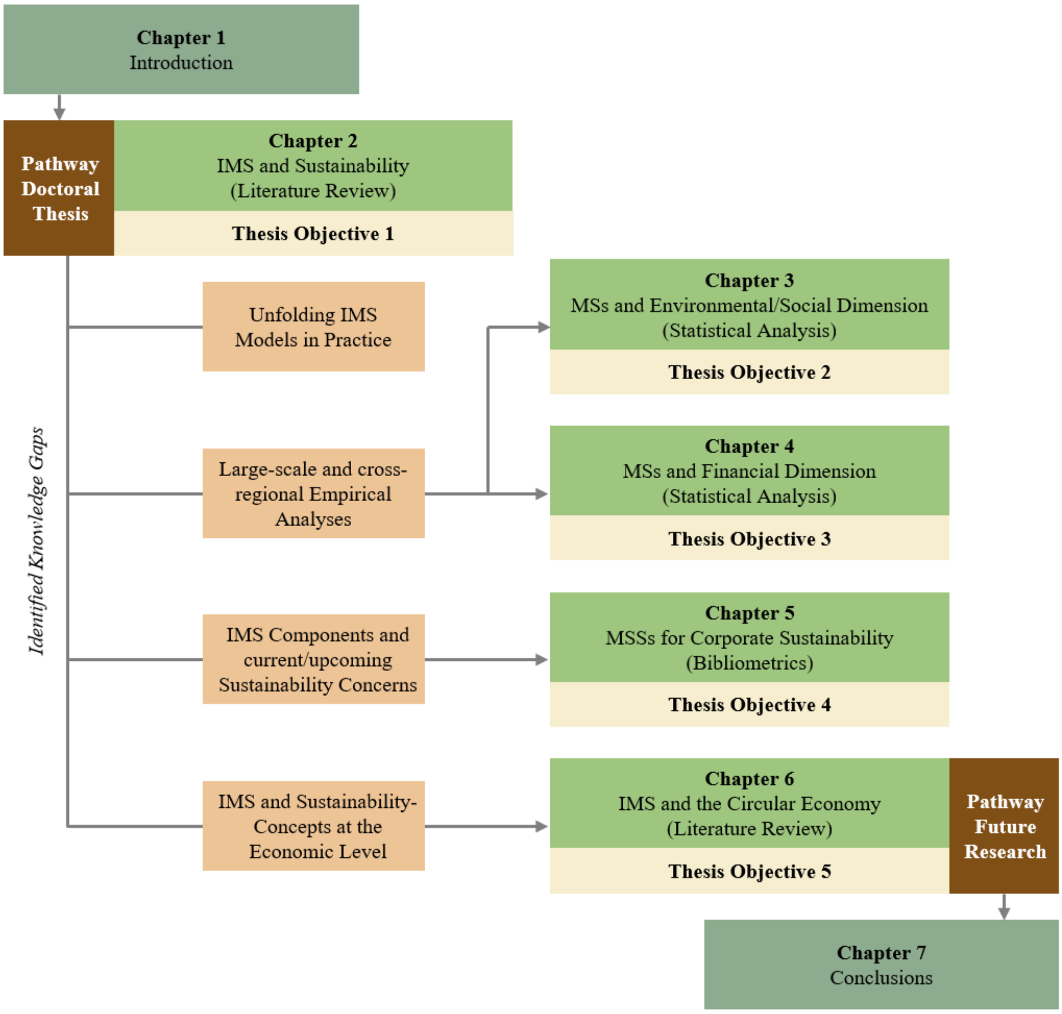


Figure 1. Thesis Structure

Source: Own elaboration.

Chapter 3 is directed at the environmental and social pillar of the TBL approach. The work is grounded in stakeholder theory and demonstrates that the implementation of MSs can assist in successfully translating stakeholders' sustainability concerns into actionable business practice. It performs quantitative research (descriptive and cluster analyses) at global level to evidence the positive impact of QMS and EMS adoption on the environmental, social, and governance (ESG) performance of firms. Therefore, ESG ratings are used, which are company assessments based on an evaluation of environmental, social, and governance matters whose individual weightings result in an overall score (Clementino & Perkins, 2021).

Chapter 4 concerns the economic pillar of the TBL approach. It applies data panel analysis on a balanced dataset consisting of companies from Europe, East Asia, and North America in order to evaluate differences in firm financial performance (FFP) related to ISO-certified QMS, EMS, and OHSMS. Thereby, the chapter applies a shareholder point of view as it analyses the return on equity (ROE) and dividend per share yield (DY). Hence, chapter 4 provides a complementary perspective to the stakeholder viewpoint taken in chapter 3.

Chapter 5 presents the broad range of MSSs published by the International Organization for Standardization (ISO) – the most famous international standardisation body – that are currently in place using a bibliometric approach. Through performance analysis, the research maturity of each MSSs is assessed. Further, science mapping is conducted to identify research relationships related to ESG-themes and, in addition, relations to the UN's SDGs are listed. Eventually, an action plan for research about MSSs ranks the identified importance of ISO MSSs in the light of corporate sustainability. In a nutshell, this chapter taps into the knowledge gap of identifying which standards and systems should be incorporated into an IMS beyond QMS, EMS, and OHSMS in order to enhance its ability of fostering SD.

Chapter 6 investigates how the integration of MSs contributes to the adoption of the circular economy (CE) in the corporate sector. Thus, the chapter relates the managerial practice of using IMS (business administration) to an economic approach (macroeconomics). Based on the examination of the common elements between IMS and CE, which is a vision for a global economy that is operating restoratively and regeneratively by intention and design (Ellen MacArthur Foundation, 2015; Wastling et al., 2018), this work results in a comprehensive research agenda consisting of 10 future research questions (FRQs) aimed at providing a pathway for research beyond the scope of this thesis.

Eventually, chapter 7 summarises the conclusions and contributions of the full thesis. The chapter further outlines academic as well as practical implications and, in addition, states directions for future research surrounding the theme of integrated management systems and sustainability.

Figure 2 visualises the overall thesis research model. In summary, chapter 2 firstly introduces the TBL approach and synthesises the links between IMS and sustainability. Then, chapters 3 (ESG scores) and 4 (FFP) directly investigate MSs adoption benefits for certain pillars of the TBL approach. Eventually, chapters 5 (ESG and SDGs) and 6 (CE) extend the thesis' scope on sustainability-relevant concepts that incorporate all three pillars, thus environmental, social, as well as economic aspects.

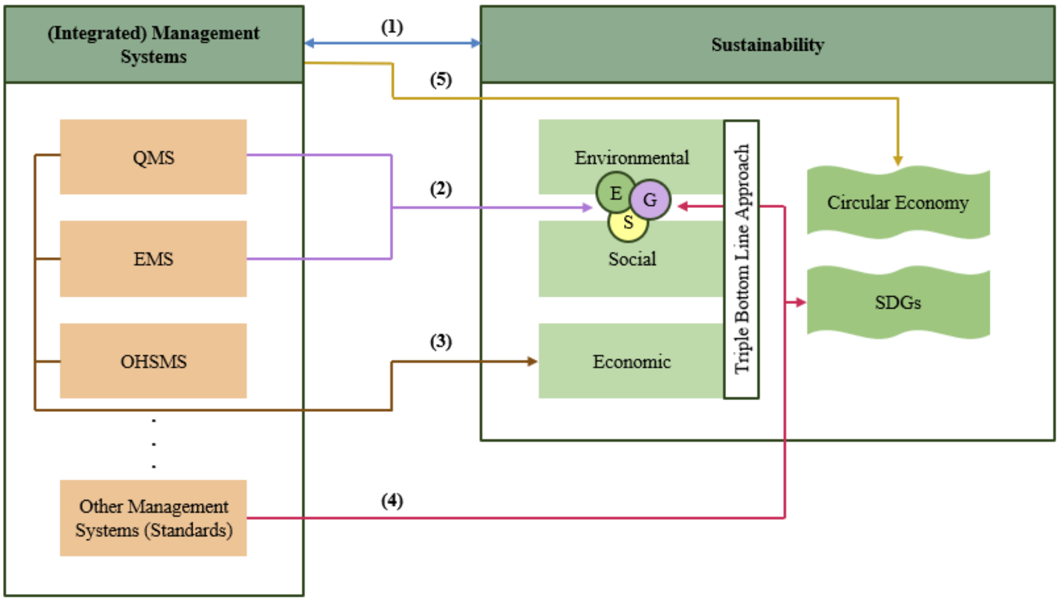


Figure 2. Thesis Research Model

Note: Specific research objectives (1) – (5) in parentheses.

Source: Own elaboration.

1.2 Academic Contributions

The academic contributions (conference presentations and journal articles) achieved throughout the development of this doctoral thesis are summarised in Table 2. The table lists the single projects, type of contribution, current project status, publication details (if applicable), and the projects' relation within this thesis structure.

Table 2. Academic Contributions derived from this Thesis

Chapter	Authors	Title	Type	Status
2	Ronalter, L.M. & Bernardo, M.	Integrated Management Systems and Sustainability: A Review on their Relationships	Journal Article	Published. Total Quality Management & Business Excellence (2023). DOI: 10.1080/14783363.2023.2178407.
			Conference Presentation	Prior version presented at the European Academy of Management Conference on 4–6 December 2020 (online) in Dublin, Ireland.
			Conference Presentation	Prior version presented at the 63rd European Congress of Quality on 23–24 October 2019 in Lisbon, Portugal.
3	Ronalter, L.M., Bernardo, M., & Romaní, J.M.	Quality and Environmental Management Systems as Business Tools to Enhance ESG Performance: A Cross-Regional Empirical Study	Journal Article	Published. Environment, Development and Sustainability (2023). DOI: 10.1007/s10668-022-02425-0.
4	Ronalter, L.M., Hernandez-Vivanco, A., Bernardo, M., & Romaní, J.M.	Certified Management Systems and Firm Financial Performance: A Shareholder View	Journal Article	To be submitted.
5	Ronalter, L.M., Poltronieri, C.F., & Gerolamo, M.C.	ISO Management System Standards in the Light of Corporate Sustainability: A Bibliometric Analysis	Journal Article	Published. The TQM Journal (2023). DOI: 10.1108/TQM-09-2022-0279.
			Conference Presentation	Prior version presented at the 5th International Conference on Quality Engineering and Management on 14–15 July2022 in Braga, Portugal.
6	Ronalter, L.M., Poltronieri, C.F., Gerolamo, M.C., & Bernardo, M.	A Conceptual Research on the Contribution of Integrated Management Systems to the Circular Economy	Journal Article	Published. Challenges in Sustainability (2022). DOI: 10.12924/cis2022.10020001.

Source: Own elaboration.

CHAPTER 2. INTEGRATED MANAGEMENT SYSTEMS AND SUSTAINABILITY: A REVIEW ON THEIR RELATIONSHIPS[1]

[1] This chapter has been adapted from Ronalter and Bernardo (2023).

Abstract

This study explores how integrated management systems as business tools relate to organisations' capability of achieving sustainable development and what knowledge gaps are still existing. Further, it discusses if IMS is only an antecedent of sustainability, or if there is a vice-versa relationship. Therefore, a systematic literature review is performed to provide a summary of existing literature. In addition, an exploratory review adds to the discussion of a vice-versa relationship.

The work reveals that the research topic is characterised by multiple constraints, thus demanding more in-detail studies. The proposed research agenda entails eight future research questions directed at unfolding models in practice, producing large-scale and cross-regional empirical analyses, exploring more IMS components, and investigating how IMS helps organisations to incorporate sustainability concepts at the economic level. An overview on the connections between IMS and sustainability has been absent in literature in such detail.

The work implicates that in practice managers should consider implementing IMS for fostering corporate sustainability, and in academia future research should be directed at the identified knowledge gaps. Thereby, the justification of a vice-versa relationship adds a new viewpoint to academics' understanding of the topic and the formulated research agenda sets the path for future studies.

Keywords: Integrated Management Systems (IMS); Management Systems (MSs); Research Agenda; Sustainability; Systematic Literature Review (SLR).

2.1 Introduction

Humanity has experienced an unprecedented increase in economic output and efficiency since the second half of the 20^{th} century (Bolt et al., 2018), which went hand in hand with environmental damages like a heavy increase in global resource extraction (IRP, 2019) and a collapse in worldwide wildlife population (WWF, 2020). Further, not all countries and social classes benefitted the same from these economic advances and, consequently, the world faces tremendous social as well as economic inequalities (UNDESA, 2020). In this zeitgeist, today's society does no longer perceive profit maximisation as the exclusive objective of companies (Kleine & Hauff, 2009), but "there is a growing debate about what and how business leaders, managers and decision makers can genuinely contribute to a transition to an ecologically sustainable society" (Milne & Gray, 2013, p. 13).

In management sciences, the term sustainability is not exclusively defined but rather contains a wide range of concepts (see e.g., Asif et al., 2013; Salzmann et al., 2005). Nonetheless, academics typically define sustainability as being based on three pillars – namely the (1) economic, (2) environmental, and (3) social dimension (Engert et al., 2016) –, an interpretation that is also known as the triple bottom line (Elkington, 1997). Since "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987, p. 54) nowadays represents a normative concept (Hahn et al., 2015), one of the key drivers for corporations to adopt sustainable practices are their stakeholders (Farmaki, 2019; Høgevold et al., 2015; Schulz & Flanigan, 2016). However, translating general principles of sustainability into organisational action represents a challenge since it requires commitment, leadership, and a systems approach with appropriate management tools (Azapagic, 2003; Galuppo et al., 2019). Therefore, organisations often only focus on measuring corporate sustainability in terms of isolated indicators but lack a transparent, systematic, and reliable way of actually managing sustainability (Gianni et al., 2017; Nawaz & Koç, 2018; Silva et al., 2020).

When it comes to dealing with stakeholder needs in other corporate areas like quality aspects, customer satisfaction, or risk management, many companies rely on management systems as they "provide a systematic way to address the interests of stakeholders" (Poltronieri et al., 2018, p. 375). The main elements of these function-specific MSs are often – but not only – described in management system standards that are developed and published by national as well as international bodies, the most famous one being the International Organization for Standardization (Karapetrovic & Jonker, 2003). Due to the proliferation of various different MSSs and MSs, the need to integrate them into an integrated management system emerged in order to reduce redundancies and to use possible synergy effects (Karapetrovic, 2002). Further, such integration can lead to various economic, environmental, and social benefits (see e.g., Bernardo et al., 2015). As a consequence, IMS initiatives are increasingly implemented from the 1990s onwards (Mohamad et al., 2014) and, by now, IMS implementation is considered to be the best management practice for organisations having multiple MSs in place (Bernardo, 2014). However, although an IMS enables the company to deal with stakeholders' needs in a systematic manner, it lacks consensus for measurement (Gianni & Gotzamani, 2020; Gianni et al., 2017) – despite some recent first attempts to develop performance indices and measuring instruments (see e.g., Gianni & Gotzamani, 2020; Silvestri et al., 2021).

Thus, both concepts have their roots in the stakeholder theory (Asif et al., 2013), and whereas IMS is managed but not measured, CS is measured but not managed (Gianni et al., 2017). Despite this apparent relation between both concepts, there is a lack of research exploring the impact of MSs integration on the TBL perspective (de Nadae et al., 2021; Nunhes et al., 2016) and contributing to the discussion whether and how IMS drives CS (Nunhes et al., 2020; Silva et al., 2020). In view of this research problem, **the objective of chapter 2 is to synthesise identified links between the integration of MSs and sustainability, to identify existing knowledge gaps, and, eventually, to put the links between both concepts into a justified relationship context.** Related to this aim, three research questions are proposed:

RQ1: How far advanced is research that links the integration of MSs to the incorporation of the TBL approach in organisational management?

RQ2: In regard to research that links the integration of MSs to the incorporation of the TBL approach in organisational management, which knowledge gaps still exist that should be investigated in future research?

RQ3: Is IMS simply an antecedent of sustainability, or is there a vice-versa relationship between both concepts?

RQ3 takes into account TBL-related benefits of MSs implementation (see e.g., Tarí et al., 2012), the prevailing view that IMS adoption positively impacts companies' ability to foster sustainability (see e.g., Asif et al., 2013; Gianni et al., 2017; Nunhes et al., 2016; Poltronieri et al., 2018), as well as CS-associated benefits of IMS (see e.g., Başaran, 2018; Bernardo et al., 2015).

A systematic literature review about the relationship between IMS and sustainability is performed to answer RQ1 and RQ2. RQ3 is answered through a discussion that combines the results of the SLR with an additional explorative literature review. Such a detailed review on the current state of research about IMS and sustainability seems to be absent in literature. Thus, this work contributes to academia by synthesising existing knowledge at hand, by providing proof for a vice-versa relationship between both concepts, and, in addition, by outlining existing knowledge gaps and formulating a corresponding research agenda.

The chapter continues in six sections. Section 2.2 offers extended background on IMS and sustainability, and section 2.3 explains the methodology used. Section 2.4 presents the findings (RQ1 and RQ2), and section 2.5 contains the discussion about a vice-versa relationships (RQ3). Eventually, section 2.6 delivers the conclusions of chapter 2.

2.2 Literature Review

2.2.1 Integrated Management Systems

In order to deal with stakeholder needs systematically in both internal and external organisational contexts, companies implement the so-called management systems (Poltronieri et al., 2018; Rebelo, Santos, & Silva, 2016), which are a set of procedures to be followed in order to achieve stakeholder satisfaction for a specific demand. In other words, they represent a "process of systemising how things are done" (Mahesh & Kumar, 2016, p. 578). Since more and more companies operate multiple function-specific MSs (Salomone, 2008), integrating them into a single IMS represents an important issue of the 21st century (Kauppila et al., 2015) as it enables firms to reduce redundancies and to use possible synergy effects (Griffith & Bhutto, 2009; Karapetrovic, 2002).

An IMS can be conceptualised as a "single set of interconnected processes that share a unique pool of human, information, material, infrastructure and financial resources in order to achieve a composite of goals related to the satisfaction of a variety of stakeholders" (Karapetrovic, 2003, p. 9). However, organisations tend to define subjectively what integration means regarding their own business context (Wilkinson & Dale, 2000). Integrating MSs is based on the thought that many MSSs share certain similarities, such as the management policy, planning, implementation, operation, evaluation, improvement, and analysis (Klute-Wenig & Refflinghaus, 2015; Rebelo et al., 2014b). ISO, for example, implements a common structure – referred to as high level structure (HLS) – in its MSSs since 2015. The integration starts with a complete understanding of the MSSs and MSs (Samy et al., 2015) and, then, subsequently puts all management standards and practices into a single system (Nunhes et al., 2017). The integration process considers four main aspects – namely the (1) integration strategy (sequence of MSs implementation), (2) integration methodology (models and tools adopted to create the IMS), (3) integration level (degree to which MSs are managed separately or jointly), and (4) integration of audits (internal as well as external) (Bernardo et al., 2012b; Domingues et al., 2015; Nunhes et al., 2017).

Integration represents an added value (Rebelo et al., 2015) since it leads to numerous tangible as well as intangible advantages that can be divided into external and internal benefits (Samy et al., 2015). External benefits of IMS implementation are, among others, enhanced customer satisfaction (Casadesús et al., 2011; Zutshi & Sohal, 2005), achievement of competitive advantages (Salomone, 2008), and improved company image (Douglas & Glen, 2000; Salomone, 2008). Internal benefits might be functional, organisational, or financial, such as simplified systems and procedures (Douglas & Glen, 2000; Simon et al., 2012), more efficient use of human resources (Salomone, 2008; Zeng et al., 2010), or cost savings by unified audits (Matias & Coelho, 2002; Winder, 2000). Consequently, IMS implementation has an impact on the business strategy as it changes a company's culture, procedures, and habits (Motta Barbosa et al., 2018).

Nonetheless, IMS implementation also has some difficulties. In fact, many organisations face struggles when integrating multiple MSs (Souza & Alves, 2018), such as lack of financial and human resources (Asif et al., 2009; Bernardo et al., 2012a; Simon et al., 2012), insufficient managerial and administrative support (Almeida et al., 2014; Khanna et al., 2010; Simon et al., 2012), as well as problems related to the corporate culture (Wilkinson & Dale, 1999; Zeng et al., 2010).

2.2.2 Sustainability

Sustainable development refers to meeting present needs without compromising future generations' abilities to meet their own needs (UNWCED, 1987) and represents both an important paradigm of the 21st century (Silva et al., 2020; Souza & Alves, 2018) as well as a societal and industrial challenge (Bastas & Liyanage, 2019).

In management sciences, the term sustainability is not exclusively defined but rather contains a wide range of concepts at the corporate level – such as SD, CS, or corporate social responsibility (CSR) (see e.g., Asif et al., 2013; Salzmann et al., 2005) – as well as concepts at the economical level – such as the green, bio, collaborative, or circular economy (see e.g., D'Amato et al., 2017; Ertz & Leblanc-Proulx, 2018; Geissdoerfer et al., 2017). Despite the multiplicity of concepts, academics and practitioners mainly agree on pursuing the TBL approach for fostering SD at the corporate level (Glac, 2015). The TBL concept was introduced by Elkington (1997) and demands organisations to explicitly take into consideration the environmental, economic, and social impacts – positive and negative – of their activities (Edgeman, 1998; Elkington, 1997, 1998; Hediger, 1999). In conformity, this doctoral thesis defines sustainability in accordance with the TBL approach.

In order to assess the level of penetration of environmental, economic, and social factors into organisations' business activities, the corporate sustainability performance (CSP) of firms is assessed (Artiach et al., 2010; Gianni et al., 2017), which reflects how well the organisation converts the managerial attitude of stakeholder orientation into actual stakeholder satisfaction (Luk et al., 2005). Although there is no common standard existing that determines how to measure the environmental and social dimensions of the TBL concept (Hubbard, 2009; Roca & Searcy, 2012), CSP is evaluated by developing and monitoring various indicators (Gianni et al., 2017). In this context, especially ESG ratings – which are company assessments based on the evaluation of environmental, social, and governance issues that result in an overall score (Clementino & Perkins, 2021) – "appear to be a widely accepted measure" (Rajesh, 2020, p. 3).

However, integrating sustainability issues into a management model represents a complex issue (Souza & Alves, 2018), because the TBL framework is an abstract concept whose practical implementation represents a difficult task (Lozano, 2012). Hence, CS is often only measured but rarely managed (Gianni et al., 2017). In other words, CS is undertaken mostly at the operational level (Fisher & Bonn, 2011) by relying on standardised guides and action schemes (van der Heijden et al., 2010), but there is a lack regarding the integration of the sustainability concept into business processes at all organisational levels (Souza & Alves, 2018). Consequently, there is the need to create new CS management approaches (Schaltegger et al., 2013) and to enlarge the current portfolio of only few available tools for sustainability management (Burritt & Schaltegger, 2010; Garcia et al., 2016; Souza & Alves, 2018) in order to overcome the challenge of translating sustainability principles into organisational action (Ajmal et al., 2018; Azapagic, 2003).

In conclusion, knowledge must be enlarged to make sustainability management more systematic, efficient, and practical (Asif et al., 2013). Since CS requires to meet key stakeholder needs – with future generations as one of these stakeholders (Isaksson, 2006) – in a systematic manner (Asif et al., 2011), it seems reasonable to seek synergies for CS incorporation by looking at current management approaches that already enable organisations to meet stakeholder demands systematically, such as integrated management systems do (Nunhes et al., 2017; Siva et al., 2016).

2.3 Methodology

2.3.1 Research Strategy

Research strategies define how the research is approached and which plan of action is likely to offer the best success prospects (Denscombe, 2010). This work is based on the literature review (LR) as research strategy, because LRs allow to evaluate the current state of scientific research fields (Cowell, 2012), as well as to develop new concepts (Rodgers & Knafl, 1993). Further, they ultimately unravel still existing research gaps and allow to present respective future research opportunities in an organised way (Fischl et al., 2014). Hence, performing a LR appears to suit the thesis objective aimed at in chapter 2 the best. LRs are thorough summaries and critical analyses of available literature relevant to the topic being studied (Hart, 1999). However, there are different types of LRs like the traditional (also called narrative or explorative) LR, the systematic LR, meta-analysis or meta-synthesis (Cronin et al., 2008). Since RQ1 and RQ2 aim at evaluating the current state of science and identifying knowledge gaps therein, they are answered by performing a SLR on the relationship between IMS and sustainability as such systematic reviews result in a list of (almost) all studies related to the investigated subject (Cronin et al., 2008). The answers to RQ1 and RQ2 might become a starting point for researchers who seek to undertake new investigations in this particular research branch (Okoli, 2015), as the SLR is likely to produce a balanced and unbiased summary of existing literature (Nightingale, 2009). RQ3, which discusses a vice-versa relationship, is based upon the results from the SLR and, in addition, considers further contributions surrounding the concepts of sustainability and IMS by means of a traditional, exploratory LR.

2.3.2 SLR Application

In order to ensure the reliability and validity of a SLR, researchers must precisely state inclusion and exclusion criteria for literature (Cronin et al., 2008) and follow a specific, systematic approach (vom Brocke et al., 2009). The SLR in this study follows the guidelines proposed by Durach et al. (2017), with the slight adjustment that relevant references found in the baseline sample are added to the selection of pertinent literature. This so-called snowballing is a useful method for extending SLRs (Wohlin, 2014) in order to identify papers that are not included in the baseline sample but, nevertheless, answer the research question. The guidelines used are applicable regardless of the academic field (Durach et al., 2017) and suggest the performance of the six steps outlined in Table 3.

Table 3. SLR Procedure

Step	**Procedure**
(1) Definition of the Research Question	The purpose and/or research question of the SLR are defined. This step was done in section 2.1.
(2) Determination of Characteristics of Primary Studies	Inclusion and exclusion criteria are crafted. The criteria should focus on the quality and content of primary studies, and they should further reflect various aspects of the research purpose and questions.
(3) Retrieve of a Relevant Literature Sample	A baseline sample of potentially relevant literature is retrieved. Therefore, bibliographic databases are searched by introducing suitable combinations of keywords.
(4) Selection of Pertinent Literature	The inclusion and exclusion criteria are applied to the baseline sample, results are refined by new keywords, and duplicates are removed. By reading the title, abstract, and, subsequently, the full text of the remaining studies, the baseline sample is further reduced towards a synthesis sample. To include (almost) all relevant papers, the SLR guidelines proposed by Durach et al. (2017) are adjusted in the sense that relevant references found in the baseline sample are added to the selection of pertinent literature (snowballing).
(5) Synthesis of Literature	The studies of the synthesis sample are analysed, summarised, and integrated. This step is presented in section 2.4.
(6) Report of Results	The report of the results consists of a thematic analysis in the form of a table and written explanations. This step is presented in section 2.4.

Source: Adapted from Durach et al. (2017).

As the research purpose (step 1) was established in section 2.1 and the literature synthesis (5) as well as the report of results (6) are presented as findings in section 2.4, the following paragraphs only depict the SLR sub-steps (2) to (4), which are also summarised in Table 4. As visible, the inclusion and exclusion criteria allow for all methodologies and time periods but make restrictions to articles in English, German, and Spanish. Therefore, this SLR follows an ‘exhaustive & selective’ coverage degree (Cooper, 1988), because it aims to include the entirety of academic literature (or at least almost all of it) that connects the integration of MSs with sustainability but thereby only considers journal articles in order to ensure a certain degree of quality and, in addition, takes into account the authors’ language constraints. To retrieve a relevant literature sample, the bibliographic databases Web of Science, Scopus, and Emerald Insight are searched by combinations of keywords. Narrowing down potential expressions and search phrases to the most relevant keywords (vom Brocke et al., 2009) represents a complicated step, because too loose search phrases can lead to too many results – which makes it hard for reviewers to identify the relevant ones – and, in contrast, too narrow search phrases bear the risk of excluding important publications (Osterrieder et al., 2020). Thus, the selection of keywords has a strong impact on the review’s completeness and quality (Baker, 2000). Suitable keywords around the concepts of IMS and sustainability are derived based upon the extended background in section 2.2. To the best of the authors’ knowledge, the combined keywords in Table 4 and the following snowballing should be suitable to retrieve (almost) all academic work that covers the specific scope of this SLR.

Table 4 illustrates the SLR sub-steps (2) and (4) in a transparent way by dividing the literature search process into five phases. The initial baseline sample of 621 papers (phase i) was reduced to 414 papers by applying the inclusion/exclusion criteria (phase ii) and to 177 articles by removing duplicates (phase iii). Reading the title and abstract further narrowed it down to 85 papers (phase iv). This phase excluded many papers, as they did not consider IMS in the sense of this study – i.e., the integration of MSs – but rather concerned topics like “integrated management system for decontamination and rehabilitation of buildings, structures and materials in urban renewal” (Sánchez & Lauritzen, 2006, p. 274), “integration in sustainable agricultural systems” (Edwards, 1989, p. 25), or “integrated water resource management” (Avellán et al., 2017, p. 1). Reading the full paper reduced the sample to 39 articles. The snowballing added 5 further journal articles, thus leading to the final synthesis sample of 44 contributions.

Table 4. SLR Outcome

Scope Definition

Inclusion: All publication years; all methdogologies.

Exclusion: Document types restricted to articles; language restricted to English, Spanish, and German.

Literature Search Process

Date	Search performed in July 2021

Topic Conceptualisation		Integrated Management Systems	Database	Web of Science					Scopus					Emerald Insight					
			Fields	topic					title, abstract, keywords					abstract					
Sustainability		management system* AND integrat* AND ("IMS" OR "integrated management system*")	Phases[1]	i	ii	iii	iv	v	i	ii	iii	iv	v	i	ii	iii	iv	v	Total
General Keywords	sustainability	AND		128	91	91	39	19	129	82	33	19	9	8	8	0	0	0	28
	triple bottom line			7	5	0	0	0	8	7	1	1	0	3	3	0	0	0	0
Concepts at the Corporate Level	sustainable development			97	70	27	15	7	132	68	13	3	2	1	1	0	0	0	9
	corporate sustainab*			17	13	0	0	0	14	10	0	0	0	1	1	0	0	0	0
	corporate social responsibility			41	30	7	5	2	27	19	5	3	0	2	2	0	0	0	2
Concepts at the Economic Level	green economy			1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	bio economy			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	collaborative economy			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	circular economy			3	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0
																		Sub-Total	**39**
																		Snowballing	5
																		Synthesis Sample	**44**

[1] Phases: i) search result, ii) applying in-/exclusion criteria, iii) removing duplicates, iv) reading title & abstract, v) reading full paper.

Source: Own elaboration.

2.4 Findings

In order to answer RQ1 (‘what has been done’) and RQ2 (‘what still must be done’), the studies from the synthesis sample are presented briefly and, in addition, an overview of all studies (see Table 5) is depicted from which valuable insights are derived.

2.4.1 Thematic Results

Empirical studies started when Fresner and Engelhardt (2004) analysed two Austrian small and medium-sized enterprises (SMEs) regarding the enhancement of environmental and economic performance through improved processes and procedures. The authors figured that CS could be achieved by implementing cleaner production (CP) methods, optimised supply chains, more sustainable products, as well as an IMS. In the following year, Oskarsson and Malmborg (2005) studied how three Swedish corporations handled environmental issues and argued that MSs themselves do not represent a sufficient management approach for establishing SD in organisations, but the integration of MSs might tie environmental issues tighter to companies’ core values. This statement is confirmed by Esquer-Peralta et al. (2008), who revealed through several interviews among researchers, experts, and government employees that although MSs are seen as helpful for fostering SD, taking real advantage of MSs requires their integration as sustainability is only possible when integrating all MSs into one system.

In addition, Jørgensen (2008) concluded that creating an IMS can pave the way towards SD after presenting experiences from a company in Denmark. Questionnaires performed in Latvian companies showed that even from the viewpoint of companies the concepts of IMS and sustainability are perceived to be related (Mežinska et al., 2015), and Holm et al. (2015) concluded that IMS suits as framework for promoting education for SD in universities.

Further, Silva et al. (2020) performed case studies in four Portuguese companies and derived that, on the one hand, IMS acts as enabler – by promoting organisational structure and enabling the deployment of sustainability – and, on the other hand, it works as pathway – as IMS helps companies implementing sustainability step by step as a standardised system. Further, de Nadae et al. (2021) conducted four case studies across different sectors and concluded that, albeit sustainability is not a motivation for IMS adoption, the integration of MSs is a driver of sustainability performance.

Rahman et al. (2021) employed ordinary least squares (OLS) and two-stage least squares (2SLS) to data from 23 companies to empirically prove a positive impact of integration on the social, environmental, economic, as well as workplace dimension. Further, Poltronieri et al. (2019) conducted a survey which revealed that the performance of all three TBL dimensions is highly impacted by the maturity of MSs integration. Focusing on SMEs, a study on 18 companies showed that SMEs barely use MSs for ensuring CS integration into business activities and, therefore, should better understand the use of integrated MSs in order to successfully integrate CS (Witjes et al., 2017).

Through the analysis of 14 Brazilian companies regarding their most common integrated elements, Nunhes et al. (2017) revealed that IMS shares synergies with CP technologies. In addition, also Hernandez-Vivanco et al. (2018) evidenced a significant positive relationship between IMS and the adoption of CP technologies. Furthermore, Rebelo, Silva, et al. (2016) analysed a manufacturing site that suffered inefficiencies resulting from a low level of integration and showed how IMS implementation promotes sustained success. Regarding the level of integration, Jørgensen et al. (2006) considered ambitious integration to be connected to "creating a culture of learning, stakeholder participation and continuous improvement of performance" (p. 714) that eventually leads to CS progress in regard to all three TBL pillars. Further, the internalisation of IMS is considered to be an "imperative for their prosperity and contribution toward CSP" (Gianni & Gotzamani, 2020, p. 1).

Internal and external factors that might condition IMS implementation in pursuing the enhancement of the organisation's sustainability are enumerated by Bernardo et al. (2017), and Hassan et al. (2021) conducted a meta-analysis incorporating 38 articles that deal with internal and external factors of integrated internal audit effectiveness, concluding that one of the top outcomes is business sustainability.

Table 5. Synthesis Sample from SLR about IMS and Sustainability

Authors (Publication Year)	Journal	Research Characteristics				Main Findings	
		Type[1]	Sample	Method[2]	Country	Research Focus	Relationship[3]
Fresner and Engelhardt (2004)	Journal of Cleaner Production	E	n=2	CS	Austria	Medium	IMS → Sustain.
Oskarsson and Malmborg (2005)	Corporate Social Responsibility and Environmental Management	E	n=3	CS	Sweden	Strong	IMS → Sustain.
Jørgensen et al. (2006)	Journal of Cleaner Production	C	-	Traditional LR	-	Weak	IMS → Sustain.
Rocha et al. (2007)	Total Quality Management & Business Excellence	C	-	Traditional LR	-	Strong	IMS → Sustain.
Esquer-Peralta et al. (2008)[4]	Management Decision	E	n=14	Interviews	Mexico	Weak	IMS → Sustain.
Jørgensen (2008)[4]	Journal of Cleaner Production	E	n=1	CS	Denmark	Strong	IMS → Sustain.
Asif et al. (2011)	European Business Review	C	-	Traditional LR	-	Strong	IMS → Sustain.
Griffith (2011)	International Journal of Construction Management	C	-	Traditional LR	-	Medium	IMS → Sustain.
Asif et al. (2013)	Journal of Cleaner Production	C	-	Traditional LR	-	Medium	IMS → Sustain.
Rebelo et al. (2014a)	Total Quality Management & Business Excellence	E	n=1; n=42	CS based on Question.	Portugal	Medium	IMS → Sustain.

Table 5. (continued)

Authors (Publication Year)	Journal	**Research Characteristics**				**Main Findings**	
		Type[1]	Sample	Method[2]	Country	Research Focus	Relationship[3]
Rebelo et al. (2014b)	The TQM Journal	E	n=1; n=137	CS based on Question.	Portugal	Medium	IMS → Sustain.
Holm et al. (2015)	Journal of Cleaner Production	E	n=11	CS	-	Strong	IMS → Sustain.
Klute-Wenig and Refflinghaus (2015)	The TQM Journal	C	-	Traditional LR	-	Medium	*
Mežinska et al. (2015)	Total Quality Management & Business Excellence	E	n=26; n=10	Questionnaires (2x)	Latvia	Strong	IMS → Sustain.
Samy et al. (2015)	Environmental Engineering and Management Journal	C	-	Traditional LR	-	Weak	IMS → Sustain.
Aquilani et al. (2016)	Sustainability	C	n=22	Systematic LR	-	Weak	*
Nunhes et al. (2016)	Journal of Cleaner Production	C	n=30	Systematic LR	-	Medium	IMS → Sustain.
Rebelo, Santos, and Silva (2016)	Journal of Cleaner Production	E	n=1; n=42	CS based on Question.	Portugal	Strong	IMS → Sustain.
Rebelo, Silva, et al. (2016)	The TQM Journal	E	n=1	CS	Portugal	Medium	IMS → Sustain.
Siva et al. (2016)	Journal of Cleaner Production	C	n=69	Systematic LR	-	Weak	IMS → Sustain.

Table 5. (continued)

Authors (Publication Year)	Journal	Research Characteristics				Main Findings	
		Type[1]	Sample	Method[2]	Country	Research Focus	Relationship[3]
Bernardo et al. (2017)	Journal of Cleaner Production	E	n=6	CS	Spain & Greece	Weak	*
Gianni et al. (2017)	Journal of Cleaner Production	C	-	Traditional LR	-	Strong	IMS → Sustain.
Martí-Ballester and Simon (2017)	Management Decision	E	n=50	PLS Analysis	Spain	Medium	*
Mustapha et al. (2017)[4]	Journal of Cleaner Production	E	n=1	CS	Malaysia	Strong	*
Nunhes et al. (2017)[4]	Journal of Cleaner Production	E	n=14	CS	Brazil	Weak	*
Witjes et al. (2017)[4]	Journal of Cleaner Production	E	n=18	CS	Netherland	Weak	IMS → Sustain.
Cazeri et al. (2018)	Journal of Cleaner Production	E	n=48	Questionnaire	Brazil	Medium	IMS → Sustain.
Hernandez-Vivanco et al. (2018)	Journal of Cleaner Production	E	n=40	Questionnaire	Spain	Medium	*
Ionescu et al. (2018)	Sustainability	E	n=130	Questionnaire	Romania	Medium	*
Nawaz and Koç (2018)	Journal of Cleaner Production	C	n=44	Systematic LR	-	Strong	IMS → Sustain.

Table 5. (continued)

Authors (Publication Year)	Journal	Research Characteristics				Main Findings	
		Type[1]	Sample	Method[2]	Country	Research Focus	Relationship[3]
Poltronieri et al. (2018)	International Journal of Quality & Reliability Management	E	n=189	Questionnaire	Brazil	Strong	IMS → Sustain.
Samy et al. (2018)	Journal of Computational and Theoretical Nanoscience	C	-	Traditional LR	-	Weak	IMS → Sustain.
Souza and Alves (2018)	Journal of Cleaner Production	E	-	Action Research	Brazil	Strong	IMS → Sustain.
de Nadae and Carvalho (2019)	Production	C	n=1,010	Systematic LR	-	Medium	IMS → Sustain.
de Nadae et al. (2019)	Journal of Manufacturing Technology Management	E	n=253	Reports Analysis	Brazil	Medium	IMS → Sustain.
Fasoulis and Rafet (2019)	Social Sciences	E	n=50	Questionnaire	Global	Medium	IMS → Sustain.
Poltronieri et al. (2019)	Journal of Cleaner Production	E	n=96	Questionnaire	Brazil	Strong	IMS → Sustain.
Gianni and Gotzamani (2020)	The TQM Journal	E	n=280	Questionnaire	Greece	Medium	IMS → Sustain.
Lozano (2020)	Corporate Social Responsibility and Environmental Management	E	n=202	Questionnaire	Global	Medium	IMS → Sustain.
Nunhes et al. (2020)	Sustainability	C	n=30	Content Analysis	-	Medium	IMS → Sustain.

Table 5. (continued)

Authors (Publication Year)	**Journal**	**Research Characteristics**				**Main Findings**	
		Type[1]	Sample	Method[2]	Country	Research Focus	Relationship[3]
Silva et al. (2020)	Sustainability	E	n=4	CS	Portugal	Strong	IMS → Sustain.
de Nadae et al. (2021)	International Journal of Quality & Reliability Management	E	n=4	CS	Brazil	Strong	IMS → Sustain.
Hassan et al. (2021)	Social Sciences & Humanities	E	n=38	Meta-Analysis	-	Medium	IMS → Sustain.
Rahman et al. (2021)	Environment, Development and Sustainability	E	n=23	OLS / 2SLS	Malaysia	Strong	IMS → Sustain.

[1] E = Empirical, C = Conceptual; [2] CS = Case Study; [3] * = No Relationship stated; [4] Selected through Snowballing

Source: Own elaboration.

Regarding the economic dimension of the TBL approach, de Nadae et al. (2019) evidenced a significant and positive impact of IMS on economic performance after performing a report analysis. Ionescu et al. (2018) confirmed the hypothesis that IMS implementation contributes to the increase of the turnover, respectively the market value, in the Romanian hospitality industry. Further, Martí-Ballester and Simon (2017) performed a partial least squares (PLS) analysis for 50 corporations and concluded that integrating MS procedures leads to scope economies, which enables companies with fully integrated MSs to financially outperform their counterparts with only partially integrated or separately managed MSs.

In literature reviews, IMS "is viewed as a viable and rational approach for (…) sustainable development" (Samy et al., 2015, p. 997) that helps companies to achieve sustainability and provides a structure for CSR integration (Nunhes et al., 2016). On account of this, sustainability support through the integration of MSs is one of the most mentioned topics regarding quality management methods, tools, and practices for SD initiatives (Siva et al., 2016). Exemplary, Nunhes et al. (2020) systematised CS, thereby identifying 60 elements that were grouped into six pillars and eventually declaring MSs as well as IMS to be one out of these six fundamental CS management pillars. Further, Lozano (2020) analysed the use of tools, initiatives, and approaches to promote sustainability in corporations, thereby identifying IMS as one out of 24 points. And de Nadae and Carvalho (2019) performed a SLR on standard MSs and claim propositions directed at a significant positive relationship – influenced by firm size and industry sector – between IMS and performance in all three TBL dimensions.

Furthermore, existing literature provides a multiplicity of frameworks that connect IMS and sustainability. Rocha et al. (2007) highlighted the need to make existing systems more reflective of SD in order to face the challenge of implementing sustainability into an organisation's business processes and, therefore, presented an IMS that provides guidance on the micro- and macro-level for integrating principles of SD within existing MSSs. By addressing the integration of sustainability through a meta-management approach, Asif et al. (2011) proposed a model in which the integration of MSs is seen as reference point that provides leverage for integrating sustainability into existing business processes.

Due to the similarity of fundamental principles of CSR practices and MSs, Asif et al. (2013) developed a framework focusing on using possible synergies in order to establish business processes that foster CSR performance by addressing a maximum broad range of stakeholders. Within the framework, the role of an IMS as the "backbone for CSR" (p. 16) is emphasised as it provides the structures for dealing with stakeholders' demands in a coherent, systematic, and synergistic manner. Rebelo et al. (2014a) proposed a flexible integrator and lean model for IMS. The same authors Rebelo et al. (2014b) also proposed a generic model for an integrated management system containing quality, environment, and safety aspects.

Souza and Alves (2018) created a lean-integrated management system for sustainability improvement model that aims at supporting organisations in improving CS. In order to facilitate the IMS assessment, Klute-Wenig and Refflinghaus (2015) developed an enlarged Excel-based tool that allows SMEs to self-assess their IMS in regard to sustainability-related aspects.

Rebelo, Santos, and Silva (2016) suggested a model to support the development of IMS based around the Plan-Do-Check-Act (PDCA) cycle, an action plan for (1) developing a global environmental, quality, and occupational health and safety compliance culture as well as for (2) developing and implementing a waste management and minimisation plan, and general integration guidelines. For managing sustainability, Mustapha et al. (2017) formulated an integrated sustainable green management system based on the PDCA cycle that could incorporate ISO 9001 for QMS, ISO 14001 for EMS, and ISO 50001 for energy management systems (EnMS). Fasoulis and Rafet (2019) proposed a conceptual CSR framework for a sustainable maritime industry with IMS in its centre. By bridging literature on sustainability, value co-creation, total quality management (TQM), environmental management, and IMS, Aquilani et al. (2016) were able to create a model of value co-creation processes – based on critical success factors (CSF), such as top management commitment and leadership, process management, human resource management, etc. – that encompasses CSFs to support sustainability via quality processes.

Gianni et al. (2017) developed a framework that relates IMS resources, IMS level, and CSP that considers IMS scope as a possible contingent factor on CS performance. Another model for measuring the integration of multiple

MSs as well as the effect of integration on sustainable performance was proposed and tested by Poltronieri et al. (2018) and is based on a questionnaire. Samy et al. (2018) designed a holistic model for IMS implementation which is said to lead to organisational efficiency, business excellence, and sustainable development as derived output and outcomes.

However, despite these multiple frameworks, a study among 48 Brazilian companies revealed that organisations still struggle to ensure that there are no clashes of interest or redundancies in different stakeholders' requirements and to evaluate the adequacy of the integration between CSR systems and MSs (Cazeri et al., 2018). Moreover, Griffith (2011) conceptually researched CSR applications in the construction business and commented that although IMS adoption can link key elements of CSR, "IMS is not a panacea for CSR" (p. 45). This statement was supported by Nawaz and Koç (2018). After conducting an SLR on different sustainability management dimensions, these authors concluded that "there will remain unaddressed sustainability issues even after full integration of MSSs" (Nawaz & Koç, 2018, p. 1257) and, in this context, the authors presented an own, multi-dimensional standalone sustainability management system framework based upon the concept of integrated MSs.

2.4.2 Observations, Knowledge Gaps, and Future Research Agenda

Based on the elaborations above and their synthesis in Table 5, RQ1 is answered by deriving the following observations and insights about how advanced research is regarding links between the integration of MSs and the incorporation of the TBL approach. Furthermore, RQ2 is answered by formulating future research questions for identified knowledge and literature gaps:

(1) The topic only emerged in the 21st century and, therefore, represents a still young field of research. Furthermore, most of the research has been done within the past few years, and the number of academic journals dealing with the topic is increasing. This fundamentally underlines the growing academic interest in examining how IMS and sustainability are related.

(2) Most research perceives IMS to be a driver of sustainability. In other words, integrating MSs is seen as an approach for achieving sustainability (see e.g., Samy et al., 2015) as it provides a structure for incorporating sustainability-related concepts into business practices (see e.g., Siva et al., 2016). In this context, section 2.5 entails a discussion with a counter perspective that claims for the existence of a vice-versa relationship between both concepts (referring to RQ3).

(3) The frameworks and models proposed in conceptual papers – such as Asif et al. (2013), Samy et al. (2018), or Gianni et al. (2017) – lack empirical proof regarding their validity, feasibility, and applicability. Furthermore, many of the papers that are indicated as empirical in Table 5 – such as Rebelo et al. (2014a) or Rebelo et al. (2014b) – used case studies and questionnaires only for producing frameworks, models, and instruments but these tools themselves have not yet been proved in further practice. In conclusion, future research should be directed at unfolding the proposed models in practice, thereby answering the question whether the existing/developed IMS frameworks for fostering SD are feasible, flawless, and effective in practice (**FRQ1**). Naturally, this imposes the question of CSF for frameworks, while taking into account specific business contexts (**FRQ2**).

(4) Research based on empirical data is often characterised by limited sample sizes and a focus on single countries and/or industries. Empirical research studies that conduct large-scale and cross-regional analyses proving the impact of MSs integration on TBL dimensions appear to be absent in current literature. Thus, academia faces knowledge gaps regarding the impact of MSs integration regarding firms' performance in the economic (**FRQ3**), environmental (**FRQ4**), and social (**FRQ5**) TBL dimension depending on the company location, size, and industry.

(5) Most research studies consider IMS consisting of combinations of QMS, EMS, and/or OHSMS. Thus, there is a lack of studies taking into account the integration of further sustainability-specialised and less widely spread MSSs and MSs like, for example, ISO 26000 (directed at social responsibility) or ISO 50001 (directed at energy management). Conclusively, future research should investigate how IMS consisting of MSs other than QMS, EMS, and/or OHSMS contribute to companies'

ability of fostering SD (**FRQ6**). Moreover, knowledge is missing on what standards and systems an IMS should entail in order to enable organisations to overcome (upcoming) sustainability-challenges of the 21st century, such as issues connected to the ongoing globalisation, increasing digitalisation, overpopulation as well as demographic change, and climate-change induced threats (**FRQ7**).

(6) No research was detected that investigates how IMS can contribute as business tool to support the adoption of economic-level sustainability concepts like the green, bio, collaborative, or circular economy. However, IMS that entail standards like BS 8001 (framework for implementing the principles of the circular economy) or incorporate principles like IWA 19 (guidance principles for the sustainable management of secondary metals) might bear potential in this regard. Proving so should be the task of future research (**FRQ8**).

The knowledge gaps and FRQs elaborated above are summarised and synthesised in the research agenda visualised in Table 6. Further, the table entails guidance that might be valuable for designing corresponding future research methodologies.

Table 6. Identified Knowledge Gaps and corresponding FRQs

Knowledge Gap	**Future Research Question**	**Guidance**
Unfolding Models in Practice	FRQ1: Are recently developed IMS frameworks for fostering SD feasible, flawless, and effective in practice? FRQ2: What are critically success factors for implementing IMS-centred sustainability models in practice?	Despite developing even more conceptually derived frameworks about how IMS relates to CS, already existing models should be unfolded in practice. Case studies in multiple differing business environments might be a suitable research methodology. Further, such studies could deliver more insights on CSF (see e.g., Aquilani et al., 2016), internal/external factors conditioning IMS implementation, and audit efficiency (see e.g., Bernardo et al., 2017; Hassan et al., 2021).
Large-scale and cross-regional Empirical Analyses	How and to what extend does the integration of MSs impact firms' performance in the … FRQ3: economic dimension FRQ4: environmental dimension FRQ5: social dimension …, depending on the company location, size, and industry?	To verify current knowledge retrieved through studies with limited sample sizes, large-scale analyses are needed. To verify the impact of integration on the economic pillar, indicators like operating profits, return on assets, and return on equity are popular (see e.g., de Nadae et al., 2019; Martí-Ballester & Simon, 2017). To evaluate CSP in the environmental and social pillar, ESG ratings represent accepted measurements (Rajesh, 2020). Biases related to country/region (see e.g., Tan, 2005), company size (see e.g., Poltronieri et al., 2019), and industry sector (see e.g., de Nadae et al., 2019) must be explicitly taken into account.

Table 6. (continued)

Knowledge Gap	Future Research Question	Guidance
IMS Components and current/upcoming Sustainability Concerns	FRQ6: Which standards and systems should be incorporated into an IMS beyond QMS, EMS, and OHSMS in order to enhance its ability of fostering sustainability? FRQ7: How must an IMS be designed in order to enable firms to overcome current/upcoming sustainability challenges of the 21st century?	Most IMS research considers QMS, EMS, and/or OHSMS. This seems reasonable considering the diffusion of MSSs (ISO, 2021). Nonetheless, also MSs surrounding topics like energy management, social responsibility, or water efficiency might be sustainability relevant IMS components. Especially in view of the 21st century's (upcoming) challenges.
IMS and Sustainability-Concepts at the Economic Level	FRQ8. How can IMS as business tool contribute to the adoption of economical sustainability approaches, such as the circular economy?	Concepts like the circular economy demand companies to rethink how they create, deliver, and capture value (Frishammar & Parida, 2019; Lewandowski, 2016). In this context, IMS could be of great support when it comes to alignments with the business strategy (Motta Barbosa et al., 2018).

Source: Own elaboration.

2.5 Discussion

RQ3 reviews the links between IMS and sustainability by discussing if IMS is only an antecedent of sustainability, or if there is also a vice-versa relationship. The question is answered by stating the prevailing relationship in academia identified in the framework of the SLR and, in addition, examining two further possible relationships – firstly sustainability as an antecedent of IMS, and secondly IMS as a sustainable tool itself – by performing an additional explorative LR.

2.5.1 IMS as Antecedent of Sustainability

As already highlighted in section 2.4, most research studies claim IMS to be a driver of sustainability. In summary, academics predominantly perceive IMS as an approach for achieving sustainability (see e.g., Samy et al., 2015) since it provides a structure for integrating sustainability-related concepts into business practices (see e.g., Asif et al., 2013; Siva et al., 2016) and, therefore, paves the way towards SD (see e.g., Jørgensen, 2008). In conclusion, integrated management systems drive sustainability by providing a holistic structure for incorporating sustainability-related concepts into action at all organisational layers.

2.5.2 Sustainability as Antecedent of IMS

Organisational attempts to adopt sustainable practices are mainly driven by stakeholder demands (Farmaki, 2019; Høgevold et al., 2015; Schulz & Flanigan, 2016), and managers apply CSR practices at the operational level in order to actually achieve better sustainability (Asif et al., 2013; Kleine & Hauff, 2009). Although the term CSR is not defined exclusively, it is said to be based on five dimensions (Dahlsrud, 2008) – namely (1) voluntariness, (2) stakeholders, as well as the (3) environmental, (4) economic, and (5) social pillars. When examining MSs under the viewpoint of these CSR dimensions, the operation of separate MSs appears to represent a sustainable practice: MSs (1) are implemented on a voluntary basis – i.e., MSs implementation is not compulsory or demanded by law (ISO states it in all its MSSs) – and (2) aim at dealing with stakeholder needs systematically (Poltronieri et al., 2018; Rebelo, Silva, et al., 2016). Further, they lead to (3) environmental, (4) economic, as well as (5) social improvements, as highlighted in Table 7. To sum it up, MSs represent sustainable tools and companies that operate separately managed MSs are in fact companies with a certain drive towards sustainability. However, operating multiple separate MSs causes the urge to integrate them in order to facilitate their management, to use possibly synergy effects, and to reduce redundancies (Griffith & Bhutto, 2009; Karapetrovic, 2002). This line of argument leads to the conclusion that the initial implementation of multiple separately managed MSs represents a sustainable action, which eventually leads to the implementation of IMS as a merge of sustainable practices. In other words, the implementation of multiple separated MSs as sustainable practices drives IMS adoption.

2.5.3 IMS as a Sustainable Tool

Since academics and specialists use the TBL approach to describe, comprehend, and measure sustainability (Glac, 2015), the definition of IMS as a sustainable tool requires to outline and emphasise the environmental, economic, and social impacts of IMS implementation. Therefore, Table 8 depicts the most highlighted IMS benefits in accordance with the TBL approach. As visible, integrating several MSs into a single IMS leads to environmental improvements, such as better resource allocation and facilitated adoption of cleaner production technologies (Hernandez-Vivanco et al., 2018; Nunhes et al., 2017). Furthermore, IMS implementation is positively connected to organisation’s economic performance (see e.g., de Nadae et al., 2019) due to cost reductions (see e.g., Douglas & Glen, 2000), cost savings (see e.g., Simon et al., 2012), and increased productivity (see e.g., Hamidi et al., 2012). Moreover, companies that integrate their MSs benefit from social performance improvements (see e.g., Poltronieri et al., 2019) like enhanced customer satisfaction (see e.g., Casadesús et al., 2011) and increased employee motivation (see e.g., Salomone, 2008). In conclusion, MS integration leads to improvements in regard to all three TBL dimensions, thus resulting in the statement that an IMS itself represents a sustainable business tool.

Table 7. MSs Benefits clustered by TBL Dimension

TBL Dimension	Benefits of MSs	References
Environmental	Environmental performance	Barla (2007); Boiral et al. (2018); Gavronski et al. (2008); Potoski and Prakash (2005); Russo (2009); Tan (2005); Yin and Schmeidler (2009); Zeng et al. (2005)
	Environmental innovation	Ann et al. (2006); Boiral et al. (2018); M. Bu et al. (2020); Erauskin-Tolosa et al. (2020); Manders et al. (2016); Montobbio and Solito (2018); Papagiannakis et al. (2019); Ziegler (2015)
Economic	Profitability	Benner and Veloso (2008); Corbett et al. (2005); Gavronski et al. (2008); Link and Naveh (2006); Lo and Chang (2007); Martínez-Costa et al. (2008); Wahba (2008); Zaramdini (2007); Zeng et al. (2005)
	Market share	Askey and Malcolm (1997); Casadesús and Karapetrovic (2005); Jang and Lin (2008); Lo and Chang (2007); Pan (2003); Rodríguez-Escobar et al. (2006); Sampaio et al. (2009); Singh (2008); Zaramdini (2007); Zeng et al. (2005)
	Sales and sales growth	Arauz and Suzuki (2004); Casadesús and Karapetrovic (2005); Corbett et al. (2005); Dick et al. (2008); Link and Naveh (2006); Martínez-Costa and Martínez-Lorente (2007); Sharma (2005); Singh et al. (2006); Terziovski et al. (2003)
Social	Improved customer satisfaction (reduction in complaints, etc.)	Ann et al. (2006); Arauz and Suzuki (2004); Casadesús and Karapetrovic (2005); Gavronski et al. (2008); Gotzamani and Tsiotras (2002); Lo and Chang (2007); Martínez-Costa et al. (2008); Mcadam (1999); Padma et al. (2008); Pan (2003); Sampaio et al. (2009); Singels et al. (2001); Singh (2008); Zaramdini (2007)
	Improvements in employee results (motivation, satisfaction, teams, communication, knowledge, etc.)	Arauz and Suzuki (2004); Casadesús and Karapetrovic (2005); Feng et al. (2007); Gavronski et al. (2008); Lo and Chang (2007); Magd and Curry (2003); Magd (2008); Martínez-Costa et al. (2008); Padma et al. (2008); Pan (2003); Rodríguez-Escobar et al. (2006); Tan (2005); Zaramdini (2007)

Table 7. (continued)

TBL Dimension	Benefits of MSs	References
Social	Improved relationships with suppliers	Arauz and Suzuki (2004); Casadesús and Karapetrovic (2005); Gavronski et al. (2008); Gotzamani and Tsiotras (2002); Lo and Chang (2007); Padma et al. (2008); Rodríguez-Escobar et al. (2006); Yin and Schmeidler (2009); Zaramdini (2007)
	Improved relationships with authorities and other stakeholders	Ann et al. (2006); Boiral et al. (2018); Gavronski et al. (2008); Heras-Saizarbitoria and Boiral (2013); Magd and Curry (2003); Padma et al. (2008); Pan (2003); Schylander and Martinuzzi (2007); Tarí et al. (2012); Yin and Schmeidler (2009); Zeng et al. (2005)

Source: Own elaboration with adaptions from Bernardo et al. (2015) and Tarí et al. (2012).

Table 8. IMS Benefits clustered by TBL Dimension

TBL Dimension	IMS Benefits	References
Environmental	Increased environmental performance	Poltronieri et al. (2019)
	Better allocation of resources	Salomone (2008); Zeng et al. (2007); Zutshi and Sohal (2005)
	Better adoption of cleaner production technologies	Hernandez-Vivanco et al. (2018); Nunhes et al. (2017)
Economic	Improved economic performance and increased profitability	de Nadae et al. (2019); Hamidi et al. (2012)
	Reduced costs in management, insurance, and operations	Douglas and Glen (2000); Jørgensen et al. (2006); Llonch et al. (2018); McDonald et al. (2003); Rebelo et al. (2014b); Santos et al. (2011); Simon et al. (2014); Wright (2000); Zeng et al. (2007); Zutshi and Sohal (2005)
	Cost savings by unified audits, internal audits, and certification costs	Abad et al. (2014); Matias and Coelho (2002); Renzi and Cappelli (2000); Shillito (1995); Simon et al. (2012); Winder (2000); Zeng et al. (2010)
	Documentation reduction, avoidance of duplication, and decreased paperwork	Beckmerhagen et al. (2003); Douglas and Glen (2000); Griffith (2000) Jørgensen et al. (2006); Karapetrovic and Casadesús (2009); McDonald et al. (2003); Salomone (2008); Sampaio et al. (2012); Santos et al. (2011); Simon et al. (2011); Simon and Douglas (2013); Simon et al. (2014); Zeng et al. (2011); Zutshi and Sohal (2005)
Social	Increased social performance	Poltronieri et al. (2019)
	Improvement of partnerships and satisfaction with the main stakeholders	Rebelo et al. (2014b); Simon et al. (2012)
	Enhance customer satisfaction and feedback analysis	Casadesús et al. (2011); Crowder (2013); Douglas and Glen (2000); McDonald et al. (2003); Salomone (2008); Zutshi and Sohal (2005)

Table 8. (continued)

TBL Dimension	IMS Benefits	References
Social	Better employee awareness of the importance of their work as a contributor to the whole organisation	Abad et al. (2014); Karapetrovic and Casadesús (2009); Rebelo et al. (2014b); Simon et al. (2012)
	Increased employee motivation	Abad et al. (2014); Salomone (2008); Zeng et al. (2011); Zutshi and Sohal (2005)
	Increased employee training	Holm et al. (2015); Santos et al. (2011)
	Organisational culture improvements and enhanced teamwork	Curkovic et al. (2005) ; Hamidi et al. (2012); Holm et al. (2015); Rebelo et al. (2014b); Simon and Douglas (2013); Wright (2000); Zutshi and Sohal (2005)

Source: Own elaboration with adaptions from Bernardo et al. (2015) and Samy et al. (2015).

2.5.4 Relationship Context

Based on the elaborations above, the relationship between IMS and sustainability can be put in the following context:

- Companies implement various single MSs, which – according to the literature revised – represent sustainable tools aiming at satisfying stakeholder needs systematically. Operating multiple MSs leads to an integration urge to reduce redundancies, facilitate management, and drive towards business excellence. In conclusion, sustainability is a driver of IMS adoption, because companies initially implement different function-specific MSs – which already are sustainable tools – and only integrate them in a subsequent step.

- Integration does not only provide the structure for an easier translation of SD concepts into organisational actions but rather also the operation of an IMS leads to numerous additional sustainable benefits. This leads to the identification of the IMS as a sustainable tool, which therefore can also be entitled as 'sustainable integrated management system' (SIMS).

- Since the integration of various MSs into a single system provides an organisational structure that allows to integrate sustainability-related concepts into business processes, integration acts as a driver of sustainability. In accordance, increasing the integration level as well as implementing new MSs and further sustainable tools into the IMS are likely to enhance firms' CSP even more.

In conclusion, IMS and sustainability share a vice-versa relationship and represent closely connected concepts that impact each other. The relationship context formulated above is illustrated in Figure 3, which visualises the identified relationships in a graphical way.

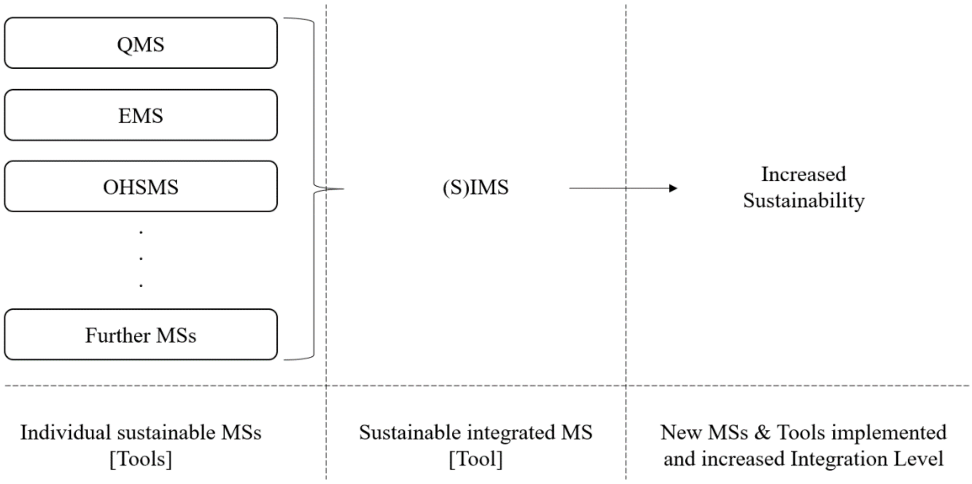


Figure 3. Identified Relationship Context between (Integrated) MSs and Sustainability

Source: Own elaboration.

2.6 Conclusions

The objective of chapter 2 was to synthesise identified links between the integration of MSs and sustainability, to identify existing knowledge gaps, and, eventually, to put the links between both concepts into a justified relationship context. Therefore, a SLR was conducted to answer how far advanced research is (RQ1) and what knowledge gaps still exist (RQ2). The SLR resulted in a synthesis sample of 44 articles. Furthermore, an additional explorative LR was performed to discuss if IMS is only an antecedent of sustainability, or if there is a vice-versa relationship (RQ3). The following conclusions can be extracted.

Firstly, the topic represents a still young research branch and academics predominantly view IMS to be a driver of sustainability (RQ1). Multiple researchers have proposed IMS-centred sustainability frameworks, many of them however lack empirical proof of feasibility and practicability. Empirical research data is often limited in terms of small sample sizes, single countries, and specific industries. Furthermore, IMS research merely considers components beyond QMS, EMS, and/or OHSMS. In addition, current research does not depict possible links between IMS as business tool and its contribution to companies' adoption of economical sustainability concepts like the circular economy.

Secondly, knowledge gaps particularly appear in four research directions. Hence, the elaborated research agenda (RQ2) formulates a total of eight future research questions aimed at (1) unfolding conceptually derived models in practice, (2) producing large-scale and cross-regional studies that focus on the impact of IMS on each TBL pillar, (3) exploring IMS components beyond QMS, EMS, and OHSMS that contribute to CSP enhancements, and (4) investigating how IMS helps organisations to incorporate fundamentals of economic-level sustainability concepts.

Thirdly, the discussion section concludes that IMS and sustainability share a vice-versa relationship (RQ3). On the one hand, MSs as sustainable business tools eventually drive integration, and, on the other hand, this integration then paves the way towards improved SD. Further, integrated MSs themselves represent sustainable tools, thus leading to the term SIMS.

This research contributes to academia by providing a synthesis regarding the connections between IMS and sustainability, which in such detail has been absent in literature so far. A further main contribution is the identification and justification of a vice-versa relationship between both concepts. In addition, existing knowledge gaps are identified, and a corresponding research agenda is formulated, which sets the path for future research studies.

2.6.1 Practical Implications

As sustainability represents an increasingly important issue for sustained success in the corporate world, knowledge on how to improve CSP will likely become a competitive advantage for firms. In this context, the findings of chapter 2 regarding the advantages of IMS implementation highlight how corporate executives can foster aforementioned CSP and better manage CS through the usage of MSs and their integration as suitable business tools. Thereby, the work urges managers to be aware of the broader context of the relationship between IMS and sustainability when driving towards leaner management and increased sustainability. Further practical implications relate to the actual application of the theoretically developed frameworks based around the concept of IMS in existing academic literature that are designed to achieve SD in the corporate context.

2.6.2 Academic Implications

Regarding academic implications, chapter 2 of this doctoral thesis provides a comprehensive overview of current research as well as a future research agenda, thereby serving as both starting point for researchers newly entering this research branch as well as source of guidance for upcoming investigations of experienced researchers. Furthermore, the identification and justification of a vice-versa relationship intends to add a new viewpoint to academics' understanding of the topic, thus hopefully opening up the line of research for more diversified future works that help to close the depicted knowledge gaps. Further, this work argues that research directed on MSs beyond QMS, EMS, and OHSMS might be fruitful for further developing the topic of IMS and its relationship to sustainability.

2.6.3 Limitations and Future Research

The limitations of chapter 2 are predominantly related to the applied SLR process. In other words, the databases used, the inclusion/exclusion criteria drafted, as well as the developed search strings might have led to a synthesis example that does not include all papers considering the topic at hand. Therefore, future work should try to overcome these limitations. In addition, further future research should be directed at the knowledge gaps identified and synthesised in this study and eventually answer the formulated future research questions.

CHAPTER 3. QUALITY AND ENVIRONMENTAL MANAGEMENT SYSTEMS AS BUSINESS TOOLS TO ENHANCE ESG PERFORMANCE: A CROSS-REGIONAL EMPIRICAL STUDY[2]

[2] This chapter has been adapted from Ronalter, Bernardo, and Romaní (2023).

Abstract

The growing societal and political focus on sustainability at global level is pressurising companies to enhance their environmental, social, and governance performance to satisfy respective stakeholder needs and ensure sustained business success. With a data sample of 4,292 companies from Europe, East Asia, and North America, this work aims to prove through a cross-regional empirical study that quality management systems and environmental management systems represent powerful business tools to achieve this enhanced ESG performance.

Descriptive and cluster analyses reveal that firms with QMSs and/or EMSs accomplish statistically significant higher ESG scores than companies without such management systems. Furthermore, the results indicate that operating both types of MSs simultaneously increases performance in the environmental and social pillar even further, while the governance dimension appears to be affected mainly by the adoption of EMSs alone.

To the best of the authors' knowledge, such large-scale, cross-regional analysis about the impact of QMSs and EMSs on ESG performance is absent from the literature, thus paving the way for pioneering academic research. The study is grounded in stakeholder theory and demonstrates managers how the implementation of MSs can assist in successfully translating stakeholders' sustainability concerns into actionable business practice.

Furthermore, it allows decision-makers to gain insights into the strengths and weaknesses of QMSs and EMSs for tackling specific ESG issues and highlights the performance advantages of combining both MSs. The work also depicts policymakers how corporate sustainability performance can be improved by fostering MSs adoption, thereby emphasising the importance of supporting and facilitating the diffusion of these systems.

Keywords: Corporate Sustainability Performance (CSP); Environmental Management Systems (EMS); Environmental, Social, and Governance (ESG) Performance; Quality Management Systems (QMS); Sustainability.

3.1 Introduction

A significant number of companies worldwide relies on management systems (ISO, 2021) to improve corporate operations (Robson et al., 2007; Sampaio et al., 2009) and address stakeholders' needs systematically (Poltronieri et al., 2018). Given that achieving "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987, p. 54) nowadays represents a normative concept (Hahn et al., 2015), corporate executives are under increasing pressure to fulfil one particular stakeholder demand: Making their companies more sustainable (see e.g., Ashrafi et al., 2020; Silva et al., 2019; Talbot et al., 2021; Yunus et al., 2020).

For example, consumer attitudes towards sustainable products and services are increasingly positive (see e.g., de-Magistris & Gracia, 2016; Jacobs et al., 2018) and investors are placing increasing value on data on sustainability-related issues for financial commitments (see e.g., Amel-Zadeh & Serafeim, 2018; Grim & Berkowitz, 2020; van Duuren et al., 2016). In this context, such stakeholders often consider firms' environmental, social, and governance scores in their decision-making process (Avetisyan & Hockerts, 2017; Rajesh & Rajendran, 2020) and, in return, companies that apply ESG practices can improve stakeholders' trust by accumulating social capital and strengthening attachment to the firm (La Fuente et al., 2022). Scholars also devote a great deal of attention to the ESG concept (Do & Kim, 2020), which has emerged as a measure of companies' corporate sustainability performance (Avetisyan & Hockerts, 2017; Dorfleitner et al., 2020; Rajesh & Rajendran, 2020).

When it comes to researching CSP in relation to MSs, however, academics focus more on investigating the benefits related to specific issues, such as reduced emissions (see e.g., Russo, 2009) and sustainable supply chains (see e.g., Zimon et al., 2022), as opposed to connecting MSs with the broader ESG concept as a framework for the various CSP demands of stakeholders. Few studies consider ESG ratings alongside MSs. Broadstock et al. (2021), for example, state that companies must perform well in EMS certification to achieve higher scores in the environmental pillar. Furthermore, Schmid et al. (2017) conclude that ESG themes may be anchored in QMSs, and Chams et al. (2021) deduce that firms with QMSs are less reliant on financial capital to improve ESG ratings. Nevertheless, to the best of the authors' knowledge, there is a shortage of academic studies that connect MSs to ESG performance and empirically analyse their relationship, which is evidenced by the lack of corresponding search results in databases like Web of Science and Scopus.

Such studies would provide valuable insight into the strengths and weaknesses of individual MSs in terms of meeting specific environmental, social, and/or governance needs. This knowledge would make it possible to draw managerial conclusions regarding which MSs to implement and combine to satisfy certain stakeholder CSP demands. Thus, **the aim of chapter 3 is to start filling this research gap by empirically proving that QMSs and EMSs, which are the most widely adopted MSs on a global level (ISO, 2021), represent powerful business tools to achieve enhanced ESG performance**, by answering the following three research questions:

RQ4: Do companies that operate QMSs and/or EMSs achieve statistically significant higher ESG scores than firms without such MSs?

RQ5: Which ESG issues are positively impacted by the implementation of QMSs and/or EMSs?

RQ6: Do companies that apply both QMSs and EMSs simultaneously achieve higher ESG performance than firms that operate with only one of these MSs?

To answer these RQs, this study presents a comprehensive exploratory literature review and both descriptive and cluster analyses of ESG data from 2019 for 4,292 companies spread among the three leading global economic areas: Europe, East Asia, and North America. Refinitiv Eikon is used as data base. The descriptive analysis describes the fundamental characteristics of the data and measures central tendencies among the sample groups with or without MSs (Mishra et al., 2019). The cluster analysis gradually classifies the sample based on similarities (J. Bu et al., 2020), thus allowing patterns to be defined between companies with QMSs, EMSs, or no alike MSs.

This chapter contributes to the academic literature by directly connecting QMSs and EMSs to the ESG concept and by empirically proving at a global level that both MS types serve as powerful business tools for enhancing ESG scores. The study helps corporate executives to understand the ESG-related strengths inherent in quality and environmental MSs and, in addition, highlights how combining these MSs can impact a corporation's sustainable performance in different ESG categories. Furthermore, the results give policymakers insights into the positive relationship between MSs and CSP as well as into the regional and industrial differences in ESG scores – thus, emphasising the importance of pushing forward with the international standardisation of best practices in management as well as with their global diffusion.

Chapter 3 continues in six sections. Section 3.2 provides extensive background information on MSs and ESG ratings. Section 3.3 explains the data sampling process and methodologies applied. Section 3.4 presents the findings, and section 3.5 entails the discussion. Section 6 offers some conclusions.

3.2 Literature Review

3.2.1 Stakeholder Theory

In accordance with the increasing stakeholder focus on CSP, chapter 3 follows the reasoning that companies must not only fulfil obligations to their shareholders in order to be successful but that the interests of multiple parties with stakes in the social and financial performance of the firm must be taken into account (Donaldson & Preston, 1995). This aligns with the concept of MSs, which are directed at satisfying specific stakeholder needs (as outlined in the MSs' underlying standards), as well as the ESG concept, which is linked to numerous stakeholders, including society, suppliers, employees, and shareholders (La Fuente et al., 2022; Muñoz-Torres et al., 2019). Thus, this chapter is grounded in stakeholder theory – which goes beyond simply maximising the wealth of owners to acknowledging "any group or individual who is affected by or can affect the achievement of an organisation's objectives" (Freeman, 1984, p. 46), while addressing "morals and values explicitly as a central feature of managing organisations" (Phillips et al., 2003, p. 481).

In general, Freeman's (1984) stakeholder theory offers a pragmatic approach to strategy that urges firms to be aware of their relationships with all stakeholders in order to become more successful (Laplume et al., 2008; Lee & Isa, 2020). At the moment, the stakeholder theory appears to be the prevailing theory in CSP-related research (Daugaard & Ding, 2022).

Thereby, it should be acknowledged that (1) different stakeholders influence organisations in different ways, (2) some stakeholders have more influence over organisations than others, (3) not all stakeholders might be regarded as legitimate stakeholders by organisations – in this regard, stakeholder theory is closely related to legitimacy and institutional theories "in the sense that only those with legitimate claims and institutional identification can be considered stakeholders" (Daugaard & Ding, 2022, p. 2) – and (4) existing organisation/stakeholder relations are not static but can change (Friedman & Miles, 2002).

Developments in relationships in any direction might be induced by (i) changes in material interests of either side, (ii) emergence of contingent factors, (iii) changes in the sets of ideas held by stakeholders and/or organisations, or (iv) institutional support changes (Friedman & Miles, 2002). Nowadays, we witness increasing contingent factors, such as related to global climate change or pandemics, causing more and more stakeholder groups (including shareholders) to adjust their material interests and to value sustainable development as an increasingly important aspect. In alignment, the institutional support for CSP increases as visible in policy making and media coverage.

Hence, to ensure sustained business success, chapter 3 argues that companies must be aware of the environmental, social, and governance demands of stakeholders and address them accordingly by using suitable business tools. Therefore, the following exploratory literature review on MSs and ESG ratings emphasises the stakeholder focus inherent in both concepts.

3.2.2 Management Systems

MSs are a set of procedures to be followed to achieve stakeholder satisfaction concerning specific demands, thus a “process of systemising how things are done” (Mahesh & Kumar, 2016, p. 578). They are implemented to handle stakeholders’ needs systematically in both internal and external organisational contexts (Poltronieri et al., 2018; Rebelo, Santos, & Silva, 2016), and are aimed at the continuous improvement of operations and procedures (Robson et al., 2007; Sampaio et al., 2009). MSs can be classified as quality, environmental, or occupational health and safety management systems, among others, depending on their objective (Jørgensen et al., 2006). The core elements of MSs are often defined in management system standards, and compliant companies can receive certification, if the standard allows it (Oliveira, 2013; Santos et al., 2011). These MSSs are developed and published by national and international bodies, the most famous being the International Organization for Standardization (Karapetrovic & Jonker, 2003), and ISO 9001 for QMSs as well as ISO 14001 for EMSs are the most commonly implemented and certified MSSs worldwide (ISO, 2021).

In general, a QMS is the means by which quality management practices – such as quality planning, control, assurance, and improvement – are turned into an integral part of an organisation that directly affects the way it conducts business (Nanda, 2005). An EMS, in turn, seeks to make organisations both more competitive and more environmentally responsible by adapting techniques aimed at reducing environmental impacts – such as waste reduction and process/product redesign (Watson et al., 2004).

The implementation of such MSs results in various benefits (see e.g., Aba & Badar, 2013; Bernardo et al., 2015; Tarí et al., 2012). For example, QMSs are positively correlated with business performance as companies improve the efficiency of their processes, provide their customers with added value, enhance customer satisfaction, and, ultimately, generate more revenue (Singh, 2008; Tarí et al., 2012; Zaramdini, 2007). Similarly, EMSs positively impact the performance of firms due to savings in resource input and energy consumption, increased efficiency, and better profitability (Tarí et al., 2012; Zutshi & Sohal, 2004).

However, the adoption benefits depend on the individual circumstances of firms. Operating MSs alongside comparable practices, for example, might be less beneficial for companies' financial performance due to the redundancy of different processes aimed at similar goals related to stakeholder satisfaction (see e.g., Franco et al., 2020).

3.2.3 ESG Ratings and Scores

ESG ratings are company assessments based on the evaluation of environmental, social, and governance matters, whose individual weightings result in an overall score (Clementino & Perkins, 2021). They are provided by specialised rating agencies, whose expertise makes them a key reference point for firms, financial markets, and scholars regarding CSP data (Escrig-Olmedo et al., 2019), which emerged in response to an increased demand for social and environmental information (Avetisyan & Ferrary, 2013). Rating agencies typically use their own research methodologies (Avetisyan & Hockerts, 2017), which are based mainly on publicly available information, third-party research, and corporate reports (Drempetic et al., 2020; Jackson et al., 2020).

Applying ESG practices is generally aligned with stakeholder theory (Lee & Isa, 2020) as the concept is linked to numerous stakeholders (La Fuente et al., 2022; Muñoz-Torres et al., 2019). Furthermore, ESG scores play a crucial role "in helping stakeholders apprehend, evaluate and manage the increasingly complex, multi-faceted nature of business ethics and sustainability" (Clementino & Perkins, 2021, p. 381). They serve as a standard for comparison and set benchmarks for further improvement (Rajesh, 2020; Tamayo-Torres et al., 2019). Managing ESG issues responsibly increases companies' integrity within society and stakeholders' trust, thus influencing the economic performance of firms (Tarmuji et al., 2016). Therefore, companies with high ESG ratings might enjoy better market and financial performance (see e.g., Aboud & Diab, 2019; Kotró & Márkus, 2020; Shakil, 2022) – although there is no univocal consensus in this regard (Brogi & Lagasio, 2019; Miralles-Quirós et al., 2019; Taliento et al., 2019).

Due to increasing public awareness of sustainability issues and the corresponding corporate acknowledgement, the number of firms disclosing ESG data is rapidly increasing (Alsayegh et al., 2020). However, ESG ratings also face criticism. As the concept has no fixed boundaries, the validity of ratings is questioned, because the various rating agencies view the ESG pillars differently and, moreover, use different weighting strategies to compile the final scores (Chatterji et al., 2016; Saadaoui & Soobaroyen, 2018). Another set of criticism concerns the quality of the data underlying the scores (Clementino & Perkins, 2021; Drempetic et al., 2020). To mitigate these key concerns related to ESG ratings, chapter 3 utilises data from Thomson Reuters, whose ESG database is one of the market leaders and is both used as well as accepted by fellow scholars (see e.g., Burritt et al., 2020; Jeriji & Louhichi, 2021; Rajesh, 2020; Yunus et al., 2020).

3.2.4 ESG-related Benefits of QMS and EMS Implementation

To justify researching the role of QMSs and EMSs as business tools to enhance ESG ratings, section 3.2.4 clusters their adoption benefits by ESG pillar (see Table 9) and, subsequently, derives corresponding hypotheses about their impact on ESG performance.

3.2.4.1 Benefits regarding the Environmental Pillar

EMS adoption leads to various environmental-related benefits, such as decreased and more efficient use of resources (see e.g., Gavronski et al., 2008; Tan, 2005), and facilitates the implementation of environmental management practices regarding green product design, procurement, production, logistics, and packaging (see e.g., Wong et al., 2020). Furthermore, EMSs enable companies to reduce emissions (see e.g., Potoski & Prakash, 2005; Russo, 2009) and the risk of environmental accidents (see e.g., Bravi et al., 2020). Environmental innovation capabilities (see e.g., M. Bu et al., 2020; Montobbio & Solito, 2018) and enhanced problem solving with regard to technologies and procedures might also evolve (see e.g., Ann et al., 2006). With regard to QMSs, these can reduce waste (see e.g., Zimon et al., 2022) and, furthermore, positively impact environmental process innovations (see e.g., Ziegler, 2015) – especially for supply chain management (see e.g., Shi et al., 2019), a crucial organisational element of CSP. In addition, quality management “can help support necessary stakeholder management in sustainable development” (Siva et al., 2016, p. 151). In conclusion, the following hypotheses (H) are derived:

H1: Companies operating with QMSs achieve higher performance scores in the environmental pillar than firms without QMSs.

H2: Companies operating with EMSs achieve higher performance scores in the environmental pillar than firms without EMSs.

3.2.4.2 Benefits regarding the Social Pillar

Both MSs present several positive effects when it comes to workforce, community, and product responsibility. Regarding human rights, no specific academic research was detected. However, EMS implementation increases legal and regulatory compliance (see e.g., Bravi et al., 2020), which implies a certain level of conformity with basic human rights. Important benefits related to workforce are increased employee motivation (see e.g., Gavronski et al., 2008; Zaramdini, 2007) and better internal communication (see e.g., Sampaio et al., 2009; Tan, 2005). With respect to community, both MSs result in improved relationships with suppliers and other key stakeholders, as stated in the standards, (see e.g., Bernardo et al., 2015; Casadesús & Karapetrovic, 2005; Zeng et al., 2005), among other benefits. Regarding product responsibility, MSs increase customer satisfaction, communication and relationships, as well as product and service quality (see e.g., Casadesús & Karapetrovic, 2005; Gotzamani & Tsiotras, 2002; Tarí et al., 2012). Hence, the hypotheses related to this pillar are as follows:

H3: Companies operating with QMSs achieve higher performance scores in the social pillar than firms without QMSs.

H4: Companies operating with EMSs achieve higher performance scores in the social pillar than firms without EMSs.

Table 9. QMS and EMS Benefits clustered by ESG Dimension

ESG Dimension	ESG Issues	QMS	EMS	References
Environmental	Resource Use	- Waste reduction	- Enhanced use of resources - Reduction in resource use - Supports implementation of environmental management practices regarding green product design, procurement, production, logistics and packaging	Tan (2005); Schylander and Martinuzzi (2007); Gavronski et al. (2008); Comoglio and Botta (2012); Wong et al. (2020); Zimon et al. (2022)
	Emissions		- Reduced emissions, water contamination, and air pollution, - Reduced risk of environmental accidents - Improved environmental performance	Potoski and Prakash (2005); Tan (2005); Russo (2009); Comoglio and Botta (2012); Boiral et al. (2018); Shi et al. (2019); Bravi et al. (2020)
	Environmental Innovation	- Improved innovation capability for supply chains - Positive impact on environmental process innovations	- Increased environmental innovation capabilities - Enhanced problem-solving regarding technologies and procedures - Greening of supply chain	Ann et al. (2006); Ziegler (2015); Manders et al. (2016); Boiral et al. (2018); Montobbio and Solito (2018); Papagiannakis et al. (2019); M. Bu et al. (2020); Erauskin-Tolosa et al. (2020)

Table 9. (continued)

ESG Dimension	ESG Issues	QMS	EMS	References
Social	Workforce	- Improved teamwork - Better commitment - Enhanced internal communication - Improved employee motivation and involvement - Increased work satisfaction - Reduced incidents, rejections, and complaints	- Enhanced risk prevention and improved safety procedures - Enhanced internal communication - Improved employee motivation - Improved work culture - Increased employee discretion	Gotzamani and Tsiotras (2002); Arauz and Suzuki (2004); Casadesús and Karapetrovic (2005); Tan (2005); Link and Naveh (2006); Zaramdini (2007); Gavronski et al. (2008); Sampaio et al. (2009); Tarí et al. (2012); Shi et al. (2019); Bravi et al. (2020)
	Human Rights		- Increased compliance with legal and regulatory requirements	Morrow and Rondinelli (2002); Ratiu and Mortan (2014); Boiral et al. (2018); Pesce et al. (2018); Bravi et al. (2020)
	Community	- Improved relationship with suppliers - Helps supplier selection - Improved relationships with authorities and other stakeholders	- Improved relationship with suppliers - Improved relationships with authorities and other stakeholders - Improved relations with communities - Enhanced corporate image - Increased Transparency	Magd and Curry (2003); Pan (2003); Casadesús and Karapetrovic (2005); Tan (2005); Zeng et al. (2005); Schylander and Martinuzzi (2007); Gavronski et al. (2008); Tarí et al. (2012); Bernardo et al. (2015); Boiral et al. (2018)
	Product Responsibility	- Improved customer satisfaction - Improved customer communication - Improved customer relationships - Improved product/service quality	- Improved customer satisfaction - Improved customer communication - Improved customer relationships - Improved product/service quality	Gotzamani and Tsiotras (2002); Magd and Curry (2003); Melnyk et al. (2003); Pan (2003); Casadesús and Karapetrovic (2005); Zaramdini (2007); Padma et al. (2008); Sampaio et al. (2009); Tarí et al. (2012); Siva et al. (2016)

Table 9. (continued)

ESG Dimension	ESG Issues	QMS	EMS	References
Governance	Management	- Enhanced internal organisation and operations - Increased commitment in moving towards best quality practices - Improved employee-management relationships	- Increased top management commitment - Adherence of EMS MSSs to best corporate governance principles - Enhanced internal organisation - Increased top management and awareness for environmental issues - Increased employee awareness for environmental issues	Gotzamani and Tsiotras (2002); Arauz and Suzuki (2004); Schylander and Martinuzzi (2007); Sampaio et al. (2009); Comoglio and Botta (2012); Tarí et al. (2012); Boiral et al. (2018); Grotta et al. (2020)
	Shareholders			
	CSR Strategy	- Provides (infra)structural framework to adopt and develop CSR policy, strategy, and activities	- Improved CSR activities - Statistically significant relationship between incorporating CSR and incorporating EMS	Castka and Balzarova (2008) ; Benavides-Velasco et al. (2014); Frolova and Lapina (2015); Ikram et al. (2019); Dubravská et al. (2020)

Source: Own elaboration, ESG issues adapted from Thomson Reuters' (2017) ESG framework conception.

3.2.4.3 Benefits regarding the Governance Pillar

Positive links have been revealed between MSs and the management of organisations. QMSs enhance internal organisation and operations (see e.g., Sampaio et al., 2009), increase the commitment of management to best quality practices (see e.g., Arauz & Suzuki, 2004), and improve management-employee relationships (see e.g., Gotzamani & Tsiotras, 2002). EMSs result in better awareness of environmental issues among both management and employees as well as in enhanced internal organisation (see e.g., Gotzamani & Tsiotras, 2002; Schylander & Martinuzzi, 2007). Regarding corporations' effectiveness with respect to the equal treatment of shareholders, no academic studies revealing specific relationships were detected. Regarding CSR strategies, EMS adoption leads to improved CSR activities (see e.g., Ikram et al., 2019) as incorporating CSR principles is closely related to EMS principles (see e.g., Dubravská et al., 2020), and QMSs provide a structural framework that facilitates the adoption of CSR policies, strategies, and activities (see e.g., Frolova & Lapina, 2015). Thus, hypotheses five and six are deduced:

H5: Companies operating with QMSs achieve higher performance scores in the governance pillar than firms without QMSs.

H6: Companies operating with EMSs achieve higher performance scores in the governance pillar than firms without EMSs.

3.2.4.4 Benefits of Operating both MSs simultaneously

Table 9 reveals that QMSs and EMSs lead to distinct CSP benefits. Consequently, operating with both MSs simultaneously should enable firms to cover an even broader range of ESG issues. Moreover, having EMSs alongside QMSs could give rise to synergy effects (see e.g., Casadesús et al., 2011; Zimon et al., 2022), and operating with both MSs together could lead to stronger business performance (see e.g., Ferrón-Vílchez & Darnall, 2016).

In addition, the benefits of MSs integration (see e.g., Bernardo et al., 2015) might also play a pivotal role. Although the sample used in this study does not reveal information regarding the integration level, integration benefits should be taken into account as most organisations with multiple MSs do actually integrate them (see e.g., Karapetrovic & Casadesús, 2009). ESG-related integration advantages include the improved adoption of CP technologies (see e.g., Hernandez-Vivanco et al., 2018), greater motivation among staff (see e.g., Abad et al., 2014), better partnerships with key stakeholders (see e.g., Rebelo et al., 2014b), and improvements in the organisational culture (see e.g., Simon et al., 2012). Therefore, the literature makes it possible to hypothesise the following:

H7: Companies operating with both QMSs and EMSs achieve higher performance scores in the environmental pillar than firms with only either QMSs or EMSs.

H8: Companies operating with both QMSs and EMSs achieve higher performance scores in the social pillar than firms with only either QMSs or EMSs.

H9: Companies operating with both QMSs and EMSs achieve higher performance scores in the governance pillar than firms with only either QMSs or EMSs.

Figure 4 offers a graphic summary of the nine hypotheses outlined in section 3.2.4 and reveals their connection to the RQs formulated in the introduction. The ESG variables (V) displayed (V1 to V16) as well as the statistical methods used for testing the hypotheses are further explained in the following section.

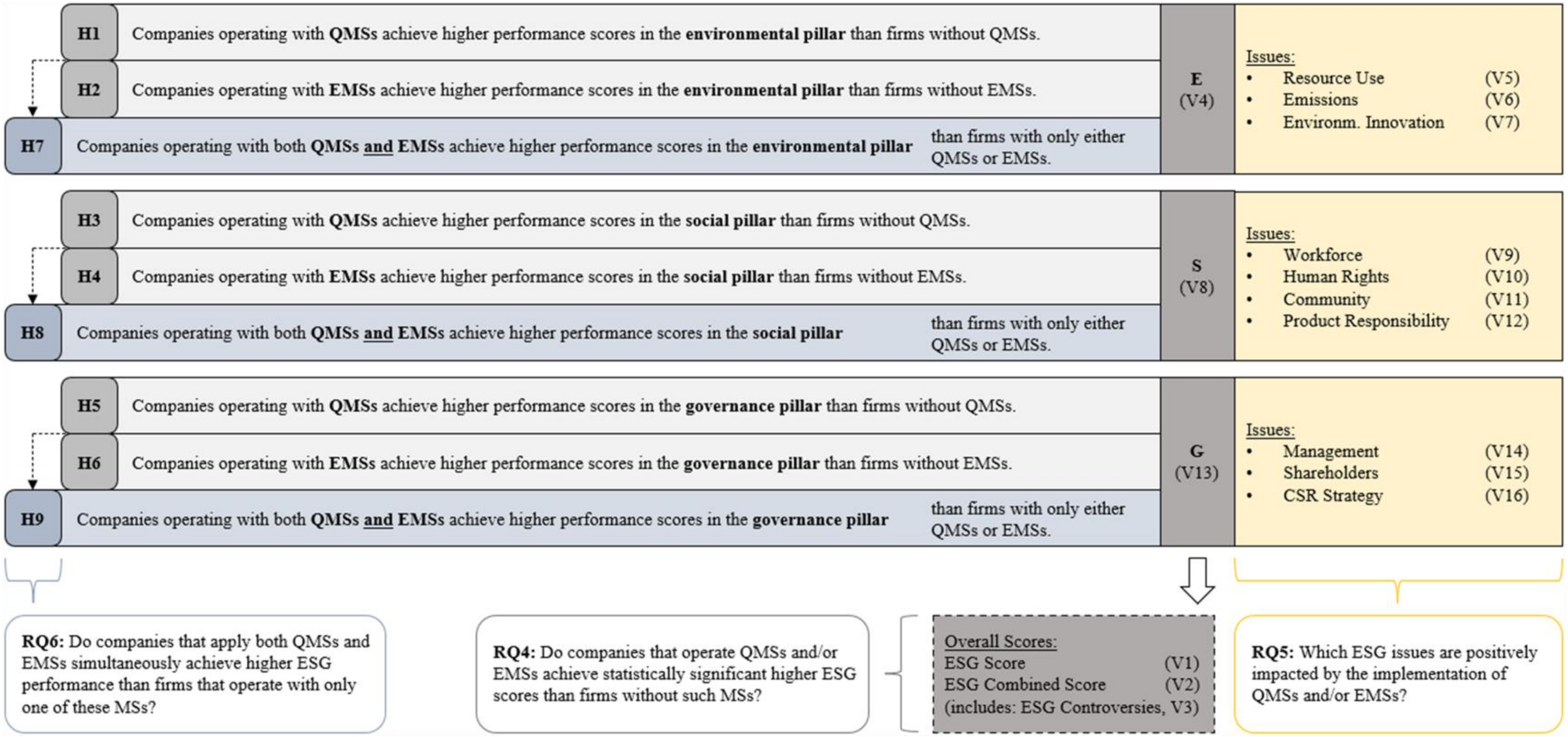


Figure 4. Hypotheses about QMS and EMS Adoption on ESG Performance

Source: Own elaboration.

3.3 Methodology

To test the hypotheses, ESG data from companies located in Europe (EU, UK, and EFTA states), East Asia (China, Japan, and four tiger states), and North America (USA and Canada) are retrieved and analysed. The country clustering considers geographic regions with comparable economic and human development status, shared commercial relationships, and common regulatory environments (see e.g., Hartmann et al., 2020; Nallari & Griffith, 2013; UNDP, 2019). The analyses consider the nineteen variables listed in Table 10. 16 variables aim at measuring ESG performance (V1 to V16), and three serve as control variables (CV) (CV1 to CV3) as empirical studies on both ESG ratings and MSs have shown that results are likely to be influenced by industrial sector (see e.g., de Nadae et al., 2019; Garcia et al., 2017), region (see e.g., Tan, 2005; Thanetsunthorn, 2015), and company size (see e.g., Arauz & Suzuki, 2004; Drempetic et al., 2020; Wong et al., 2020).

Table 10. Variables for Descriptive and Cluster Analyses

Code	Variable	ESG Dimension	Description
V1	ESG Score	/	Overall company score based on the self-reported information in the environmental, social, and corporate governance pillars.
V2	ESG Combined Score	/	Overall company score with ESG Controversies Score overlay.
V3	ESG Controversies Score	/	Measures a company’s exposure to environmental, social, and governance controversies as well as to negative events reflected in global media.
V4	Environment Pillar Score	Environmental	Measures a company’s impact on living and non-living natural systems – including the air, land, and water – as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and to capitalise on environmental opportunities in order to generate long-term shareholder value.
V5	Resource Use Score	Environmental	Reflects a company’s performance and capacity to reduce the use of materials, energy, or water, and to find more eco-efficient solutions by improving supply chain management.
V6	Emissions Score	Environmental	Measures a company’s commitment and effectiveness towards reducing environmental emission in the production and operational processes.

Table 10. (continued)

Code	Variable	ESG Dimension	Description
V7	Environmental Innovation Score	Environmental	Reflects a company’s 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.
V8	Social Pillar Score	Social	Measures a company’s capacity to generate trust and loyalty with its workforce, customers, and society through its use of best management practices. It is a reflection of the company’s reputation and the health of its license to operate, which are key factors in determining its ability to generate long-term shareholder value.
V9	Workforce Score	Social	Measures a company’s effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce.
V10	Human Rights Score	Social	Measures a company’s effectiveness towards respecting the fundamental human rights conventions.
V11	Community Score	Social	Measures the company’s commitment towards being a good citizen, protecting public health, and respecting business ethics.
V12	Product Responsibility Score	Social	Reflects a company’s capacity to produce quality goods and services integrating the customer’s health and safety, integrity, and data privacy.
V13	Governance Pillar Score	Governance	Measures a company’s systems and processes, which ensure that its board members and executives act in the best interests of its long-term shareholders. It reflects a company’s capacity, through its use of best management practices, to direct and control its rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long-term shareholder value.
V14	Management Score	Governance	Measures a company’s commitment and effectiveness towards following best practice corporate governance principles.
V15	Shareholders Score	Governance	Measures a company’s effectiveness towards equal treatment of shareholders and the use of anti-takeover devices.
V16	CSR Strategy Score	Governance	Reflects a company’s practices to communicate that it integrates the economic (financial), social, and environmental dimensions into its day-to-day decision-making processes.

Table 10. (continued)

Code	Variable	ESG Dimension	Description
CV1	Market Capitalisation	/	Market capitalisation of the company.
CV2	Country of Headquarter	/	Country, in which the company´s headquarter is located.
CV3	Industry	/	Industry, in which the company operates.

Source: Adapted from Thomson Reuters (2017).

3.3.1 Sampling Process

The first step in the sampling process involves searching for reliable ESG data. Therefore, Thomson Reuters Eikon, also known as Refinitiv Eikon (formerly ASSET4), is used as it offers one of the largest ESG databases with ratings for over 10,000 companies worldwide. Refinitiv Eikon calculates 10 ESG category scores, which evaluate the environmental (V5, V6, V7), social (V9, V10, V11, V12), and governance (V14, V15, V16) dimensions. The category scores are based on numerous data points and summarised in the respective pillar scores (V4, V8, V13), which together result in the overall score (V1). In addition, the ESG combined score (V2) takes into account scandals relating to any of Refinitiv Eikon's 23 ESG controversy topics (V3). All scores are expressed in values between 0 (worst) and 100 (best) (Refinitiv, 2020).

The second step consists of retrieving the aforementioned data for companies headquartered in the regions of interest. Refinitiv Eikon allows users to filter by companies that use QMSs and EMS-certified organisations. The third step involves filtering these data for 2015 through to 2019 to ensure that the companies have been running their MSs for at least five consecutive years. This is done to ensure that the sample firms have accumulated experience of working with MSs to avoid distorting the ESG data with short-term influences that might occur straight after implementing MSs (see e.g., Casadesús & Karapetrovic, 2005; Testa et al., 2014). In addition, the filtering by time considers the renewal of certified MSs after a three-year period. To ensure data quality, the fourth step consists of removing all companies that lack information (i.e., that present no value for any of the 19 variables).

3.3.2 Sample Description

The sampling process was performed on 15 November 2020 and results in data on 4,292 companies, which are classified into the following four sample groups:

- Group 1: Companies without a QMS or an EMS.
- Group 2: Companies with a QMS but no EMS.
- Group 3: Companies with an EMS but no QMS.
- Group 4: Companies with both a QMS and an EMS.

As illustrated in Table 11, most companies in the sample have not been operating any QMS or EMS (74.5%) consecutively between 2015 and 2019. Firms operating both MSs represent the second largest group (17.4%), and corporations with either a QMS (2.9%) or an EMS (5.1%) constitute less than 10% of the sample.

Regarding sectors, most firms are engaged in finance (27.5%), consumer cyclicals (15.2%), industry (13.5%), technology (12.0%), or healthcare (11.0%). The geographical distribution shows that the majority of the companies is from North America (53.8%), while the number of European (23.4%) and East Asian (22.8%) enterprises is roughly the same. The percentage shares of the four sample groups per region reveal that, whereas a significant portion of the sample in Europe (45.3%) and East Asia (38.8%) runs MSs, companies in North America are much more likely to operate without them (88.7%). This is consistent with the fact that the 10 countries with the most ISO 9001 and ISO 14001 certifications are based predominantly in Europe and East Asia, while neither the USA nor Canada appear in the Top-10 ranking (ISO, 2021). Furthermore, the sample presents a well-distributed cross section of company sizes, which are measured by market capitalisation (see e.g., Dang et al., 2018). Small (market capitalisation < USD 1 billion), medium (< 5 bn), and large companies (> 5 bn) each make up about one third of the sample.

Table 11. Sample Description by Sample Group

Control Variable	Total	in %	Group 1	in %	Group 2	in %	Group 3	in %	Group 4	in %
<u>Industry</u>										
Academic & Educational Services	17	0.4%	16	0.5%	-	0.0%	1	0.5%	-	0.0%
Basic Materials	259	6.0%	109	3.4%	7	5.6%	23	10.4%	120	16.0%
Consumer Cyclicals	654	15.2%	511	16.0%	16	12.9%	36	16.3%	91	12.2%
Consumer Non-Cyclicals	247	5.8%	146	4.6%	18	14.5%	12	5.4%	71	9.5%
Energy	200	4.7%	147	4.6%	10	8.1%	4	1.8%	39	5.2%
Financials	1,182	27.5%	1,097	34.3%	9	7.3%	57	25.8%	19	2.5%
Healthcare	474	11.0%	395	12.3%	19	15.3%	9	4.1%	51	6.8%
Industrials	579	13.5%	305	9.5%	26	21.0%	37	16.7%	211	28.2%
Technology	514	12.0%	366	11.4%	17	13.7%	14	6.3%	117	15.6%
Telecommunications Services	67	1.6%	43	1.3%	1	0.8%	8	3.6%	15	2.0%
Utilities	99	2.3%	64	2.0%	1	0.8%	20	9.0%	14	1.9%
<u>Region</u>										
Europe	1,003	23.4%	549	17.2%	32	25.8%	93	42.1%	329	44.0%
East Asia	978	22.8%	599	18.7%	21	16.9%	83	37.6%	275	36.8%
North America	2,311	53.8%	2,051	64.1%	71	57.3%	45	20.4%	144	19.3%
<u>Market Capitalisation</u>										
Small	1,328	30.9%	1,196	37.4%	31	25.0%	19	8.6%	82	11.0%
Medium	1,544	36.0%	1,192	37.3%	30	24.2%	66	29.9%	256	34.2%
Large	1,420	33.1%	811	25.4%	63	50.8%	136	61.5%	410	54.8%
Total	**4,292**	**100.0%**	**3,199**	**74.5%**	**124**	**2.9%**	**221**	**5.1%**	**748**	**17.4%**

Source: Own elaboration.

3.3.3 Applied Data Analysis

The sample is analysed with IBM SPSS Statistics 25 and StataSE 16. First, a descriptive analysis is performed to describe the basic features and characteristics of the dataset (Mishra et al., 2019). This makes it possible to explain and validate the research findings and serves as a basis for further quantitative analysis, which is carried out in the framework of a cluster analysis. The cluster analysis is designed to produce a logical structure concerning ESG performance that is easy to read and interpret so that similarities can be analysed (J. Bu et al., 2020).

The descriptive analysis consists of four steps. First, the full sample is analysed to describe the ESG performance of all four sample groups in comparison. Second, data normality is tested with the Kolmogorov-Smirnov test and the Shapiro-Wilk test. As the sample does not present a normal distribution of data, the nonparametric Kruskal-Wallis test is performed in the third step to evaluate the statistical significance of differences. Moreover, the Dunn-Bonferroni post hoc test is conducted as well as Cohen's d is calculated in order to determine the sample groups between which these statistically significant differences exist and to what extent. Fourth, the Kruskal-Wallis test, the Dunn-Bonferroni test, and Cohen's d are performed and analysed for the single control variables – i.e., each company size, each region, and each sector (except for the academic and educational services sector due to the small sample size). This is done to detect possible influences and potential biases of the control variables. The descriptive analysis is presented in section 3.4.1.

The cluster analysis considers the 10 ESG category scores and is conducted in three subsequent steps. First, the single-linkage method is applied to detect and exclude outliers that might distort the classification. Furthermore, hierarchical methods are applied to produce a small number of clusters and distances are measured to evaluate similarities and dissimilarities. To obtain homogeneous groups with minimum variances, the Ward method is used. Such hierarchical clustering is the most widely applied methodology in cluster analysis (J. Bu et al., 2020). This first step results in two clusters. Second, the Mann-Whitney U test is performed to verify the clustering after ensuring that the cluster analysis samples are also not normally distributed via the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Third, the clusters are analysed. The cluster analysis is presented in section 3.4.2.

Figure 5 summarises these methodological steps, their application, and how they fit into the structure of chapter 3.

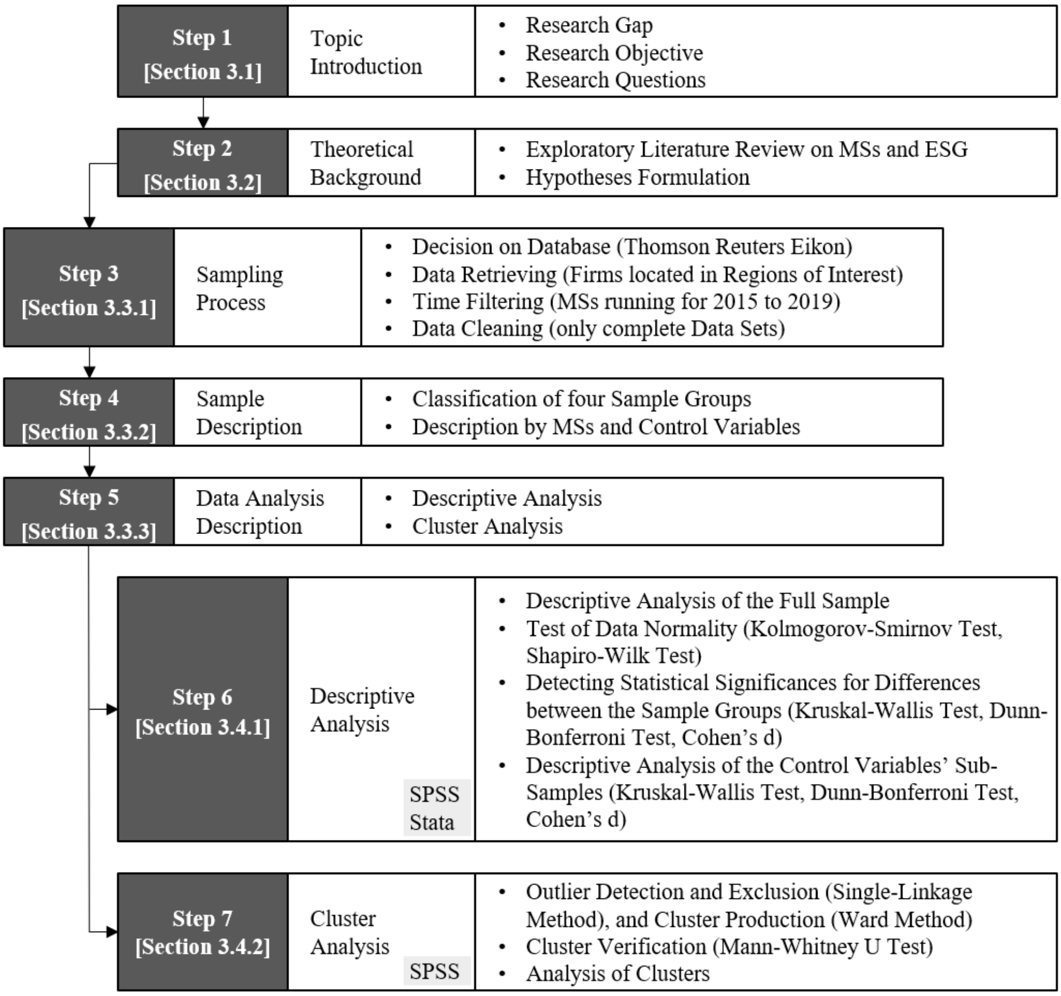


Figure 5. Applied Research Methodology

Source: Own elaboration.

3.4 Findings

3.4.1 Descriptive Analysis

3.4.1.1 Step 1 – Descriptive Analysis of the Full Sample

The descriptive analysis of the full sample is summarised in Table 12. As shown, group 4 reveals the best performance as measured by the mean and median of the ESG score (V1) and the ESG combined score (V2), whereas group 3 performs second best, group 2 third best, and group 1 exhibits the lowest values. With respect to the controversy score (V3), group 1 presents the highest mean. However, this outperformance might be due to the fact that group 1 has the highest percentage of SMEs (74.7%), which are less likely than their bigger counterparts to be featured in the global media. The environmental (V4) and social pillars (V8) show the same performance pattern as the overall score, while group 3 performs best in the governance dimension (V13). The sample groups rank nearly the same for most ESG category scores as for the respective ESG pillar scores. The only exceptions are emissions (V3) and workforce (V9) matters, which are highest in group 3. The overall score and pillar scores are illustrated in Figure 6 in the form of four box plots.

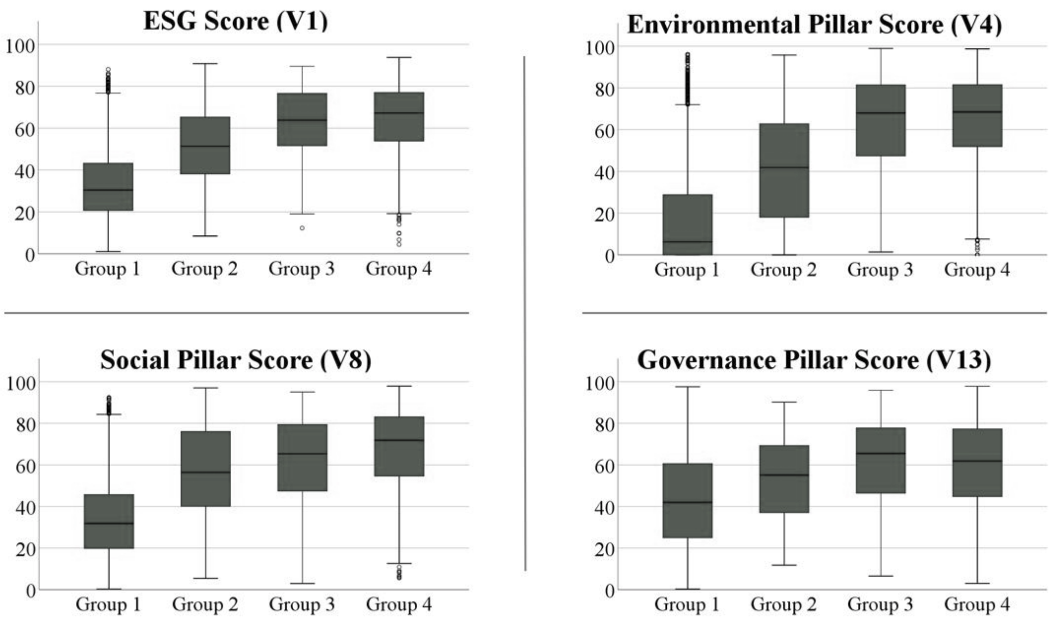


Figure 6. Boxplots for the ESG Overall and Pillar Scores

Source: Own elaboration.

Table 12. Descriptive Analysis of Full Sample

Variable	n	Mean	SD	Min.	Q1	Median	Q3	Max.
Group 1								
V1	3,199	33.23	16.69	1.06	20.70	30.41	43.25	88.06
V2	3,199	32.67	16.08	1.06	20.57	30.19	42.56	88.06
V3	3,199	95.04	17.29	0.60	100.00	100.00	100.00	100.00
V4	3,199	17.63	23.14	0.00	0.00	6.26	28.85	96.13
V5	3,199	19.21	27.30	0.00	0.00	0.00	34.19	99.88
V6	3,199	20.74	27.41	0.00	0.00	6.67	36.34	99.43
V7	3,199	11.65	23.74	0.00	0.00	0.00	5.86	99.38
V8	3,199	34.11	18.94	0.35	19.82	31.86	45.73	92.44
V9	3,199	38.25	25.84	0.11	16.85	34.07	57.16	99.94
V10	3,199	14.94	25.46	0.00	0.00	0.00	22.50	98.91
V11	3,199	44.72	26.27	0.59	22.80	45.06	64.57	99.89
V12	3,199	30.62	23.08	0.00	16.11	30.47	41.67	99.84
V13	3,199	42.76	21.77	0.31	24.93	41.96	60.66	97.55
V14	3,199	46.28	28.51	0.15	21.02	44.49	70.09	99.98
V15	3,199	47.81	29.05	0.02	21.85	46.53	73.05	99.92
V16	3,199	17.57	27.33	0.00	0.00	0.00	28.83	99.89
Group 2								
V1	124	51.86	18.79	8.48	38.09	51.39	65.31	90.80
V2	124	49.88	17.41	8.48	37.07	48.76	61.91	88.38
V3	124	90.85	22.72	7.81	100.00	100.00	100.00	100.00
V4	124	41.48	26.53	0.00	18.00	41.87	62.84	95.76
V5	124	46.53	30.95	0.00	21.37	45.47	72.74	99.66
V6	124	43.77	31.82	0.00	16.34	40.08	70.91	99.09
V7	124	27.87	30.41	0.00	0.00	18.18	50.42	95.57
V8	124	57.10	22.01	5.43	40.09	56.39	76.06	96.98
V9	124	58.56	25.79	1.22	39.98	61.72	79.99	99.80
V10	124	39.16	34.47	0.00	4.93	28.06	74.19	97.08
V11	124	58.91	29.45	0.79	34.26	65.20	84.18	99.81
V12	124	72.95	19.56	21.47	60.37	77.41	88.73	99.53
V13	124	53.05	20.35	11.79	37.01	55.12	69.25	90.16
V14	124	56.76	26.40	2.98	34.64	59.96	77.46	99.75
V15	124	50.66	26.88	1.12	29.26	49.91	72.25	99.42
V16	124	38.05	33.52	0.00	0.00	37.06	68.82	97.44
Group 3								
V1	221	62.11	17.06	12.28	51.61	63.80	76.59	89.54
V2	221	58.67	16.73	12.28	47.54	58.82	72.54	89.41
V3	221	85.91	27.52	0.44	90.91	100.00	100.00	100.00
V4	221	62.66	22.13	1.41	47.43	68.00	81.48	98.89
V5	221	68.35	25.54	0.00	50.12	73.61	90.48	99.80
V6	221	71.95	24.55	0.00	55.70	79.91	91.76	99.88
V7	221	42.88	31.48	0.00	11.86	47.89	62.88	99.08
V8	221	61.56	20.95	2.96	47.40	65.33	79.37	95.02

Table 12. (continued)

Variable	n	Mean	SD	Min.	Q1	Median	Q3	Max.
Group 3								
V9	221	72.00	23.58	2.63	59.21	79.41	90.12	99.86
V10	221	54.39	31.16	0.00	30.00	60.48	79.73	97.47
V11	221	61.90	29.10	4.03	35.94	68.58	88.22	99.75
V12	221	50.10	30.23	0.00	23.19	47.65	78.75	98.90
V13	221	61.87	20.93	6.53	46.42	65.51	77.74	95.82
V14	221	63.83	26.67	2.08	42.03	67.62	88.71	99.67
V15	221	55.11	26.45	0.22	34.47	57.95	75.10	99.38
V16	221	62.25	28.27	0.00	41.10	67.26	86.29	99.66
Group 4								
V1	748	64.32	16.83	4.47	53.82	67.23	77.04	93.72
V2	748	60.05	16.34	4.47	49.31	61.58	72.41	93.72
V3	748	84.25	28.57	0.93	82.53	100.00	100.00	100.00
V4	748	64.36	22.15	0.00	51.87	68.50	81.52	98.68
V5	748	69.82	24.93	0.00	54.60	77.28	89.65	99.85
V6	748	69.34	26.45	0.00	54.21	77.43	90.68	99.85
V7	748	50.20	32.21	0.00	26.35	50.00	79.74	99.84
V8	748	67.09	20.24	5.63	54.61	71.79	83.11	97.84
V9	748	71.65	23.67	0.95	57.03	77.45	91.75	99.81
V10	748	59.94	29.61	0.00	40.12	66.72	86.71	98.12
V11	748	65.66	27.39	0.55	47.48	73.29	88.51	99.77
V12	748	73.03	21.60	5.98	59.64	78.95	90.75	99.87
V13	748	59.74	20.49	3.02	44.78	61.85	77.30	97.76
V14	748	61.19	26.10	0.86	41.57	63.33	84.33	99.72
V15	748	54.29	28.61	0.32	29.74	57.54	79.81	99.85
V16	748	60.68	29.45	0.00	40.39	66.68	85.37	99.67

Source: Own elaboration.

3.4.1.2 Step 2 – Test of Data Normality

Data normality is tested with the Kolmogorov-Smirnov and Shapiro-Wilk tests. Only variables V1, V2, and V13 have an approximately normal distribution for group 2, as assessed by the Kolmogorov-Smirnov test ($p > 0.05$). However, as assessed by the Shapiro-Wilk test, only V1 and V2 have an approximately normal distribution for group 2 ($p > 0.05$). When testing data normality for the full sample rather than for the four sample groups, the results of both tests indicate that the data are in fact not normally distributed.

3.4.1.3 Step 3 – Kruskal-Wallis Test, Dunn-Bonferroni Post-Hoc Test, and Cohen's d

Therefore, the nonparametric Kruskal-Wallis test is used to analyse the statistical significance of the differences between sample groups. As demonstrated in Table 13, there are differences for all 16 ESG indicators regarding the central tendencies between the four sample groups ($p < 0.05$).

Table 13. Independent-Samples Kruskal-Wallis-Test

	V1	**V2**	**V3**	**V4**	**V5**	**V6**	**V7**	**V8**
Significance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Decision	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject
	V9	**V10**	**V11**	**V12**	**V13**	**V14**	**V15**	**V16**
Significance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Decision	Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject

Asymptotic significances are displayed. The confidence level is 0.95, the significance level is 0.05. Null Hypothesis: The distribution of the indicator is the same across the sample groups.

Source: Own elaboration.

The Dunn-Bonferroni test is used to reveal the sample groups between which there are statistically significant differences. Table 14 provides an overview of the post-hoc test. In addition, the effect size is quantitatively measured by Cohen's d to evaluate the magnitude of these differences, as shown in Table 15.

The Dunn-Bonferroni test confirms H1 to H6 as companies with QMSs or EMSs achieve statistically significant higher performance scores in the environmental (V4), social (V8), and governance (V13) pillars than firms without these MSs. Furthermore, groups 2, 3, and 4 present statistically significant higher overall ESG scores (V1, V2) as compared to group 1, thereby making it possible to answer RQ4 positively.

With respect to RQ5, the descriptive analysis of the full data sample reveals that group 2 has significantly higher ratings for nine areas (except V15), while groups 3 and 4 present enhanced performance in all 10 ESG category scores (again compared to group 1). The values for Cohen's d confirm these statements.

Table 14. Dunn-Bonferroni Test

Sample 1 - Sample 2	V1	V2	V3	V4	V5	V6	V7	V8
Group 1 - Group 2	0.000	0.000	0.018	0.000	0.000	0.000	0.000	0.000
Group 1 - Group 3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group 1 - Group 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group 2 - Group 3	0.000	0.007	0.093	0.000	0.000	0.000	0.000	0.749
Group 2 - Group 4	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.002
Group 3 - Group 4	1.000	1.000	1.000	1.000	1.000	1.000	0.095	0.117
	V9	**V10**	**V11**	**V12**	**V13**	**V14**	**V15**	**V16**
Group 1 - Group 2	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Group 1 - Group 3	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000
Group 1 - Group 4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Group 2 - Group 3	0.001	0.003	1.000	0.000	0.005	0.173	1.000	0.000
Group 2 - Group 4	0.000	0.000	0.087	1.000	0.022	0.686	1.000	0.000
Group 3 - Group 4	1.000	0.386	0.446	0.000	1.000	1.000	1.000	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is 0.05.
Significance values have been adjusted by the Bonferroni correction for multiple tests.

Source: Own elaboration.

Table 15. Cohen's d

Sample 1 - Sample 2	V1	V2	V3	V4	V5	V6	V7	V8
Group 1 - Group 2	-1.110	-1.067	0.239	-1.025	-0.995	-0.835	-0.675	-1.206
Group 1 - Group 3	-1.728	-1.613	0.504	-1.951	-1.807	-1.880	-1.284	-1.440
Group 1 - Group 4	-1.860	-1.697	0.542	-2.036	-1.883	-1.784	-1.508	-1.719
Group 2 - Group 3	-0.579	-0.518	0.191	-0.889	-0.791	-1.030	-0.482	-0.209
Group 2 - Group 4	-0.728	-0.617	0.237	-1.002	-0.900	-0.937	-0.699	-0.487
Group 3 - Group 4	-0.131	-0.084	0.059	-0.077	-0.058	0.101	-0.229	-0.271
	V9	**V10**	**V11**	**V12**	**V13**	**V14**	**V15**	**V16**
Group 1 - Group 2	-0.786	-0.937	-0.537	-1.843	-0.474	-0.369	-0.098	-0.742
Group 1 - Group 3	-1.314	-1.526	-0.649	-0.825	-0.880	-0.618	-0.253	-1.631
Group 1 - Group 4	-1.313	-1.711	-0.790	-1.859	-0.789	-0.531	-0.224	-1.553
Group 2 - Group 3	-0.551	-0.470	-0.102	0.849	-0.426	-0.266	-0.167	-0.800
Group 2 - Group 4	-0.546	-0.685	-0.244	-0.004	-0.327	-0.169	-0.128	-0.753
Group 3 - Group 4	0.015	-0.185	-0.135	-0.962	0.104	0.101	0.029	0.054

The confidence level is 0.95.

Source: Own elaboration.

Furthermore, group 3 achieves significantly higher ESG scores (V1, V2) than group 2 due to significant outperformance in the environmental (V4) and governance (V13) dimensions – even though the management (V14) and shareholder (V15) scores do not differ significantly, companies with EMSs achieve considerably better values in the CSR strategy category (V16), which causes the outperformance in the pillar's rating. Although the consolidated social pillar score (V8) is not significantly different between groups 2 and 3, companies with QMSs significantly outperform their counterparts with EMSs in terms of product responsibility (V12), while underperforming in the workforce (V9) and human rights (V10) categories.

Thus, to answer RQ4 more precisely, it is concluded that EMSs appear to represent more effective business tools for enhanced ESG performance than QMSs. With respect to RQ5, it is important to mention that both MSs apparently share common strengths (V11, V14, V15) but also possess individual advantages (QMSs: V12; EMSs: V5, V6, V7, V9, V10, V16).

In terms of RQ6, group 4 statistically outperforms group 2 in the overall (V1, V2) and pillar (V4, V8, V9) scores, thus confirming H7 to H9 with respect to companies with QMSs only. There are no significant differences compared to group 3. Nonetheless, the mean and median values for group 4 are higher in the overall scores (V1, V2) as well as the environmental (V4) and social (V8) dimensions – except for emissions (V6) and workforce (V9) matters. However, for the governance categories and pillar score (V13, V14, V15, V16), companies with EMSs alone present the highest mean and median values. In summary, H7 to H9 are confirmed with respect to firms with QMSs only but not with respect to companies with EMSs only.

3.4.1.4 Step 4 – Descriptive Analysis of the Control Variables' Sub-Samples

Company size (CV1) appears to affect the magnitude of differences as the Dunn-Bonferroni test reveals far more statistically significant differences between the four sample groups when it comes to large companies as opposed to SMEs. Furthermore, it is noticeable that large companies on average achieve higher ESG ratings than small firms. Nonetheless, companies with QMSs and/or EMSs significantly outperform firms without MSs in the overall ESG scores (V1, V2) regardless of their size. The same is true for the environmental (V4) and social (V8) dimensions, thus confirming H1 to H4. However, in the governance pillar (V13) small firms with EMSs and medium-sized firms with QMSs lack this statistically significant outperformance, thereby only partially supporting H5 and H6.

On average, European companies achieve higher ESG ratings than East Asian or North American firms, but companies with QMSs or EMSs achieve significantly better ESG performance (V1, V2) than companies without these MSs regardless of the location (CV2). This outperformance also holds true for the social dimension (V8). However, European firms with QMSs lack this statistically significant outperformance in the governance dimension (V13) and, in East Asia, also in the environmental dimension (V4). For East Asia, the Kruskal-Wallis test even retains its null hypothesis for the shareholders score (V15). Hence, the analysis fully confirms H2, H3, H4 and H6, while only partially supporting H1 and H5.

Moreover, the nature of business operations (CV3) impacts ESG performance per sample group. For basic materials, consumer (non-) cyclicals, energy, industry, and telecommunication services the Kruskal-Wallis test retains its null hypothesis for the shareholders score (V15) and for the utilities sector also for the management category (V14) as well as, conclusively, the whole governance pillar score (V13). The statistically significant higher ESG performance (V1, V2) of companies with MSs holds true for all sectors except for energy, telecommunication, and utilities, in which companies with QMSs do not present significantly better performance than companies without MSs. The same pattern appears for the same sectors as well as for basic materials for the environmental (V4) and social (V8) dimensions. For the energy sector, even companies with EMSs fail to outperform in the social pillar (V8). Regarding the governance pillar (V13), there are numerous sectors in which group 2 (consumer (non-)cyclicals, energy, finance, industry, technology, telecommunications, utilities) and group 3 (consumer non-cyclicals, technology, utilities) do not show statistically significant higher values than group 1. Hence, the analysis fully confirms H2 but only partially supports H1 and H3 to H6.

Although H7 to H9 are confirmed with respect to QMSs in the full sample analysis, the analyses of control variables deliver a mixed picture. Despite the fact that H7 holds true for medium and large firms (CV1) and all three regions (CV2) against group 2, statistically significant higher ESG scores in the environmental pillar (V4) are revealed only for industrial companies when it comes to business sectors (CV3). H8 does not hold true against group 2 when the location is considered (CV2). Significant outperformance in the social pillar (V8) is visible only in the analysis of large firms (CV1) and companies classified as industrial (CV3). The same (CV1, CV2) accounts for H9 related to the governance dimension (V13), but for technology companies (CV3). Thus, although the full sample analysis confirms H7 to H9 with respect to firms with QMSs only, the analyses of the control variables reveal numerous exceptions – which calls for more detailed research in the future.

Table 16 shows the sample group with the highest mean value for the overall and pillar scores per control variable. This overview strengthens the tendency observed in group 4 to perform best in terms of the ESG score (V1) and the environmental (V4) as well as social pillars score (V8) – regardless of the control variables –, while the governance pillar (V13) appears to be affected most by the adoption of EMSs alone. Thus, Table 16 supports the findings of the full dataset analysis.

Table 16. Sample Group with highest Mean Value

Control Variable	V1	V4	V8	V13
Industry				
Academic & Educational Services	n/a	n/a	n/a	n/a
Basic Materials	Group 3	Group 3	Group 4	Group 2
Consumer Cyclicals	Group 4	Group 4	Group 4	Group 3
Consumer Non-Cyclicals	Group 4	Group 4	Group 4	Group 4
Energy	Group 4	Group 4	Group 4	Group 3
Financials	Group 3	Group 3	Group 3	Group 3
Healthcare	Group 4	Group 4	Group 4	Group 3
Industrials	Group 4	Group 4	Group 4	Group 3
Technology	Group 4	Group 4	Group 4	Group 4
Telecommunications Services	Group 4	Group 2	Group 2	Group 3
Utilities	Group 2	Group 2	Group 2	Group 2
Region				
Europe	Group 4	Group 4	Group 4	Group 3
East Asia	Group 4	Group 4	Group 4	Group 4
North America	Group 3	Group 3	Group 4	Group 3
Market Capitalisation				
Small	Group 4	Group 4	Group 4	Group 4
Medium	Group 4	Group 4	Group 4	Group 3
Large	Group 4	Group 4	Group 4	Group 3

Source: Own elaboration.

To summarise the findings of the descriptive analysis, Table 17 provides an overview of the confirmation status of the nine hypotheses, including the exceptions detected in relation to the control variables.

Table 17. Findings from the Descriptive Analysis

Hypothesis	**Result (Full Sample)**	**Exceptions (Control Variables)**		
		Size	Location	Industry
H1	Confirmed	/	East Asia	Basic Materials, Energy, Telecommunication Services, Utilities
H2	Confirmed	/	/	/
H3	Confirmed	/	/	Basic Materials, Energy, Telecommunication Services, Utilities
H4	Confirmed	/	/	Energy
H5	Confirmed	Medium	East Asia, Europe	Consumer (Non-)Cyclicals, Energy, Financials, Industrials, Technology, Telecommunication Services, Utilities
H6	Confirmed	Small	/	Consumer Non-Cyclicals, Technology, Utilities
H7	Only confirmed against QMS	Small	/	Basic Materials, Consumer (Non-) Cyclicals, Energy, Financials, Healthcare, Technology, Telecommunication Services, Utilities
H8	Only confirmed against QMS	Small, Medium	No confirmation	Basic Materials, Consumer (Non-) Cyclicals, Energy, Financials, Healthcare, Technology, Telecommunication Services, Utilities
H9	Only confirmed against QMS	Small, Medium	No confirmation	Basic Materials, Consumer (Non-) Cyclicals, Energy, Financials, Healthcare, Industrials, Telecommunication Services, Utilities

Source: Own elaboration.

3.4.2 Cluster Analysis

3.4.2.1 Step 1 – Single-Linkage Method and Ward Method

The cluster analysis considers the 10 ESG category scores. To detect outliers, the single-linkage method is applied. Therefore, nine data points are eliminated, which reduces the sample size from 4,292 to 4,283 companies. The outliers excluded are from all three regions and operate across various industries, and seven outliers have a large market capitalisation. No outlier operates any QMSs or EMSs, and each company presents extremely low values for at least one ESG issue. The Ward method is applied to obtain homogenous groups with minimum variance. The resulting dendrogram, shown in Figure 7, indicates clustering with two groups.

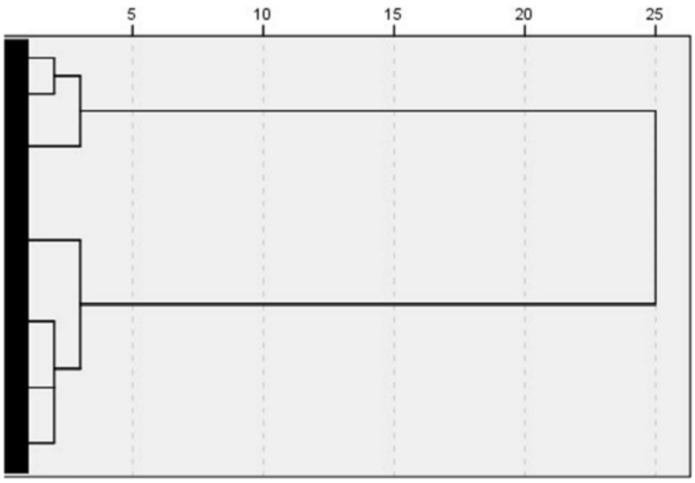


Figure 7. Retrieved Dendrogram

Source: Own elaboration.

3.4.2.2 Step 2 – Test of Data Normality and Mann-Whitney U Test

Both the Kolmogorov-Smirnov test and the Shapiro-Wilk test disprove data normality for the reduced sample with 4,283 companies as well as for the two clusters. The Mann-Whitney U test verifies the clustering. Table 18 illustrates that there are indeed statistically significant differences in the central tendencies of all ESG indicators ($p < 0.05$).

Table 18. Independent-Samples Mann-Whitney-U-Test

Cluster 1 - Cluster 2	**V1**	**V2**	**V3**	**V4**	**V5**	**V6**	**V7**	**V8**
Mann-Whitney U	114,023	162,081	1,627,708	120,488	145,009	155,507	818,921	259,465
Wilcoxon W	3,946,319	3,994,377	2,776,078	3,952,784	3,977,305	3,987,803	4,651,217	4,091,761
Z	-51.244	-50.002	-19.432	-51.631	-51.962	-51.299	-37.541	-47.485
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	V9	**V10**	**V11**	**V12**	**V13**	**V14**	**V15**	**V16**
Mann-Whitney U	340,245	370,305	1,051,221	739,630	919,584	1,273,263	1,687,330	211,470
Wilcoxon W	4,172,541	4,202,601	4,883,517	4,571,926	4,751,880	5,105,559	5,519,626	4,043,766
Z	-45.397	-47.600	-27.023	-35.126	-30.424	-21.283	-10.582	-51.097
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Own elaboration.

3.4.2.3 Step 3 – Analysis of Clusters

The cluster compositions are shown in Figure 8 and 9. Cluster 1 contains 1,515 companies, thus 35.4% of the full sample. The majority of cluster 1 has at least one MS in place. More specifically, 4.9% run QMSs, 12.5% EMSs, and 42.0% operate both MSs simultaneously. Although 40.7% of the cluster does not have any MSs, the disproportionally low presence of companies without MSs is obvious when looking at the horizontal distribution. Only 19.3% of the companies without any MSs make it into cluster 1, whereas the respective figures for companies with QMSs, EMSs, and both MSs amount to 59.7%, 85.5%, and 85.0%, respectively. Therefore, cluster 1 is clearly dominated by companies operating MSs. In turn, cluster 2 with 2,768 organisations is clearly overpopulated by companies without any MS (93.0%).

Regarding company size, cluster 1 in particular contains organisations with large market capitalisations (55.7%) and only a few small companies (11.6%). This tendency is underlined by figures from the horizontal analysis. Whereas 59.7% of all large companies are in cluster 1, only 13.3% of the small companies can be found here. This is clearly an anomaly, given that each company size represents approximately one third of the full sample. The vertical (32.7%) and horizontal (32.1%) share of medium-sized companies is reasonable in light of the fact that cluster 1 makes up only around a third of the full sample. Thus, cluster 1 is dominated by large companies and, in turn, cluster 2 is characterised by small companies (41.6%) and an underrepresentation of large organisations (20.6%). This is in line with the observations and remarks concerning firm size and ESG ratings presented in section 3.4.1.

When it comes to geography, North American (29.2%) and East Asian (27.9%) firms have almost the same weight in cluster 1, while companies from Europe are noticeably overrepresented (42.9%). Cluster 2 presents the opposite composition, with more than two thirds of enterprises located in North America (67.4%) and much smaller shares of East Asian (19.9%) and European firms (12.6%).

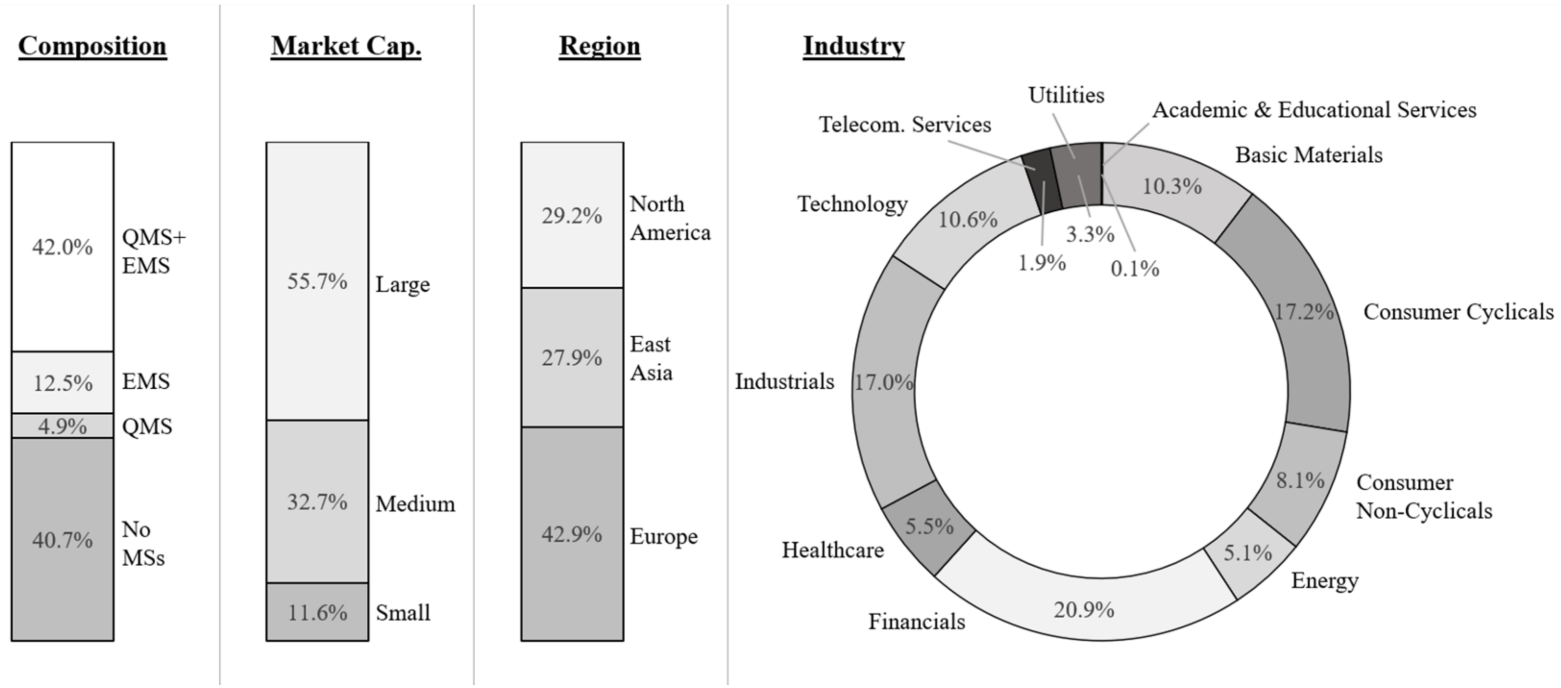


Figure 8. Description of Cluster 1

Source: Own elaboration.

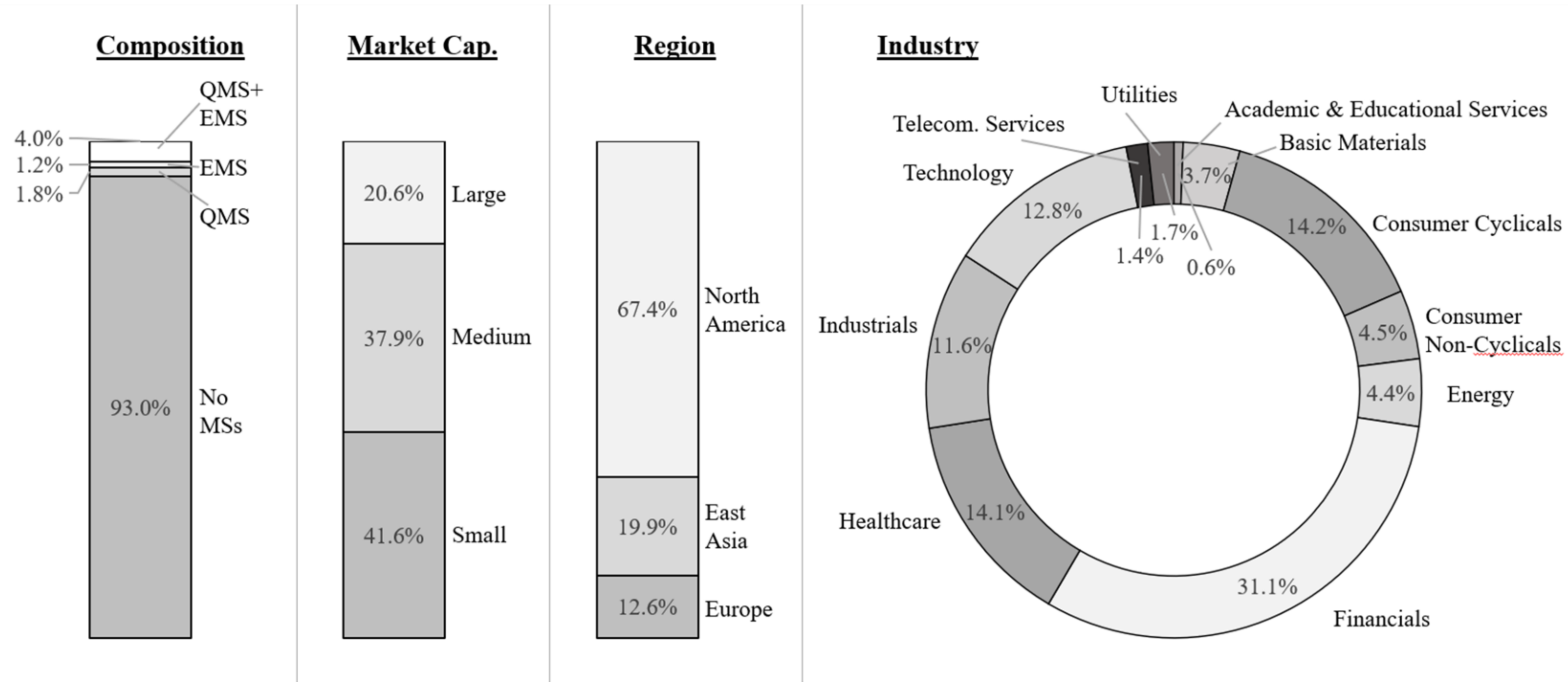


Figure 9. Description of Cluster 2

Source: Own elaboration.

The horizontal analysis reveals that 65.0% of European enterprises make it into cluster 1, whereas the respective figures for East Asia and North America are only 43.4% and 19.1%, respectively. This is consistent with the observations and remarks about location and ESG ratings mentioned in section 3.4.1.

With respect to sectors, most organisations in cluster 1 operate in industry (17.0%), consumer cyclicals (17.2%), or finance (20.9%). Considering that this cluster represents only about one-third of the full sample, it is noticeable that 60.2% of the companies engaged in basic materials, 49.8% in consumer non-cyclicals, and 44.6% in industry can be found here. Most organisations in cluster 2 are engaged in healthcare (14.1%), consumer cyclicals (14.2%), or finance (31.1%).

In addition to the numerous contrasts between the compositions of the clusters, there are also major ESG performance differences between clusters 1 and 2. As shown in Figure 10, the mean values for the ESG indicators (V1 to V16) are higher for cluster 1 than for cluster 2 – except for the ESG controversy score (V3). The smallest performance gap between the two clusters is detected in the shareholder score (V15).

Cluster 1 clearly presents higher ESG performance ratings. The overall ESG score (V1) achieves a mean of 63.73 and a median of 63.80 – both values are more than 35 points higher than for cluster 2. The scores are comparably high with respect to the environmental (V4), social (V8), and governance (V13) pillars. At the level of single ESG issues, cluster 1 reveals particularly strong outperformance in terms of resource use (V5) and emissions (V6) in the environmental dimension, workforce (V9) and human rights (V10) in the social pillar, as well as CSR strategy (V16) in the governance pillar – as visible in Table 19.

Cluster 2 shows relatively low ESG ratings. In concrete terms, the overall score (V1) is only 28.02 on average, with a median value of 27.02. The respective values for the three ESG dimensions are especially low for the environmental (V4) and social (V8) dimensions, while the highest scores are detected in the governance pillar (V13). With respect to the numerous ESG issues, cluster 2 presents its highest performance in the management (V14) and shareholder categories (V15). These two indicators are also those with the lowest underperformance as opposed to cluster 1 (see Table 19).

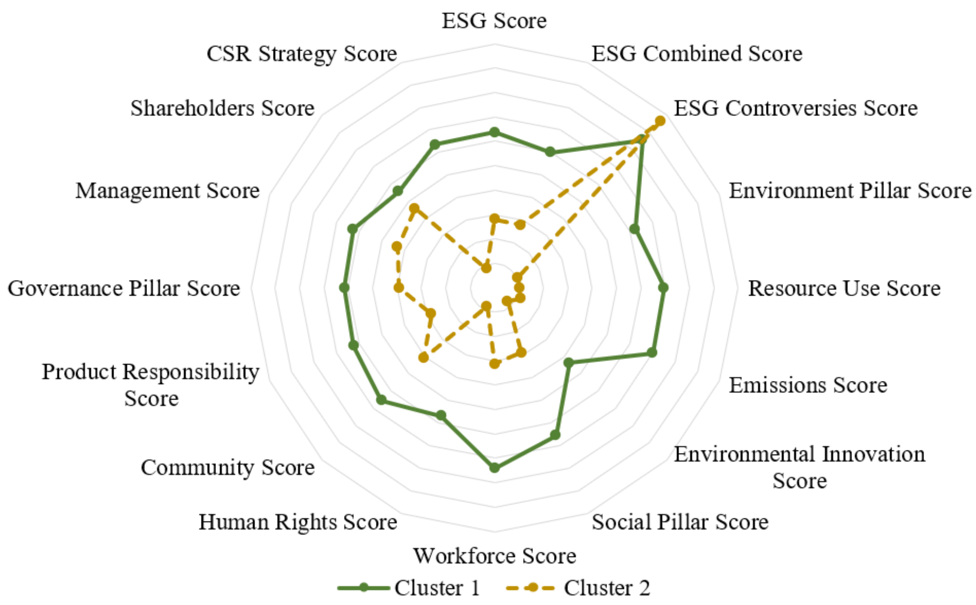


Figure 10. Mean ESG Performance by Cluster

Source: Own elaboration.

In summary, the cluster analysis produces two large clusters, and most of the companies with QMSs (59.7%), EMSs (85.5%), or both MSs (85.0%) are grouped in cluster 1, whereas the majority of companies without MSs (80.7%) populates cluster 2. In addition, cluster 1 is characterised by a high percentage of large organisations and European companies. The first cluster shows significantly higher values for the 10 ESG category scores, the three ESG pillar scores and the (combined) ESG score than the second cluster. In conclusion, the patterns detected through the cluster analysis support H1 to H6 and make it possible to answer RQ4 positively. The analysis offers insight into RQ5 by showing that cluster 1 outperforms cluster 2 regarding all ESG issues, while revealing the smallest performance gap for the shareholder category (V15). Referring to RQ6, the composition of the clusters supports H7 to H9 with respect to companies with QMSs only.

Table 19. Descriptive Analysis for ESG Performance Variables by Cluster

Indicator	n	Mean	SD	Min.	Q1	Median	Q3	Max.
Cluster 1								
V1	1,515	63.73	13.61	26.75	53.77	63.80	74.23	93.72
V2	1,515	60.12	13.55	26.09	50.26	59.62	70.74	93.72
V3	1,515	85.69	27.58	0.44	87.50	100.00	100.00	100.00
V4	1,515	62.54	20.19	3.17	48.00	64.22	79.05	98.89
V5	1,515	69.46	22.31	0.00	54.71	73.32	87.84	99.88
V6	1,515	70.28	22.30	0.00	55.52	75.00	88.68	99.88
V7	1,515	43.51	33.52	0.00	0.00	49.38	76.32	99.84
V8	1,515	65.66	17.35	13.30	53.03	67.57	79.80	97.84
V9	1,515	74.08	19.15	6.05	62.22	77.75	89.85	99.94
V10	1,515	56.97	29.38	0.00	35.80	60.26	82.12	98.91
V11	1,515	65.47	27.19	0.55	45.06	71.88	88.93	99.89
V12	1,515	62.43	27.50	0.00	35.42	68.41	86.51	99.87
V13	1,515	61.42	19.34	5.85	47.67	63.22	77.01	97.76
V14	1,515	62.70	25.68	0.35	43.83	65.70	85.10	99.72
V15	1,515	55.75	27.77	0.22	32.82	59.38	79.58	99.85
V16	1,515	63.55	25.03	0.00	46.72	67.39	85.37	99.89
Cluster 2								
V1	2,768	28.02	11.89	1.06	19.23	27.02	36.03	66.90
V2	2,768	27.83	11.77	1.06	19.14	26.84	35.69	66.90
V3	2,768	96.32	14.89	0.60	100.00	100.00	100.00	100.00
V4	2,768	10.22	14.51	0.00	0.00	2.90	16.41	82.28
V5	2,768	10.42	17.41	0.00	0.00	0.00	16.33	95.17
V6	2,768	11.77	17.84	0.00	0.00	0.00	19.73	92.86
V7	2,768	7.72	18.68	0.00	0.00	0.00	0.00	99.38
V8	2,768	28.90	14.83	0.35	17.56	28.25	38.92	85.09
V9	2,768	31.18	21.19	0.11	13.78	27.75	44.93	98.40
V10	2,768	8.22	17.93	0.00	0.00	0.00	3.10	94.84
V11	2,768	41.01	24.49	0.59	20.25	42.18	61.57	98.91
V12	2,768	28.09	21.21	0.00	14.72	28.89	35.29	99.60
V13	2,768	39.11	20.41	0.31	22.96	37.13	55.22	87.41
V14	2,768	43.17	27.92	0.15	18.70	40.24	66.01	99.98
V15	2,768	45.99	28.93	0.02	20.54	43.61	69.92	99.92
V16	2,768	8.46	17.36	0.00	0.00	0.00	6.96	99.45

Source: Own elaboration.

3.5 Discussion

The statistically significant outperformance of firms with QMSs and/or EMSs as opposed to companies without such MSs for all ESG category scores (except for V15 for group 2) aligns with previous research that revealed the positive impacts of these MSs on several issues in all three ESG pillars. Such as waste reduction (E) and improvements in customer (S) as well as internal communication (G) for QMSs (see e.g., Sampaio et al., 2009; Zimon et al., 2022), and improved resources consumption (E), enhanced stakeholder relationships (S), as well as better manager involvement (G) for EMSs (see e.g., Boiral et al., 2018). Therefore, the results support the literature review summarised in Table 9 and contribute to the debate regarding the positive relationship between QMSs/EMSs and CSP (see e.g., Ferreira et al., 2019).

Furthermore, it is noteworthy that, although both MSs have comparable theoretical benefits for certain areas – such as workforce (V9), product responsibility (V12), and management (V13) (refer to Table 9) –, the empirical results reveal varying magnitudes for these benefits, as measured by ESG category scores – with group 2 significantly underperforming compared to group 3 for V9, outperforming it for V12, and presenting comparable results for V13. This contributes valuable in-depth information to the existing literature reviews about the benefits of implementing QMSs and EMSs that do not mention data-based, magnitude-related differences between both types of MSs, such as Tarí et al. (2012) and Aba and Badar (2013). Furthermore, in regard to stakeholder theory, this study evidences the MSs' focus on specific stakeholder groups, such as QMSs' overperformance in V12 being mainly beneficial for customers and EMSs' V9 overperformance being favourable for employees.

In addition to discussing the results of the full sample, more light should be shed on the deviations detected in relation to the control variables. The descriptive analysis reveals more statistically significant differences between the four sample groups for large companies than for SMEs. Furthermore, cluster 1 presents strong underrepresentation of small firms, thus demonstrating that large companies are more likely to achieve higher ESG scores. These findings relating to company size are consistent with previous research on ESG ratings (see e.g., Drempetic et al., 2020). They might be due to the fact that SMEs have fewer resources to implement environmental strategies (see e.g., Loucks et al., 2010), and because firm size moderates issues like stakeholder pressure and impacts media coverage (see e.g., Darnall et al., 2010; Seroka-Stolka & Fijorek, 2020) – which, in turn, affects quality and environmental disclosure (see e.g., Dienes et al., 2016; Junita & Yulianto, 2018; Solikhah & Subowo, 2020).

Furthermore, the analyses confirmed that European companies tend to achieve higher ESG ratings than firms from East Asia or North America, a finding that is generally aligned with previous cross-regional sustainability research (see e.g., Thanetsunthorn, 2015). The geographic heatmap of ESG performances for 2018 displayed by Daugaard and Ding (2022) visualises the ESG scores around the globe and shows that also other providers of ESG data (these authors used Sustainalytics as data source) confirm the European ESG-related superiority. Such geographical differences in CSP might be due to different sociocultural systems, legal frameworks, and stakeholder pressure for sustainability in the three regions (see e.g., Camilleri, 2015; Rosati & Faria, 2019; Singhania & Saini, 2023; Tran & Beddewela, 2020; Yu & Rowe, 2017). Furthermore, it should be noted that such formal and informal institutional frameworks also play a pivotal role in facilitating or obstructing the diffusion of standards (see e.g., Orcos et al., 2018) – including promotional, informational, financial, and legal measures (Pantelitsa et al., 2018) –, which, in turn, impacts ESG scores (as demonstrated by this study). Therefore, it is worth noting that the European and Asian countries included in the sample experience greater QMS and EMS diffusion rates than North American countries do (ISO, 2021).

Comparable normative and coercive pressures might also contribute to the deviations detected regarding sectors. Business sectors have varying levels of competition and stakeholder pressure (see e.g., Betts et al., 2015; Yalabik & Fairchild, 2011) as well as varying needs, motivations, and barriers regarding MSs implementation. As indicated in ISO (2021), the tendency to adopt QMSs and EMSs does indeed differ among sectors. Moreover, the documented impact of the nature of business operations on ESG scores might be partially explained by the differing degree of ESG transparency among sectors (see e.g., Tamimi & Sebastianelli, 2017). The cluster analysis, however, with its two distinctive clusters of ESG performance patterns clearly reveals that cluster 1 is overpopulated by companies with MSs, which holds true for every control variable (except for the industrial sector). Although even companies without QMSs or EMSs are found in the cluster with the higher ESG scores, this likelihood appears to be connected to the sector type, location, and firm size. Future research should seek to gather more data on the variances identified in relation to the control variables as well as on possible interdependencies amongst these.

In summary, the cluster composition supports the proposed ESG-related advantages of adopting MSs. Furthermore, companies with EMSs or both MSs are more likely to be in cluster 1 (on average 85.5% and 85.0%, respectively) than firms operating with QMSs only (59.7%) for most control variable inputs. This is in line with both the descriptive analysis of the full sample – which shows that group 3 outperforms group 2 in several ESG categories (see Table 12) – as well as the summarised literature review – which only reveals ESG-related benefits of EMSs for some areas, such as emissions (see e.g., Russo, 2009) and regulatory compliance (see e.g., Bravi et al., 2020; Morrow & Rondinelli, 2002) (see Table 9).

Hence, it appears reasonable that combining both MSs is significantly more favourable than operating with QMSs alone (thus confirming H7 to H9 for QMSs). However, this combination leads to slight decline in performance in the governance dimension as opposed to running EMSs only (thus refuting H7 to H9 for EMSs). This might be due to the duplication of tasks and the suboptimal use of resources when multiple separate MSs are in place (see e.g., Lim et al., 2020), or because the negative effects of carrying out practices with comparable goals (compare, for example, Franco et al., 2020) outweigh the potential benefits of combining the systems.

This contributes to the line of discussion related to complementarities in the capabilities required for QMS and EMS adoption and their impact on business performance (see e.g., Allur et al., 2018; Ferrón-Vílchez & Darnall, 2016). Moreover, this result calls for more detailed studies on the ESG-related impacts of having multiple MSs, while distinguishing if companies simply add or actually integrate these systems (Sampaio et al., 2012), because integration can lead to a reduction in administrative burdens and progress in the sustainable development of corporations (Jørgensen et al., 2006), among other benefits. Regrettably, it is not possible to draw any conclusions from the study sample about either the integration level (none, partial or full) (Asif et al., 2010; Bernardo et al., 2017) nor the corresponding integration strategies (QMS or EMS implemented first or simultaneous implementation) (Karapetrovic & Willborn, 1998). Therefore, addressing the integration maturity level (Domingues et al., 2016), which evidently affects CSP (Poltronieri et al., 2019; Poltronieri et al., 2018), would contribute additional knowledge related to the results of this work.

3.6 Conclusions

The literature suggests that ESG themes may be anchored in MSs (Schmid et al., 2017), thus leading to increased scores in certain pillars (Broadstock et al., 2021), and chapter 3 empirically proves that quality and environmental MSs are indeed suitable business tools to achieve significantly higher performance in the environmental, social, and governance dimensions.

The analysis reveals two major clusters, which demonstrate quite different ESG score patterns for firms with and without the aforementioned MSs. The findings support hypotheses H1 to H6 as well as H7 to H9 for firms with QMSs, while revealing some exceptions related to the control variables. In summary, the work concludes that both QMSs and EMSs enable companies to achieve enhanced ESG performances (RQ4), thus being suitable business tools for addressing sustainability-related stakeholder demands. It is further demonstrated that, despite sharing certain comparable sustainability-related benefits, MSs present varying strengths and weaknesses when it comes to tackling specific ESG categories – while, overall, EMSs achieve a greater impact than QMSs on ESG pillar scores (RQ5). Consequently, combining both MSs leads to statistically significant improved ESG performance compared to operating QMSs alone, whereas the combination leads to slightly – albeit not significantly – improved scores in the environmental and social pillars as well as to minor performance losses in the governance dimension compared to only operating with EMSs (RQ6).

Through these conclusions, chapter 3 makes three key contributions to the literature and allows to derive several academic, managerial, and policy-related implications aimed at satisfying stakeholders’ needs for greater CSP.

First, chapter 3 contributes to the literature on the impact of QMSs and EMSs on firms' ESG performance (see e.g., Chams et al., 2021; Miralles-Quirós et al., 2019) by directly linking the concept of ESG ratings to quality and environmental MSs. Thereby, the focus is on all three pillars simultaneously as opposed to one dimension alone (see e.g., Alsayegh et al., 2020; Frolova & Lapina, 2015; Russo, 2009). In this context, sorting the benefits of implementing QMSs and EMSs by a detailed ESG classification, which is broadly used and accepted by practitioners, represents a valuable step.

Second, to the best of the authors' knowledge, this is the first study to quantitatively investigate the relationship between MS implementation and ESG scores. Thus, it contributes to the academic literature by empirically proving the positive impact of QMS and EMS implementation on ESG performance through a large-scale, cross-regional analysis.

Third, this study sheds some additional light on the advantages of MSs in the context of the stakeholder theory. It shows that MSs adoption leads to positive developments in CSP-relevant organisation/stakeholder relations – such as workforce, customers, and community – as well as to enhancements in the environmental dimension.

3.6.1 Managerial Implications

The results show corporate executives that MSs adoption represents a way of successfully responding to the increasing CSP demands of stakeholders in areas like product responsibility (which is best addressed by QMSs) or resource use and emissions (which are best addressed by EMSs). Decision-makers find out about the single ESG-related benefits of QMSs and EMSs with respect to the numerous stakeholder issues, as well as how combining them can impact CSP. This enables them to implement MSs in accordance with their firm's individual sustainability needs. In view of the global green awakening and its influence on business success (see e.g., Hoffman, 2018; Weidinger, 2014), such knowledge will likely become a competitive advantage for enterprises and a benefit for their stakeholders (see e.g., Cantele & Zardini, 2018; Kahupi et al., 2021; Laszlo & Zhexembayeva, 2017).

3.6.2 Policy Implications

The findings of chapter 3 support studies that declare MSs to foster CSP (see Table 9), thus emphasising the importance of their international diffusion (Heras-Saizarbitoria & Boiral, 2013). Therefore, regulators should take advantage of the fact that companies view regulators as the stakeholder group with the strongest influence on organisations’ environmental sustainability efforts (Deloitte, 2021). The differences detected in ESG scores across regions and company sizes call for greater standardisation in sustainability reporting (see e.g., Mynhardt et al., 2017). In addition, to encourage CSP across all industries, policymakers must closely monitor which sectors are shifting towards greater sustainability due to pressure from certain stakeholder groups and which sectors require additional institutional pressure to increase ESG practices – thus, allowing coercive and regulatory forces to be balanced in order to foster the global diffusion of standards (see e.g., Braun, 2019; Delmas & Montes-Sancho, 2011).

3.6.3 Academic Implications

The relationship identified allows deepening the research on which MSs can lead to a better ESG performance. Thus, the importance and impact of MSs implementation as well as their internalisation is still crucial to make companies more efficient and sustainable. Also, the stakeholder theory framework has been identified as important because stakeholders can be the drivers for implementing more sustainable practices – such as the adoption of MSs (and their integration) are.

3.6.4 Limitations and Future Research

Future research should be directed at overcoming this study’s limitations as well as at enlarging and/or specifying the research scope. Firstly, the chosen database and its ESG classification – ESG database providers use their own methodologies (Avetisyan & Hockerts, 2017), thus conceptualising the ESG dimensions differently (Saadaoui & Soobaroyen, 2018) – impact the availability and quality of data. Hence, subsequent research should consider different databases to support the outcomes.

Secondly, the study is intentionally directed at QMSs and EMSs in general, thus providing space for both either restricting this focus to specific MSSs (such as ISO 9001 and ISO 14001) or expanding it to other types of MSs (such as OHSMS) and related practices.

Thirdly, the study's data sample makes no statements regarding the integration level (see e.g., Karapetrovic, 2002) of companies with both MSs, or if other management-related practices are in place (see e.g., Franco et al., 2020). Hence, future investigations should shed light on the degree of integration, firm-specific circumstances, and their impacts.

Fourthly, albeit the country-clustering considers common economic, cultural, and regulatory features, there are nevertheless likely to be certain MSs-related differences among countries from the same regions (see e.g., Pan, 2003), which is why more in-detail research is needed for single countries.

Fifthly, the chosen methodology implies certain limitations. Despite conducting a time filtering, this study is not longitudinal but only depicts the year 2019, thus demanding to verify the outcomes for other time periods (see e.g., the longitudinal panel data analysis applied by Hernandez-Vivanco et al. (2019) for combinations of MSSs and firm financial performance). Moreover, applying other methodologies – such as the mentioned panel data analysis (Yıldırım, 2021) or structural equation modelling (Barrett, 2007) – might enable researchers to draw additional or adjusted conclusions that lead to a broader picture of the relationship between MSs implementation and ESG performance.

CHAPTER 4. CERTIFIED MANAGEMENT SYSTEMS AND FIRM FINANCIAL PEROFRMANCE: A SHAREHOLDER VIEW

Abstract

This study aims to empirically evidence that companies operating with certified ISO 9001 quality, ISO 14001 environmental, and/or ISO 45001 organisational health and safety management systems create statistically significant higher shareholder wealth, as measured by return on equity and dividend per share yield.

With a balanced data sample of more than 1,300 companies from Europe, East Asia, and North America, this paper performs a large-scale longitudinal dynamic data panel analysis for the years 2010 to 2019. The applied two-step system generalised-method-of-moments model quantitatively depicts and compares firm financial performance of companies with single, double, and triple certification against firms with no alike certification, while controlling for the organisational context and shareholder engagement aspects.

The results neglect any significant relation between single certifications and FFP. However, ROE is positively impacted by double certifications that include ISO 9001, and DY reveals positive relationships in the context of any possible combination (double as well as triple certifications).

Consequently, this work argues that operating with multiple certified MSs might be positively related to shareholder wealth. Thereby, this study contributes to the ongoing academic discussion about the relation between MSSs certifications and FFP by providing results from a global dataset. Moreover, it takes on a shareholder-centred approach and introduces DY as relevant FFP indicator in this research stream.

Keywords: Data Panel Analysis; Firm Financial Performance (FFP); Management System Standards (MSSs); Shareholder Theory.

4.1 Introduction

In the world of business, most firms have the key goal of making money – regardless in which sector they operate in. Neither tech start-ups, product manufacturers, nor hair salons can sustain in the private markets in the long-run without creating any profits. Thus, albeit companies currently face increasing societal and political pressure to become more social as well as environmental, companies that seek long-term, sustainable business success must not forget about the financial impact of their actions. In fact, besides social and environmental aspects, the economic dimension is one of the three pillars underlying the triple bottom line concept (Elkington, 1997), which serves as framework for the understanding of sustainability at the corporate level.

In regard to the economic dimension, the corporate governance perspective labelled 'shareholder theory' claims that businesses exist to serve the interests of company owners by generating financial surpluses and maximising their financial returns (Friedman, 1970; Jensen, 2001; Zhang, 2011). To this end, managers should structure organisational processes in a manner that enhances firm financial performance in order to fulfil their fiduciary duty to the owners (Donaldson & Preston, 1995; Moore, 1999; O'Connell & Ward, 2020). When it comes to structuring organisational processes, a common way for systematising and formalising operational procedures is to follow management system standards, which are voluntary guidelines for specific issues published by national as well as international standardisation bodies (Boiral & Heras-Saizarbitoria, 2015). Existing MSSs cover numerous business relevant topics, such as quality, innovation, business continuity, or energy management (see e.g., Ronalter, Poltronieri, & Gerolamo, 2023).

These standards eventually govern the implementation of management systems, thus business tools that enable companies to establish and maintain consistent practices, streamline operations, and improve overall performance (see e.g., Tarí et al., 2012). Such MSs can be certified, if the underlying MSSs allows it, and corresponding certifications have gained significant prominence worldwide. The most certified standards are ISO 9001 for QMS, ISO 14001 for EMS, and ISO 45001 for OHSMS (ISO, 2022b). These certifications demonstrate a company's commitment to quality, environmental sustainability, and occupational health and safety, respectively – which relates to various benefits, such as increased product/service quality (see e.g., Zaramdini, 2007), enhanced use of resources (see e.g., Comoglio & Botta, 2012), as well as improved safety performance (see e.g., Lo et al., 2014). Having numerous MSs in place can lead to even stronger business performance through complementarities and synergy effects (see e.g., Casadesús et al., 2011, Ferrón Vílchez & Darnall, 2016).

However, the impact of MSs adoption on FFP remains a subject of scholarly discussion as academic literature exploring their relationship has produced divergent findings. As Wang et al. (2016) outlines, on the one hand, some studies suggest that ISO certifications are related to operational benefits that should translate to financial advantages like increased revenue or reduced costs, and, on the other hand, some scholars neglect any financial performance benefits as the operational advantages are offset by the costs of running an ISO-certified MS. The tabulated literature review of Hernandez-Vivanco et al. (2019) emphasises the differing observed results about the impact of operating with ISO-certified QMS, EMS, and OHSMSs and combinations of these standards (unclear, negative, no, or positive effect) and, further, shows that empirical studies on this subject use a wide range of indicators for measuring firm performance like return on assets (ROA), sales figures, or market value of firms, among others.

Chapter 4 intends to contribute to the existing academic discussion by empirically examining the impact of certified MSs on FFP with a focus on shareholder wealth – using return on equity as well as dividends per share yield (or simply dividend yield) as shareholder-centred FFP-indicators. **The research objective is to determine whether companies operating with certified ISO 9001 QMS, ISO 14001 EMS, and/or ISO 45001 OHSMS[3]**

[3] In 1999, the British Standards Institution – a national standards body of the United Kingdom – adopted the OHSAS 18001 (Occupational Health and Safety Assessment Series) as a British standard for an OHSMS. The standard was cancelled after a transition period of three years after the ISO 45001 standard has been published in March 2018 by the International Organization for Standardization. Due to the worldwide diffusion of OHSAS 18001 and its structural comparability to ISO MSSs, it is seen as the predecessor of the ISO 45001. In this line of argument, in order to increase the readability of chapter 4 this chapter refers to both standards – depending on the timeline of their existence – when mentioning the term “ISO 45001”.

create statistically significant higher financial benefits for shareholders, as compared to firms without such certifications. Therefore, this work answers the following two research questions:

RQ7: Do shareholders of companies that operate either ISO-certified QMS, EMS, or OHSMS enjoy statistically significant higher financial benefits?

RQ8: Does the combination of ISO-certified QMS, EMS, and/or OHSMS lead to statistically significant higher financial benefits for shareholders?

The RQs are answered by performing a longitudinal data panel analysis based on a balanced dataset of more than 1,300 companies from Europe, East Asia, and North America covering the time period between 2010 to 2019 (one decade). The results provide empirical evidence regarding the financial advantages for shareholders associated with MSs certifications and explore potential synergies from combining multiple standards. Thereby, the work taps into the research gap of missing large-scale, cross-regional empirical analyses about MSs and their impact on the economic dimension of firm performance proposed by Ronalter and Bernardo (2023).

Chapter 4 continues in five sections. Section 4.2 provides extended background information and derives four hypotheses regarding MSs and FFP. Section 3 outlines the used variables, the data sampling, the balanced dataset, as well as the methodology applied, and section 4.4 presents the findings of the data panel analysis. Eventually, section 4.5 offers the conclusions.

4.2 Literature Review

This section presents the shareholder theory, elaborates on the concept of management systems, and sheds light on the existing academic literature about the relation between MSSs certification and FFP. Eventually, four hypotheses are derived that are answered in the course of chapter 4.

4.2.1 Shareholder Theory

According to Pfarrer (2010), the origin of the shareholder theory can be traced back to Adam Smith's (1776) world-famous publication *"The Wealth of Nations"* as it espouses the ideas of (1) free markets, (2) the 'invisible hand' of self-regulation, and (3) the importance of enlightened self-interest. In more recent times, the theory's foundation is rooted in Friedman's (1970) doctrine, which proclaims that businesses exist to serve the interests of their owners and that the firms' primary objective is to maximise shareholder wealth. The subsequent management philosophy may be summarised in four propositions (Fontrodona & Sison, 2006): (1) shareholders own the firm, (2) shareholders act in accordance with the criterion of utility maximisation, (3) the firm is a nexus of contractual relationships, and (4) the purpose of the firm is to maximise shareholder value. This perspective has had a significant influence on corporate governance discussions, especially during the second half of the 20th century (see e.g., Jensen, 2001; Jensen & Meckling, 1976).

The theory highlights the importance of market mechanisms as well as of competition in driving efficiency and maximising shareholder wealth (Friedman, 1970; Jensen & Meckling, 1976). By focusing on profitability and delivering value to their owners, companies are motivated to operate efficiently and to make strategic choices that enhance financial performance. A financially healthy and successful company, in turn, can generate economic growth, create jobs, and support communities – which makes financial performance also important for other stakeholders (O'Connell & Ward, 2020). Thus, Mansell (2013) argues from a philosophical viewpoint that "it is possible for managers to pursue directly the well-being of non-share-owning stakeholders" (p. 597) within the principles of the shareholder theory.

One important implication of the theory is its impact on executive compensation practices. By linking compensation to FFP, it is believed that managers are incentivised to prioritise actions that drive profitability and generate long-term shareholder wealth (Baker et al., 1988; Pfarrer, 2010; Queen, 2015). Thus, as shareholders rely on the top managers to fulfil their fiduciary duty of maximising their share vale, companies are conceptually encouraged to employ performance-based elements in their compensation policy – such as stock options and bonuses being tied to financial performance metrics as well as penalties for poor performances (Callan & Thomas, 2014; Jensen & Murphy, 1990).

It is important to acknowledge that the shareholder theory also faces criticism and debate. Critics argue that a singular focus on shareholder wealth maximisation may lead to short-term decision-making, disregarding the interests of other stakeholders and the broader societal impacts of business activities (Fontrodona & Sison, 2006; Freeman, 1984). Therefore, a counter viewpoint that advocates for a broader 'stakeholder theory' considering the interests of employees, customers, suppliers, and the community alongside shareholders emerged from the 1980s onwards (Donaldson & Preston, 1995; Freeman, 1984; Freeman & Reed, 1983). However, based on the premise that "if corporations cannot meet shareholder expectations, there is little value considering other stakeholders" (How et al., 2019, p. 135), this study is grounded on shareholder theory and seeks to investigate if ISO-certifications are related to key financial performance indicators relevant to owners.

4.2.2 Management Systems

Management systems are structured frameworks and processes implemented within organisations to guide and govern their operations, activities, and decision-making. They provide a systematic approach for managing different aspects of an organisation in both internal and external contexts, such as quality, environmental sustainability, or occupational health and safety (Poltronieri et al., 2018; Rebelo, Santos, & Silva, 2016).

Management system standards – such as ISO 9001, ISO 14001, and ISO 45001 – play a crucial role in shaping and standardising management systems across various industries and regions. These standards are developed and published by specialised standardisation bodies, and they serve as globally recognised benchmarks for specific areas of management (Brenner, 2007). Organisations often seek certification to these standards in order to strengthen their corporate image by signalling their compliance and adherence to industry best practices (see e.g., Pan, 2003; Poksinska et al., 2003).

Studies have shown that organisations certified to MSSs tend to exhibit improved performance in various areas (see e.g., literature reviews by Aba & Badar, 2013, Boiral et al., 2018, or Tarí et al., 2012). For example, ISO 9001 certification is associated with quality improvements, customer satisfaction, productive efficiency, and financial performance (Hernandez-Vivanco et al., 2018; Hernandez-Vivanco & Bernardo, 2023; Martin, 2017; Pan, 2003). ISO 14001 certification relates to improved environmental performance and lower emissions (Pan, 2003; Russo, 2009) as well as to enhanced eco-innovation (Hernandez-Vivanco & Bernardo, 2022). ISO 45001 certification is linked to positive effects on occupational health and safety outcomes, including the reduction of costs related to stoppages of production, lost work days, and insurance (Morgado et al., 2019; Šolc et al., 2022).

In addition, companies operating with multiple certified MSs simultaneously in the framework of an integrated management system are prone to enjoy further internal as well as external benefits – such as increased organisational efficiency, elimination of conflicts between individual systems, and improved partnerships with main stakeholders (see e.g., literature review by Bernardo et al., 2015).

However, the impact of MSSs on organisational performance and competitiveness is not without debate. Some studies suggest that the benefits of certification may vary depending on the organisational context like firm size, sector, and location, among other factors – such as, for example, having comparable management tools in place (see e.g., Franco et al., 2020; Okudan & Budayan, 2021; Singh et al., 2006; Taylor, 1995). Further, companies should consider the challenges in adopting ISO MSSs like cost considerations, resistance to change, employee training, the full spectrum of MS auditing, and necessary top management commitment (see e.g., Hussein et al., 2017; Searcy et al., 2012; Waxin et al., 2019).

4.2.3 MSSs Certifications and Firm Financial Performance

4.2.3.1 ISO 9001 Certification and FFP

Among ISO MSSs, research about ISO 9001 for quality MSs is the most saturated (Ronalter, Poltronieri, & Gerolamo, 2023). Extensive literature reviews summarised the numerous benefits of its certification, highlighting the improvement in systematisation (improved documentation, work procedures, clarity of work, improvement in responsibilities) and enhanced efficiency (productivity, savings in costs, reduction in mistakes and rework, shorter lead time, improved management control), which eventually relate to larger market share, increased sales, and improved quality of products and services, among others (see e.g., Tarí et al., 2012). From a systematic viewpoint, the two key factors of quality improvement that drive financial performance are that (1) it generates greater value for customers, which, in turn, builds market shares and revenues, and (2) lowers firms' costs, which, in turn, increases margins and asset usage (George, 2002).

Empirically confirmed benefits of ISO 9001 to the financial perspective can be clustered into four groups (Rusjan & Alič, 2010): (1) decrease in actual and potential damage due to identified non-conformities (actual and potential costs or loss of income), (2) savings and decreased operational costs due to continuous improvement of the QMS, (3) higher incomes, sales per employee, and asset turnover due to better product quality and its signalling by certification, and (4) improved performance, efficiency, profitability, and return on investment. However, it should be well noted that conclusions from empirical studies have yet reached a rather contradictory nature, as outlined by Sampaio et al. (2009) (in this context, also refer to the tabulated literature reviews by Hernandez-Vivanco et al., 2019, Hernandez-Vivanco & Bernardo, 2023, or Siougle et al., 2019, respectively).

In regard to ROE, there is little QMS-related research existent, thus representing a knowledge gap (Crv & Markic, 2023). Despite the low number of contributions at hand, there are nevertheless opposing findings. For example, on the one hand, Siougle et al. (2019) reveals a positive effect of ISO 9001 certifications on ROE for Greece companies and also Soares and Mendes (2018) claim a positive relationship for Portuguese pharmacies. On the other hand, Neves et al. (2023), who recently applied the generalised-method-of-moments (GMM) model on data from Portuguese companies, conclude that ISO 9001 certifications do not impact the ROE in neither a positive nor a negative way (the same accounts for ISO 14001 certifications). Regarding the dividend per share yield, the authors of chapter 4 could not identify relevant contributions in any academic database such as Scopus, Web of Science, or Emerald Insights.

Despite this ongoing discussion, the vast amount of works concludes positive impacts of ISO 9001 certifications on firm performance in general. Therefore, this work follows the reasoning that the evidenced benefits of ISO 9001 certification should eventually translate into financial benefits for the company owners. Hence, improved quality and lower costs should positively impact the profit (resulting in increased ROE) and, conclusively, lead to higher payouts to shareholders (resulting in increased DY). Therefore, the below hypotheses are derived:

H10: ISO 9001, when implemented as single certification, has a positive effect on shareholder financial key performance indicators.

- **H10a:** ISO 9001, when implemented as single certification, has a positive effect on the return on equity.

- **H10b:** ISO 9001, when implemented as single certification, has a positive effect on the dividend per share yield.

4.2.3.2 ISO 14001 Certification and FFP

ISO 14001 deals with environmental MSs. When researching the outcomes of its implementation, most authors focus on environmental management (such as impacts on rigour of practices and regulatory compliance), environmental impact (such as improvements in air pollution or waste management), and environmental awareness including social aspects (such as corporate image and stakeholder relationships) (see e.g., Boiral et al., 2018). In this course, the most highlighted benefits of ISO 14001 certification relate to (1) raised awareness on compliance requirements, (2) facilitated planning and controlling of environmental management, (3) reduced externalities (like pollution and emissions), and (4) communication with stakeholders, among others (Camilleri, 2022).

Nonetheless, existing literature also argues for enhanced profitability as well as efficiency (see e.g., Tarí et al., 2012) and, conclusively, positive impacts on FFP (see e.g., Padua et al., 2020). However, the effects of EMS certification on FFP as well as the reasons explaining them are inconclusive and underdeveloped (Wang & Mao, 2020).

As for ISO 9001, research about ROE produced somewhat divergent findings. On the one hand, Nga (2009) performed a descriptive analysis for financial data of Malaysian firms concluding that ISO 14001 certification improves the average ROE. In addition, Ong et al. (2016) confirms the positive relationship in the Malaysian context. On the other hand, the majority of researchers neglect any significant impact. For example, He et al. (2015) (Chinese firms), Neves et al. (2023) (Portuguese firms), and Wagner et al. (2002) (European companies) do not conclude any statistically significant relationship between ISO 14001 certifications on ROE. In regard to DY, the authors of chapter 4 did not identify any relevant literature.

In alignment with mainly environmental-related benefits evidenced so far and the majority of scholars arguing for the ISO 14001 certification not being a driver of profitability, the following hypotheses are concluded:

H11: ISO 14001, when implemented as single certification, has no effect on shareholder financial key performance indicators.

- **H11a:** ISO 14001, when implemented as single certification, has no effect on the return on equity.

- **H11b:** ISO 14001, when implemented as single certification, has no effect on the dividend per share yield.

4.2.3.3 ISO 45001 Certification and FFP

The implementation of the ISO 45001 standard about occupational health and safety management (or its predecessor OHSAS 18001, respectively) is often motivated by its prospects to eliminate or minimise risks to workers (valuing human capital) and to enhance organisational image (business reason) (see e.g., Santos et al., 2013). In the academic literature, the outcomes and main benefits related to the OHSMS standards include (1) improved organisational health and safety performance with the reduction of risks, incidents, and accidents, (2) its continuous improvement, (3) more motivation, moral, and satisfaction among workers, as well as (4) positive corporate image, among others (see e.g., Karanikas et al., 2021; Madsen et al., 2020).

Studies like the empirical analysis of 149 Spanish companies by Abad et al. (2013) indeed support the argument of OHSMSs' significant positive impact on labour productivity. That higher productivity and enhanced safety can indeed be related to certain financial performance improvements like sales growth is proven by Lo et al. (2014). Further, Yang and Maresova (2020) researched the adoption of OHSMS standards in pharmaceutical firms in China, revealing that the positive effect on contemporaneous financial performance is even beneficial for shareholders, as measured by ROE. The authors of chapter 4 did not identify any studies relating DY to ISO 45001 certification. Based on the reasoning outlined above, the below hypotheses are stated:

H12: ISO 45001, when implemented as single certification, has a positive effect on shareholder financial key performance indicators.

- **H12a:** ISO 45001, when implemented as single certification, has a positive effect on the return on equity.

- **H12b:** ISO 45001, when implemented as single certification, has a positive effect on the dividend per share yield.

4.2.3.4 Multiple Certifications

In regard to operating with multiple certified management systems simultaneously, two main lines of argument should be considered. First, despite each standard having its own distinct scope of benefits, combinations can enrich the sum of individual effects even further. Hence, having numerous MSs in place can lead to stronger business performance through complementarities (see e.g., Ferrón-Vílchez & Darnall, 2016). For example, having ISO 9001 QMS alongside ISO 14001 EMS yields synergy effect (see e.g., Casadesús et al., 2011), and the safety performance of OHSAS 18001 increases alongside the two former MSSs (Wiengarten et al., 2017). Second, since most organisations with multiple MSs do actually integrate them (see e.g., Karapetrovic & Casadesús, 2009), the benefits related to operating with an IMS are likely to impact the financial performance – such as optimised resources, reduction in duplication of policies, and reduced bureaucracy (see e.g., literature review by Bernardo et al., 2015).

In regard to FFP and multiple certifications, Martí-Ballester and Simon (2017) performed interviews amongst Spanish organisations, revealing a positive relationship between ISO 9001 and ISO 14001 integration on corporate financial performance. Further, Hernandez-Vivanco et al. (2019) performed a longitudinal analysis with data from 2007 to 2015 using return on sales, return on capital employed, and ROA as indicators, arguing in favour of a positive relationship between firm performance and ISO 9001 (single certification) as well as its combinations with either ISO 14001 (double certification) or both ISO 14001 and ISO 45001 (triple certification) – thus, suggesting ISO 9001 as relevant driver for improved firm performance. Also, Ionașcu et al. (2017) claim triple certification to be positively related to firms' ROA.

However, de Nadae and Carvalho (2019) researched the impact of triple certification on financial performance indicators in Brazil, highlighting that companies with ISO certifications indeed outperformed others in several financial categories – but not in view of ROE. To this end, also Wang and Liu (2023) concluded in the context of Chinese companies that firms with double certifications, consisting of ISO 9001 and ISO 14001, indeed outperform firms with single or no certification in regard to certain FFP indicators like ROA and operating cycle – but reveal significant underperformance when it comes to ROE.

Nevertheless, based on the line of argument that having multiple MSs in place yields synergy effects and their integration can further enhance firm performance, this study proposes that any combination of certifications (double as well as triple certifications) results in increased FFP. Therefore, the following is hypothesised:

H13: Multiple certifications have a positive effect on shareholder-centred financial key performance indicators.

- **H13a:** ISO 9001 and ISO 14001, when implemented as double certification, have a positive effect on the return on equity.
- **H13b:** ISO 9001 and ISO 14001, when implemented as double certification, have a positive effect on the dividend per share yield.
- **H13c:** ISO 9001 and ISO 45001, when implemented as double certification, have a positive effect on the return on equity.
- **H13d:** ISO 9001 and ISO 45001, when implemented as double certification, have a positive effect the dividend per share yield.
- **H13e:** ISO 14001 and ISO 45001, when implemented as double certification, have a positive effect on the return on equity.
- **H13f:** ISO 14001 and ISO 45001, when implemented as double certification, have a positive effect on the dividend per share yield.
- **H13g:** ISO 9001, ISO 14001, and ISO 45001, when implemented as triple certification, have a positive effect on the return on equity.
- **H13h:** ISO 9001, ISO 14001, and ISO 45001, when implemented as triple certification, have a positive effect on the dividend per share yield.

All four hypotheses H10 to H13 are compared against companies operating without any of these three certifications.

4.3 Methodology

To answer the RQs whether shareholders enjoy financial benefits from operating with any (RQ7) or combined (RQ8) management system certifications, this study applies a balanced data panel analysis. This section firstly presents the variables used in the quantitative analysis, secondly explains the data sampling process, thirdly describes the datasets, and fourthly depicts the statistical method performed to obtain the results eventually shown in section 4.4.

4.3.1 Variables

For measuring FFP in regard to shareholder wealth, this study uses ROE as well as DY as dependent variables (DV). Both indicators are amongst the most important ones in the context of the return on shares (see e.g., Kai & Rahman, 2018).

- **DV1:** The return on equity measures the profitability of a company in relation to the amount of shareholder equity. Thus, it is an important indicator of how well a company is using its resources to generate profits for its owners. In a nutshell, the ROE ratio tells how much profit a company generates for every dollar of equity invested by its shareholders. A higher ROE typically indicates that a firm is using its equity efficiently to generate profits. In conclusion, the ROE has a significant effect on firm value (Sutomo & Budiharjo, 2019). To this end, ROE is one of the most widely used measures for profitability and shareholder return (Heinfeldt & Rindler, 2010).

- **DV2:** The dividend per share yield (or just dividend yield) measures the percentage amount of dividends that a company pays out to its shareholders for each share of its stock. DY is an important indicator of how much income owners can expect to receive from their investment in the firm. A high DY indicates that a company is paying out a significant portion of its earnings as dividends to its shareholders. A company’s dividend policy explains a lot of its financial performance (Kanakriyah, 2020) and can impact shareholders’ value (Farrukh et al., 2017; Wet &

Mpinda, 2013). As outlined in section 4.2.3, DY has not yet been researched when relating ISO MSSs certifications to FFP. Therefore, this shareholder-centred variable seeks to provide relevant novelty.

As explanatory (or independent) variable (EV), the certification status is used (EV1). This categorial variable includes eight categories, which represent the possible certifications of the company – i.e., no certification, single certification (3 different standards), double certification (3 different combinations), and triple certification.

To account for confounding influence factors between treatment and outcome, the regression analysis includes a set of control variables for obtaining consistent effect estimates (Hünermund & Louw, 2020). To control for the organisational context, exogenous data on firms' industry (CV1), location (CV2), and size (CV3) is considered. Further, due to the link between shareholder theory and executive compensation (outlined in section 4.2.1), a shareholder score (CV4) measuring shareholder engagement and treatment – including shareholders' influence on management payment – from the ESG framework by Thomson Reuters (2017) is applied as regressor.

As the shareholder score itself is composed of twelve different shareholder engagement scores and, thus, is subject to endogeneity, the aspects most relevant for executive compensation and equal treatment of different shareholders are instrumented as exogenous instrumental variables (IV). These binary variables indicate if CEOs' compensation is linked to the shareholder return (IV1), if shareholders can vote on executive compensation (IV2), and if shareholder approval is necessary for stock-based compensation plans (IV3). Moreover, it is considered if a company treats shareholders equally (IV4) and facilitates shareholder engagement (IV5).

Furthermore, as the combination of certifications (EV1) is not strictly exogenous but, instead, depends to a certain extent on past observations – i.e., on the certifications held during the previous years –, the applied model instruments the lagged independent variable (IV6).

Table 20 summarises the variables used in this study.

Table 20. Variables for Data Panel Analysis

Code	Variable	Value	Description
DV1	Return on Equity (ROE)	Percentage value	Return on equity is the measure of a company’s net income divided by its shareholders’ equity.
DV2	Dividend per Share Yield (DY)	Percentage value	Dividend per share is calculated by dividing the total dividends paid out by the number of outstanding ordinary shares issued. The DY is calculated by dividing the dividend per share by the market price of the share.
EV1	Certification Status	Categorial value	The explanatory variable entails eight categories, representing the different possible combinations of (non-)certification. Category C0 – No certification (control category) Category C1 – ISO 9001 (company claims to have an ISO 9000 certification or any industry specific certification) Category C2 – ISO 14001 (company claims to have an ISO 14000 certification) Category C3 – ISO 45001 (company claims to have health and safety management systems in place like the OHSAS 18001 / ISO 45001) Category C4 – ISO 9001 + ISO 14001 Category C5 – ISO 9001 + ISO 45001 Category C6 – ISO 1400 + ISO 45001 Category C7 – ISO 9001 + ISO 14001 + ISO 45001
CV1	Industry	Non-numerical value	Industry, in which the company operates. The global industry classification standard is used to assign each firm to one out of eleven sectors.

Table 20. (continued)

Code	Variable	Value	Description
CV2	Location	Non-numerical value	Region, in which the company's headquarter is located. The location variable considers if the headquarter of a company is based in Europe (EU, UK, and EFTA states), East Asia (China, Japan, and four tiger states), or North America (USA and Canada). This country clustering is done in accordance with Ronalter, Bernardo, and Romaní (2023).
CV3	Company Size	Numerical value	The size is measured by market capitalisation (in USD).
CV4	Shareholders Score	Score between 0 (low) to 100 (high)	The shareholder score incorporates twelve different shareholder engagement scores from the ESG framework by Thomson Reuters (2017).
IV1	CEO Compensation Link to TSR Score	Binary value (1 = yes, 0 = no)	Is the CEO's compensation linked to total shareholder return?
IV2	Shareholders' Vote on Executive Pay Score	Binary value (1 = yes, 0 = no)	Do the company's shareholders have the right to vote on executive compensation? (Voting on senior executive compensation like advisory vote, say on pay, approval of overall remuneration report.)
IV3	Shareholders' Approval on Stock Compensation Plan Score	Binary value (1 = yes, 0 = no)	Does the company require that shareholder approval is obtained prior to the adoption of any stock-based compensation plans? (Relates to any stock-based compensation plan, approval of new share-based compensation plan, or the renewal of an existing plan by shareholders.)
IV4	Equal Shareholder Rights	Binary value (1 = yes, 0 = no)	Does the company treat all shareholders equally?

Table 20. (continued)

Code	Variable	Value	Description
IV5	Shareholder Rights Policy Score	Binary value (1 = yes, 0 = no)	Does the company have a policy for ensuring equal treatment of minority shareholders, facilitating shareholder engagement, or limiting the use of anti-takeover devices?
IV6	Lagged Certification Status	Categorial value	As the explanatory variable is not strictly exogenous but depends to a certain extent on past observations, the lagged EV1 is instrumented.

Note: DV = Dependent Variable, EV = Explanatory Variable, CV = Control Variable, IV = Instrumental Variable

Source: Own elaboration, descriptions are partially adapted from the Refinitiv Eikon database.

4.3.2 Sampling Process

The first step in the sampling process involves searching for reliable data on the FFP variables in focus as well as on companies' MSs certification status. Therefore, Thomson Reuters Eikon, also known as Refinitiv Eikon (formerly ASSET4), is used. It is one of the world's biggest databases for firms' financial data and, in addition, this database provides an ESG dataset for about 10,000 companies worldwide that entails information on (1) if a company claims to have an ISO 9000 certification, (2) if a company claims to have an ISO 14000 certification, and (3) if a company has a health and safety management system in place like the OHSAS 18001 (note that ISO 45001 replaced OHSAS 18001 during a three-year migration period from 2018 to 2021). From this database, a list of 8,202 companies providing information on their MSs certification as of 2019 is retrieved, and data points on the variables (refer to Table 20) dating back to 2010 are downloaded. The data download took place on 3 June 2023.

The second step concerns data cleaning. Data on certifications is checked for obvious abnormalities[4]. DVs showing extreme outliers[5] are emptied, and companies showing no value for the DVs throughout the whole time period 2010 to 2019 are excluded. The country-level locations are grouped into the three regions, and companies outside this scope are excluded. Furthermore, organisations without information on their industry or continuous data on their size, which is also filtered for extreme outliers, are excluded. These actions reduce the sample to an unbalanced dataset of 5,987 firms.

In the third step, balanced datasets are created. This is done because certifications should be seen as strategic decision maintained in the long-term to "pursue excellence by practicing and interiorising the philosophy embedded in the standards" (Hernandez-Vivanco et al., 2019, p. 397), and because effects are more clearly evidenced in the long run (see e.g., Abad et al., 2013; Corbett et al., 2005; Testa et al., 2014). Therefore, a balanced panel approach consisting of the longest possible runs allows to keep the most

[4] E.g., when a company reports MSs certifications for several years, then there is a year for which Eikon simply does not provide any information, and for the following years the dataset states MSs adherence again, then the authors filled in the missing data.

[5] Defined as >3 times the interquartile range.

available information about firms' strategies – as discussed in Hernandez-Vivanco and Bernardo (2023). The balanced datasets contain 1,393 companies for ROE (DV1) and 1,544 firms for DY (DV2).

4.3.3 Sample Description

Figures 11 (ROE) and 12 (DY) show the composition of both datasets, which are quite similar to each other. In both samples, most companies operate in the sectors industrials (19.5% ROE / 20.2% DY), financials (14.5% / 14.9%), and consumer discretionary (11.8% / 12.3%). Albeit the financial analysis considers the company size as a continuous number, the figures include a grouping – in alignment with Ronalter, Bernardo, & Romaní (2023) – into small (market capitalisation < USD 1 billion), medium (<5 bn), and large companies (>5 bn) in order to give the reader an objective overview on the distribution of firm sizes.

As visible, both data samples are mainly populated by medium-sized and large companies, and the share of large companies even increases throughout the time frame. As size is measured by market capitalisation, the development of share prices impacts this grouping. A detail-view on the regional aspect reveals that especially North American companies are classified as large ones (76.9% / 76.3%), while the large-sized shares for Europe (64.6% / 66.4%) and East Asia (59.7% / 60.1%) are somewhat smaller.

When it comes to certifications, both balanced datasets contain similar percentages for the eight categories of EV1 and show a comparable development pattern in regard to certifications. The percentage of companies without any certification decreases significantly from 2010 (38.5% / 40.9%) to 2019 (25.4% / 27.7%), while the number of firms with triple certifications increases from the beginning of the decade (20.3% / 19.1%) towards its end (34.9% / 32.7%). However, the percentages of single certification (2010: 19.7% / 19.7%; 2019: 19.7% / 19.9%) and double certification (2010: 21.5% / 20.3%; 2019: 20.0% / 19.8%) stay more or less stable. The regional differences in the sample group distribution are consistent with the global distribution of ISO MSSs certifications (ISO, 2022b).

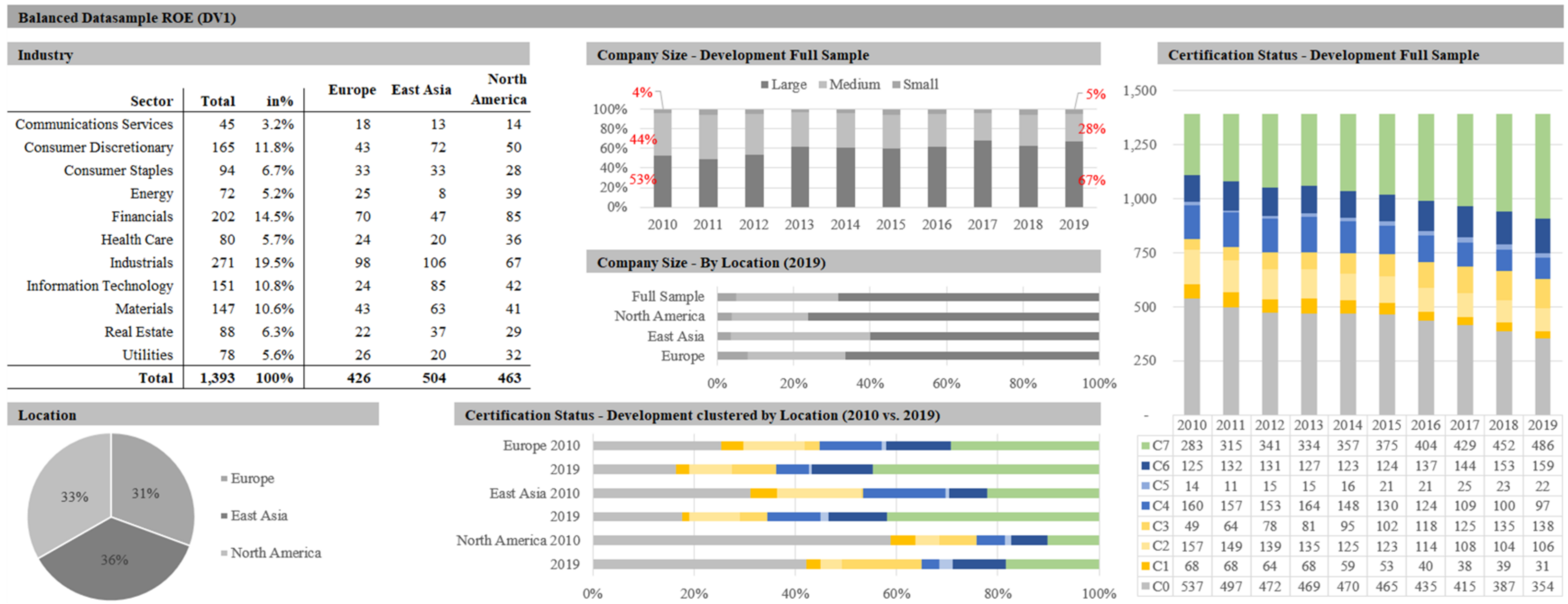
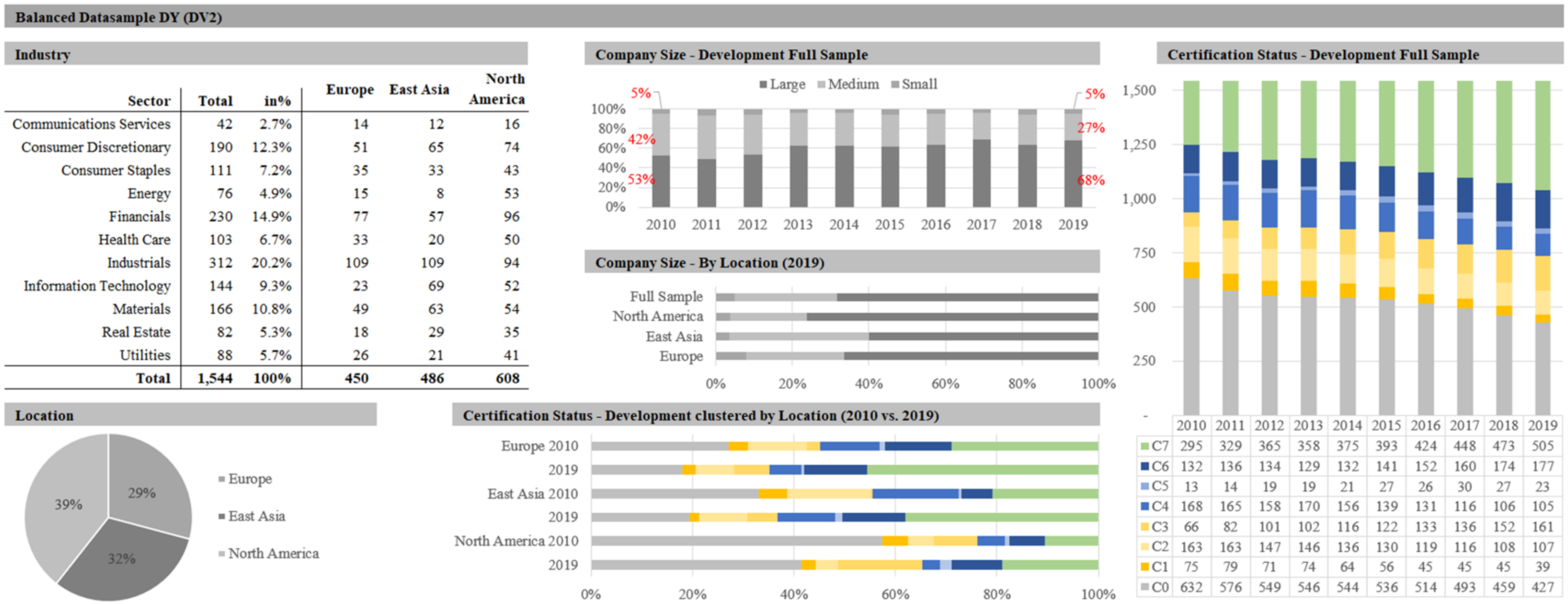


Figure 11. Description of the Balanced Dataset on ROE

Source: Own elaboration.



Sector	Total	in%	Europe	East Asia	North America
Communications Services	42	2.7%	14	12	16
Consumer Discretionary	190	12.3%	51	65	74
Consumer Staples	111	7.2%	35	33	43
Energy	76	4.9%	15	8	53
Financials	230	14.9%	77	57	96
Health Care	103	6.7%	33	20	50
Industrials	312	20.2%	109	109	94
Information Technology	144	9.3%	23	69	52
Materials	166	10.8%	49	63	54
Real Estate	82	5.3%	18	29	35
Utilities	88	5.7%	26	21	41
Total	**1,544**	**100%**	**450**	**486**	**608**

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
C7	295	329	365	358	375	393	424	448	473	505
C6	132	136	134	129	132	141	152	160	174	177
C5	13	14	19	19	21	27	26	30	27	23
C4	168	165	158	170	156	139	131	116	106	105
C3	66	82	101	102	116	122	133	136	152	161
C2	163	163	147	146	136	130	119	116	108	107
C1	75	79	71	74	64	56	45	45	45	39
C0	632	576	549	546	544	536	514	493	459	427

Figure 12. Description of the Balanced Dataset on DY

Source: Own elaboration.

4.3.4 Applied Data Analysis

The two-step system generalised-method-of-moments approach is chosen to take into account that the dependent as well as explanatory variables are not strictly exogenous but, instead, depend to a certain extent on their own past observations. Further, this technique allows for estimating the fixed individual effects of the ISO certifications, while addressing challenges like endogeneity, autocorrelation, and unobserved heterogeneity in the panel datasets. Arellano and Bover (1995) first introduced the GMM estimator for dynamic panel data, and Blundell and Bond (1998) introduced the system-GMM estimator. It extends the original first-difference GMM estimator by including equations for both levels and differences of variables, enhancing the system's orthogonality conditions. The main equation used in the applied system-GMM model is as follows:

$$(1)\ FFP_{i,t} = \alpha + \beta_1\ FFP_{i,t-1} + \beta_2\ Cert_{i,t} + \beta_3\ Industry_i + \beta_4\ Region_i$$

$$+ \beta_5\ Size_{i,t} + \beta_6\ ShareholdersScore_{i,t} + u_{i,t}$$

where $FFP_{i,t}$ denotes the two equations related to DV1 and DV2, respectively; $i = 1, \ldots, N$ represents the firms; $t = 1, \ldots, T$ represents the time periods; $FFP_{i,t-1}$ is the lagged DV with the value of a previous time period, which accounts for potential serial correlation; $Cert_{i,t}$ refers to the EV1 categorial variable that indicates the ISO certification status (see eight categories listed in Table 20); and $u_{i,t}$ represents the error term, which accounts for unobserved factors that affect the dependent variable (takes into consideration the dynamics of the data and the potential correlation across time periods and cross-sectional units). It is important to note that IV1 to IV5 (shareholder engagement scores) as well as IV6 (lagged certification status) are used solely as instrumental variables in order to address potential endogeneity and biases in the analysis. These variables are not displayed explicitly as regressors in equation (1) but, as IVs, they are critical for ensuring the validity of the estimated relationships.

This work applies the two-step system-GMM model using Stata/SE 17.0 with the xtabond2 command (Roodman, 2009). This command is particularly beneficial when dealing with limited time-series observations, where system-GMM leverages additional cross-sectional variation. To counteract the typically occurring downward bias in the outcomes of the two-step process, the finite sample correction for asymptotic variance, as suggested by Windmeijer (2005), is employed.

4.4 Findings

The correlation coefficients between the variables included in the main model for the balanced datasets for ROE and DY are presented in Table 21 and Table 22, respectively. Positive correlation coefficients ($\rho > 0$) indicate that when one variable increases, the other tends to increase as well. Contrary, negative correlation coefficients ($\rho < 0$) suggest that as one variable increases, the other tends to decrease. The strength of the correlation is indicated by the magnitude of the correlation coefficient, ranging from -1 to 1. Larger absolute values indicate stronger correlations (Senthilnathan, 2019).

Table 21 shows that ROE (DV1) is positively correlated with ROE_{t-1} (ρ = 0.820), which is expected given that the previous ROE is likely to be somewhat related to the current ROE. Besides this observation, the highest correlations between DV1 and the other variables are found among the control variables related to the organisational context – industry (CV1, ρ = -0.127), region (CV2, ρ = 0.247), and size (CV3, ρ = 0.238). These linear relationships appear reasonable as such organisational contexts tend to have impact on the ROE ranges of firms. The correlations between DV1 and the different combinations of ISO certifications (EV1 categories C1 to C7) as well as between DV1 and the shareholder score (CV4) are rather low ($\rho < |0.1|$). These low correlations suggest that the studied ISO certifications and shareholder engagement do not have strong linear relationships with ROE. In a similar manner, Table 22 reveals a strong positive correlation between DY (DV2) and DY_{t-1} (ρ = 0.896). This reinforces the idea that the dividend per share yield is somewhat persistent over time as firms tend to operate with stable dividend policies. This implies that past dividend levels are strong predictors of current (as well as future) dividend levels. The other variables have rather low correlations with DV2 ($\rho < |0.1|$), which suggests that they do not have strong linear relationships with the dividend per share yield – except for the region (CV2, ρ = -0.114).

Table 21. ρ Correlation Coefficients in the Balanced Dataset for ROE

		ROE	ROE_{t-1}	EV1							CV1	CV2	CV3	CV4
				C1	C2	C3	C4	C5	C6	C7				
	ROE	1												
	ROE_{t-1}	0.820	1											
EV1	**C1**	0.030	0.033	1										
	C2	-0.079	-0.073	-0.063	1									
	C3	-0.011	-0.012	-0.055	-0.087	1								
	C4	-0.050	-0.051	-0.065	-0.103	-0.090	1							
	C5	0.037	0.034	-0.023	-0.036	-0.032	-0.038	1						
	C6	0.006	0.007	-0.065	-0.104	-0.091	-0.107	-0.038	1					
	C7	0.001	0.001	-0.121	-0.192	-0.168	-0.199	-0.070	-0.200	1				
	CV1	-0.127	-0.128	-0.006	-0.026	-0.009	0.002	-0.010	0.067	0.140	1			
	CV2	0.247	0.240	0.014	-0.122	0.145	-0.106	0.032	-0.020	-0.158	-0.043	1		
	CV3	0.238	0.228	-0.059	0.024	0.057	-0.088	0.013	0.074	0.021	-0.095	0.165	1	
	CV4	0.011	0.012	-0.023	0.012	0.029	-0.022	-0.033	0.026	0.048	0.011	0.045	0.101	1

Source: Own elaboration.

Table 22. ρ Correlation Coefficients in the Balanced Dataset for DY

		DY	DY_{t-1}	EV1							CV1	CV2	CV3	CV4
				C1	C2	C3	C4	C5	C6	C7				
	DY	1												
	DY_{t-1}	0.896	1											
EV1	**C1**	-0.069	-0.068	1										
EV1	**C2**	0.015	0.013	-0.62	1									
EV1	**C3**	-0.003	-0.003	-0.057	-0.088	1								
EV1	**C4**	-0.053	-0.055	-0.064	-0.098	-0.091	1							
EV1	**C5**	-0.003	-0.001	-0.024	-0.037	-0.034	-0.038	1						
EV1	**C6**	0.026	0.027	-0.065	-0.100	-0.093	-0.103	-0.039	1					
EV1	**C7**	0.014	0.012	-0.118	-0.181	-0.168	-0.187	-0.071	-0.191	1				
	CV1	0.056	0.059	-0.009	-0.012	-0.001	0.013	-0.004	0.064	0.152	1			
	CV2	-.0114	-0.109	0.012	-0.122	0.160	-0.123	0.026	-0.013	-0.147	-0.045	1		
	CV3	0.020	-0.010	-0.053	0.024	0.067	-0.086	-0.005	0.095	0.034	-0.094	0.172	1	
	CV4	-0.012	-0.012	-0.011	0.009	0.027	-0.026	-0.026	0.031	0.040	0.030	0.067	0.103	1

Source: Own elaboration.

Given the relatively low correlations, the statistically more advanced two-step system-GMM is conducted to assess the impact of the explanatory variables on both ROE and DY, while controlling for potential confounding factors. The system-GMM model helps determining the significance and direction of the relationships among the variables more accurately. The results of the applied main model are displayed for both dependent variables in Table 23.

In regard to the return on equity (DV1), the following main observations are made:

- The coefficient for the lagged return on equity is 1.009, and it is statistically significant ($p < 0.01$). This shows the strong positive relationship between the lagged ROE and the current ROE, which is consistent with the correlation coefficient in Table 21 and the idea that past profitability affects current profitability.
- Amongst the certifications, none of them show statistically significant relationships with ROE on an individual basis. However, operating ISO 9001 jointly with either ISO 14001 or ISO 45001 results in statistically significant positive relations at the 5% ($p < 0.05$) and 10% ($p < 0.10$) significance level, respectively. This suggests that these combinations of ISO certifications have a positive influence on ROE.
- Regarding the organisational context, several industry sectors (CV1; consumer staples, information technology, materials) have significant negative effects on ROE compared to the reference group (communication services). Further, the region of North America is strongly positively associated with ROE ($p < 0.01$), indicating that North American companies tend to have higher ROE compared to firms located in the reference region (East Asia). The size of the company (CV3) does not show any significant relationship with ROE.
- When it comes to the engagement and treatment of the firms' owners, the shareholder score shows a positive and statistically significant relationship with ROE ($p < 0.05$). This implies that a higher degree of shareholder engagement and treatment is positively associated with enhanced profitability, as measured by the ROE.

Table 23. Two-Step System-GMM Outcomes

	ROE		DY	
	Coefficient	**St. Error**	**Coefficient**	**St. Error**
Lagged Dependent Variables				
ROE_{t-1}	**1.009*** **	0.072		
DY_{t-1}			**0.923*** **	0.035
Explanatory Variable Categories				
C1: ISO 9001	3.183	3.150	-0.169	0.490
C2: ISO 14001	4.055	3.467	0.199	0.471
C3: ISO 45001	-0.399	3.767	0.831	0.598
C4: ISO 9001 + ISO 14001	**6.805** **	2.374	**0.815* **	0.475
C5: ISO 9001 + ISO 45001	**24.246* **	14.049	**3.195* **	1.668
C6: ISO 14001 + ISO 45001	-0.337	1.892	**0.717* **	0.369
C7: Triple Certification	0.775	1.251	**0.416* **	0.220
Organisational Context				
Consumer Discretionary	-0.181	0.459	-0.013	0.081
Consumer Staples	**-2.035** **	0.976	**-0.355** **	0.173
Energy	-1.136	1.275	**-0.439* **	0.238
Financials	-0.208	0.492	**0.202** **	0.100
Health Care	-1.139	0.724	**-0.346** **	0.138
Industrials	-1.124	0.735	**-0.368** **	0.158
Information Technology	**-1.202* **	0.661	**-0.365** **	0.162
Materials	**-1.075* **	0.549	**-0.349** **	0.160
Real Estate	0.391	0.630	0.084	0.123
Utilities	-0.510	0.647	**-0.230* **	0.135
Europe	0.276	0.418	-0.025	0.045
North America	**1.117*** **	0.290	-0.043	0.055
Company Size	-0.085	0.169	-0.031	0.021
Shareholder Engagement & Treatment				
Shareholders Score	**0.006* **	0.003	0.000	0.001
Robustness				
Constant	-1.494	1.111	0.162	0.108
Number of Observations	12,515		10,798	
Number of Firms	1,393		1,544	
Number of Instruments	46		57	
Wald Chi-Squared	**46,051.843*** **		**7,686.562*** **	
Degrees of Freedom	22		25	
Autoregressive Model (AR1)	**-9.574*** **		**-8.656*** **	
Autoregressive Model (AR2)	1.051		0.342	
Hansen J Statistic	30.741		38.315	
Hansen Test (p-Value)	23.000 (0.129)		31.000 (0.172)	

Explanatory variable categories tested against EV1 category C0 as control category; location variable (CV2) tested against East Asia; industry variable (CV1) tested against communication services. Significances: ***p < 0.01, **p < 0.05, *p < 0.10.

Source: Own elaboration.

For the dividend per share yield (DV2), the following main observations are derived:

- The lagged DY coefficient is 0.923 with strong statistical significance ($p < 0.01$). Similar to ROE, this underlines the strong positive relationship between past and current values of DY, as already depicted in the correlation coefficients in Table 22.
- Concerning the explanatory variables, combining multiple ISO certifications results in statistically significant impact on DY ($p < 0.10$) – regardless their combinations. This suggests that both double certifications as well as triple certification of ISO 9001, ISO 14001, and ISO 45001 influence DY. As for ROE, single certifications do not reveal any statistical significance.
- Whereas location (CV2) and company size (CV3) do not show significant relations to DY, there are multiple significant relationships among industry sectors (CV1) and DY as tested against the reference sector.
- In contrast to the ROE results, the shareholder score (CV4) does not show any significant relationship with DY.

Regarding the robustness of the applied method, the Wald Chi-Squared statistic, Hansen J Statistic, and AR(1) as well as AR(2) p-values are used for testing the validity of the model and the instrumental variables. The p-values for these tests suggest that the models and instruments for both ROE and DY are statistically valid.

In concrete, the Hansen J statistic (Hansen, 1982), a reliable measure for assessing overidentifying restrictions, yields non-significant results. This affirms the assumption of instrument exogeneity. To explore the presence of autocorrelation beyond the fixed effects, the Arellano-Bond test to the second-order correlation, AR(2), is applied. Its outcomes do not provide substantial evidence to question the validity of instruments due to autocorrelation. Notably, there is no compelling indication of serial first-order correlation. The significant nature of AR(1) is an outcome of its design and does not bear relevance to the assessment of model validity. Furthermore, the instruments count (46 for ROE and 57 for DY), which is comparatively smaller than the sample size (12,515 for ROE and 10,798 for DY), does not raise substantial concerns across all evaluated instances.

In course of the hypotheses proposed in section 4.2.3, it can be summarised that the results do not show any statistically significant relationships between single certification and ROE or DY ($p > 0.10$). Thus, H10 as well as H12 are rejected and H11 is confirmed. In regard to multiple certifications, there are significant positive relationships with ROE ($p < 0.05$ and $p < 0.10$, respectively) when combining ISO 9001 with ISO 14001 (H13a) or ISO 45001 (H13c), respectively. In addition, for DY any double certification combination (H13b, H13d, and H13f) as well as the triple certification (H13h) reveal significant positive relations ($p < 0.10$).

In sum, H11 is confirmed and H13 is partially confirmed, while H10 and H12 are rejected. Table 24 gives a tabularised overview on the results in regard to the individual (sub-)hypotheses.

Therefore, the findings negatively answer RQ7, as shareholders do not enjoy any increased financial benefits, as measured by the return on equity and by the dividend per share yield, when their companies operate with ISO-certified QMS, EMS, or OHSMS as single certification. However, the answer to RQ8 is positive (to a certain extent), because the empirical data indeed proves that certain combinations of ISO 9001, ISO 14001, and ISO 45001 lead to statistically significant higher values for ROE and/or DY. This final outcome is visualised in Figure 13.

Table 24. Findings from the Data Panel Analysis

Hypothesis	Certification(s)	FFP	Claim	Confirmation Status
Hypothesis 10 (single certification)				
H10a	ISO 9001	ROE	Positive impact	Rejected
H10b		DY	Positive impact	Rejected
Hypothesis 11 (single certification)				
H11a	ISO 14001	ROE	No impact	Confirmed
H11b		DY	No impact	Confirmed
Hypothesis 12 (single certification)				
H12a	ISO 45001	ROE	Positive impact	Rejected
H12b		DY	Positive impact	Rejected
Hypothesis 13 (double/triple certification)				
H13a	ISO 9001 + ISO 14001	ROE	Positive impact	Confirmed
H13b		DY	Positive impact	Confirmed
H13c	ISO 9001 + ISO 45001	ROE	Positive impact	Confirmed
H13d		DY	Positive impact	Confirmed
H13e	ISO 14001 + ISO 45001	ROE	Positive impact	Rejected
H13f		DY	Positive impact	Confirmed
H13g	ISO 9001 + ISO 14001 + ISO 45001	ROE	Positive impact	Rejected
H13h		DY	Positive impact	Confirmed

Source: Own elaboration.

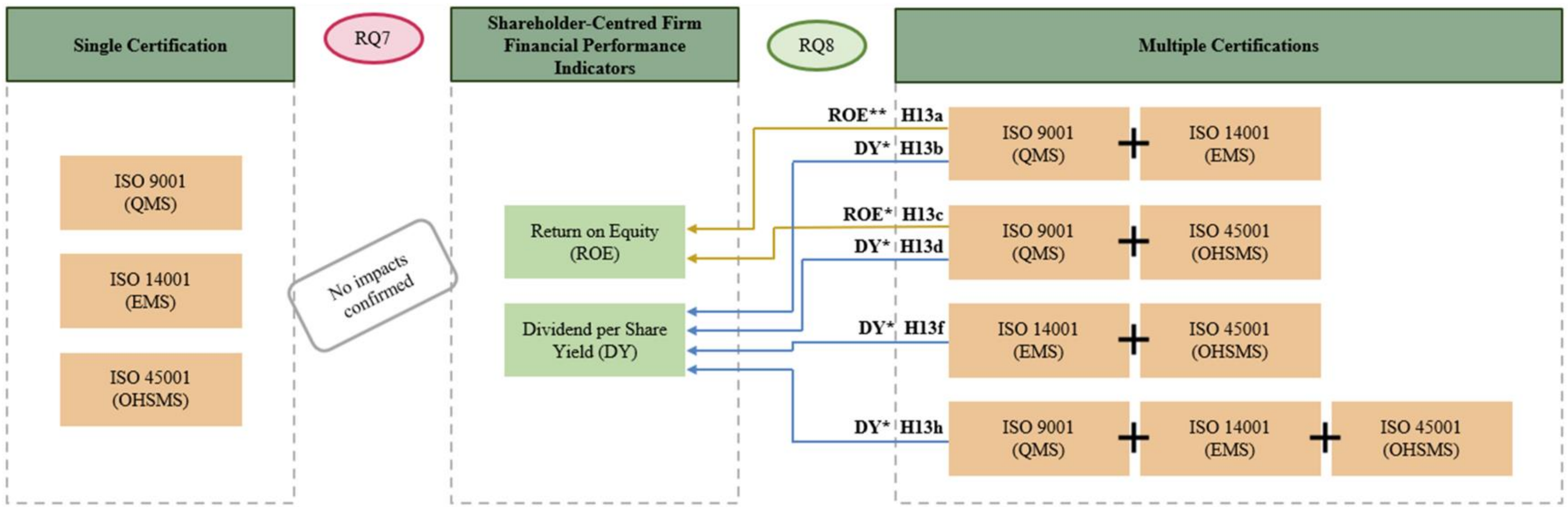


Figure 13. Visualised Results

Note: Significances: ***p < 0.01, **p < 0.05, *p < 0.10.

Source: Own elaboration.

4.5 Conclusions

Based on the thought that management systems and standards are implemented in order to structure and streamline business procedures – which results in more efficiency and profitability (see e.g., Boiral & Heras-Saizarbitoria, 2015; Tarí et al., 2012) –, logical reasoning makes it plausible that such enhanced organisational performance will eventually translate to financial benefits for the companies' owners. Therefore, this study seeks to answer whether operating with the three most widely diffused ISO MSSs – namely ISO 9001 for QMS, ISO 14001 for EMS, and ISO 45001 for OHSMS (ISO, 2022b) – leads to statistically significant higher financial outcomes, as measured by the return on equity as well as the dividend per share yield.

The applied two-step system-GMM model (Arellano & Bover, 1995; Blundell & Bond, 1998) on a balanced dataset for over 1,300 firms spanning a time range of 10 years reveals that single certification of any standard does not lead to higher shareholder-centred FFP variables (RQ7). Despite previous research and reasonable assumptions (see e.g., Hernandez-Vivanco et al., 2019; Siougle et al., 2019; Yang & Maresova, 2020), neither ISO 9001 (H10 rejected) nor ISO 45001 (H12 rejected) have a significant relation to ROE or DY on an individual basis. In turn, the assumed insignificant effect of ISO 14001 certification (see e.g., He et al., 2015; Neves et al., 2023) is validated (H11 confirmed).

In case of double and triple certifications (RQ8), the dividend yield is positively impacted by any set of combination (H13b, H13d, H13f, and H13h confirmed). From the viewpoint of the shareholder theory (Friedman, 1970), this implies that the adoption of multiple certifications indeed represents a tool for executive managers to structure organisational processes in a way that positively impacts the distribution of dividends – and, therefore, eventually benefits the wealth of company owners. Unfortunately, there is yet a lack of comparable studies on DY. In view of ROE, only the simultaneous operation of ISO 9001 with either ISO 14001 (H13a confirmed) or ISO 45001 (H13c confirmed) yields significant benefits, while double certification for EMS and OHSMS (H13e rejected) does not. This supports the viewpoint that ISO 9001 is a relevant driver for firm performance and productive efficiency (see e.g., Hernandez-Vivanco et al., 2019; Hernandez-Vivanco & Bernardo, 2023). However, the positive outperformance of ISO

9001 and ISO 14001 double certification is somewhat contradictory to the findings of Wang and Liu (2023). Furthermore, the finding of triple certification (H13g rejected) not being positively related to ROE is in alignment with previous research, such as the results obtained by de Nadae et al. (2019). This underlines that running more than two MSs is not favourable to all financial key performance indicators of organisations.

Through these conclusions, chapter 4 makes the key contribution that single certification is inferior to operating with numerous different MSs in terms of financial performance relevant for company owners. This allows to derive several managerial as well as academic implications.

4.5.1 Managerial Implications

Based on shareholder theory, which claims firms' primary objective to be the maximisation of their owners' wealth (Friedman, 1970), the results of this study argue that corporate executives should strive for adopting multiple certifications. The set of combinations leading to significantly increased higher ROE and/or DY shown in Figure 13 serves as pathway for managers to fulfil their fiduciary duty of increasing shareholder wealth. Thus, this work motivates firms to capitalise on synergy effects (see e.g., Casadesús et al., 2011; Ferrón-Vílchez & Darnall, 2016) as well as on integration benefits (see e.g., Bernardo et al., 2015) inherent when operating with numerous MSs simultaneously. When adopting new standards, managers should be well aware about integration strategies (see e.g., Karapetrovic & Willborn, 1998; Wang & Liu, 2023) and possible timing issues (see e.g., Yang et al., 2021), albeit this work does not control for these.

4.5.2 Academic Implications

The findings of this study contribute to the ongoing discussion about the impact of MSs on FFP (see e.g., Sampaio et al., 2009; Wang et al., 2016). The negation of a positive relationship between single certifications and FFP (RQ7) might support the viewpoint that performance benefits of certification are offset by the operating costs of MSs (cost of certification, audit costs, etc.) (see e.g., Wang & Mao, 2020).

Further, the positive relation detected between specific combinations of ISO certifications and ROE or DY, respectively, (RQ8) implies that in-detail studies are necessary which shed light on the explicit reasons behind the observed differences. Especially synergy effects and integration impacts should be considered. However, when researching financial impacts of integrated MSs, scholars should consider the maturity in management system integration (see e.g., Poltronieri et al., 2019) rather than simply assuming that companies with multiple certifications operate with an IMS, which, as for now, if often done – refer, for example, to de Nadae et al. (2012) or Wagner and Liu (2023).

Conclusively, this work urges fellow academics to extend their research from looking on individual standards and their impacts on FFP towards a scope that considers all MSs a firm has in operation as well as if these MSs are operated jointly or separately.

4.5.3 Limitations and Future Research

This work faces several limitations. Firstly, the dataset and its specifications impact the findings. For example, the regional scope focuses on rather developed countries, while developing countries – such as from Africa or Latin America – are not included. Further, the size of data points is limited, and for some combinations of ISO certifications the sample size is comparatively small (such as for the EV1 category of ISO 9001 and ISO 45001 double certification). This reduces the results' validity and universal applicability. Also, the study's data sample does neither provide information about the integration level (none, partial or full) (Asif et al., 2010; Bernardo et al., 2017), integration strategy (which MSSs to adopt first) (see e.g., Karapetrovic & Willborn, 1998, Wang & Liu, 2023), nor timing issues (early/late adopters) (Su et al., 2015; Yang et al., 2021). Future investigations should mitigate these issues.

Secondly, this study uses ROE and DY as shareholder-centred indicators. Upcoming research should consider further variables related to shareholder wealth. Such as the share price itself (see e.g., Cañón-de-Francia & Garcés-Ayerbe, 2009; Ferreira et al., 2008) or variables related to firms' profitability (e.g., earnings per share such as Muda and Wahyuni (2019) did) and their capacity to change the capital structure (e.g., free cash flow per share).

Thirdly, the study is intentionally directed at ISO-certified QMS, EMS, and OHSMS. On the one hand, this leaves space to focus on different quality, environmental, and/or organisational health and safety MSSs published by other standardisation bodies. Such alternative standards like IATF 16949:2016 (addresses quality management for automotive manufacturers and their suppliers), EMAS (eco-management and audit scheme), or CAN/CSA Z1000 (Canadian standard for occupational health and safety) will likely come with a specific industrial or regional focus and diffusion pattern, which will further enrich academic knowledge. On the other hand, the research scope could be enlarged to MSSs addressing other operational areas relevant for sustained business success – for example, ISO 31000 for risk management or ISO/IEC 27001 for information security management (see e.g., Ronalter, Poltronieri, & Gerolamo, 2023), but also standards outside the ISO-family like the AA1000 assurance standard, might bear potential.

Future research should consider these limitations and further enhance the ongoing discussion whether – as well as which – management systems do positively impact the financial performance of companies – and, eventually, benefit the firms' owner by maximising their wealth.

CHAPTER 5. ISO MANAGEMENT SYSTEM STANDARDS IN THE LIGHT OF CORPORATE SUSTAINABILITY: A BIBLIOMETRIC ANALYSIS[6]

[6] This chapter has been adapted from Ronalter, Poltronieri, and Gerolamo (2023).

Abstract

This work aims to present existing management system standards published by the International Organization for Standardization through a bibliometric analysis, thereby outlining their academic research status and highlighting their relation to the sustainable development goals as well as to environmental, social, and governance themes.

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 academic 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.

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.

The paper connects the concepts of MSSs and sustainability, an upcoming research branch yet characterised by a shortage of academic studies (given that research continues to focus on only a few standards, such as ISO 9001, ISO 14001, and ISO 45001). Therefore, the work 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 (MSSs); Sustainability; Sustainable Development Goals (SDGs).

5.1 Introduction

Planet Earth greatly suffers from increasing environmental destruction (see e.g., WWF, 2020), and the responsible human race itself faces significant social as well as economic inequalities among its people (see e.g., UNDESA, 2020; UNDP, 2019). To tackle related challenges, in 2015 the United Nations launched a global agenda consisting of 17 sustainable development goals 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 behaviour and strategies (Sachs, 2012)[7].

But measuring a company's corporate sustainability performance 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 disclosure and their SDG footprint (Bekaert et al., 2023; Plastun et al., 2020). Further, the level of SDG commitment and ESG outcomes are viewed as highly correlated (see e.g., Sasaki, 2020), and researchers started to connect SDG targets and indicators to certain ESG variables (see e.g., Delgado-Ceballos et al., 2023). In this spirit, ESG ratings evolved as a measurement tool for firms' CSP (see e.g., Avetisyan & Hockerts, 2017; Rajesh & 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 standardised by applying ESG frameworks[8].

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[7] 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).

[8] The United Nations Conference on Trade and Development (UNCTAD) published the research paper *"Reporting on the Sustainable Development Goals: A Survey of Reporting Indicators"* (UNCTAD, 2018), 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).

The ESG concept itself is linked to numerous stakeholders, such as society, suppliers, employees, and shareholders (La Fuente et al., 2022; Muñoz-Torres et al., 2019), and in the organisational context firms often rely on management systems 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, 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 represents the most important standardisation body. However, only few of its standards are widely diffused (as evidenced in section 5.2.1). 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 5.4). 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, chapter 5 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 chapter 5 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 are answered:

RQ9: How mature is academic research about existing ISO MSSs?

RQ10: 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 RQ9) and applies science mapping of co-occurrences of keywords (directed at RQ10) 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.

Chapter 5 continues in six sections. Section 5.2 provides extensive background information on the topic at hand. Section 5.3 explains the methodology applied. Section 5.4 presents the findings of the bibliometric analyses. Section 5.5 entails the discussion, which derives future research opportunities. Section 5.6 offers the conclusions.

5.2 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.

5.2.1 ISO's Management System Standards

In general, MSSs are voluntary guidelines used by companies to formalise and systematise their managerial activities, and they govern the implementation of MSs (Boiral & Heras-Saizarbitoria, 2015) – such as quality, environmental, or occupational health and safety 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., 2022). These tools can promote comprehensive changes in organisations regarding value creation and sustainable development (see e.g., Sebhatu & Enquist, 2007).

Regarding internationally applicable MSSs, the International Organization for Standardization represents the most important standardisation body. Based in Geneva, Switzerland, ISO acts as independent, non-governmental international organisation 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 7 January 2023, 24,613 international standards are in existence, which cover nearly all aspects related to technology and manufacturing (ISO, 2022a) and that often take into account sustainability-relevant aspects. Table 25 shows the number of ISO standards that are directly applicable to the SDGs according to ISO (2022d) itself.

However, only a few of these ISO standards are MSSs, thus standards for formalising and systematising 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 7 January 2023), see the Appendix. Companies compliant to such MSSs' core elements and requirements can receive corresponding certification, if the standard allows it (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 26, 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 standardisation – 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 5.4, which identifies the research maturity of ISO MSSs based on a set of bibliometric indicators). Nonetheless, chapter 5 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.

Table 25. Number of ISO Standards directly applicable to the SDGs

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

<u>Note:</u> Goal 17 (‘Partnerships for the Goals’) has been excluded in the table since ISO only relates two standards to this goal.

Source: Adapted from ISO (2022d), as of 7 January 2023.

Table 26. Total Number of Valid Certificates for MSSs

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 organisation 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 organisations	157
ISO 44001	Collaborative business relationship management systems - Requirements and framework	136

Note: Only MSSs that are covered by *"The ISO Survey of MSSs Certifications – 2021"* are depicted.

Source: Adapted from ISO (2022b).

5.2.2 Studies on Management Systems and Standards related to SDGs and Firm's ESG Performance

Besides ISO mapping its own standards to the SDGs (refer to Table 25), few detailed research on management systems and standards in the context of SDGs is identified. For example, Carvalho and Fonseca (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. (2023) conclude that ISO 50001 (EnMS) 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 section 5.1). Therefore, empirical studies might use the ESG concept as proxy variable for CSP – and, eventually, SDG achievement – as benefits of MSs implementation can be directly related to corporate sustainability issues mirrored in ESG frameworks[9].

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[9] In this spirit, it should be well noted that different combinations of MSs can lead to different levels of performance (To et al., 2012).

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 (see e.g., Ziegler, 2015) (environmental pillar of the ESG concept), improving product and service quality (see e.g., Tarí et al., 2012) (social pillar), and increasing the commitment of management to best quality practices (see e.g., Arauz & 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, Bernardo, and Romaní (2023), 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 is noteworthy that, albeit there are some academic discussions about how sophisticated MSSs for sustainability-related issues like the circular economy (see e.g., Ronalter et al., 2022) or corporate sustainable development in general (see e.g., Asif & 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 of chapter 5 cannot identify any ESG-related studies with a sole focus on MSSs and their core elements in any major academic database. Therefore, this chapter 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 synthesised in Figure 14.

ISO's Management System Standards

a) Are voluntary guidelines used by companies to formalise and systematise their managerial activities
b) ISO relates its MSSs to the SDGs, if applicable (ISO, 2022d)
c) There are 93 documents/standards for ISO MSSs (ISO, 2022c)
d) Only a few ISO MSSs are widely diffused (ISO, 2022b)
e) Research focuses mainly on the few widely diffused standards

Studies on Management Systems and Standards related to SDGs and Firms' ESG Performance

a) Only a few studies about management systems and standards in relation to SDGs, which are often designed as conceptual works
b) Only a few studies about management systems in relation to the ESG concept, which are often designed as empirical works with a focus on performance

This study presents ISO MSSs currently in place, thereby outlining their academic research status and highlighting their relation to the SDGs as well as to ESG themes.
By doing so, this work enlarges the still small number of studies about management systems and standards in relation to the SDGs and the ESG concept. Further, it encourages fellow scholars to overcome the still apparent focus on the widely diffused standards.

Figure 14. Synthesis of the Literature Review

Source: Own elaboration.

5.3 Methodology

The methodology follows the 3-steps-process visualised in Figure 15. Section 5.3 performs steps 1 and 2 and, further, outlines step 3, whose actual results are presented in section 5.4. The bibliometric analysis eventually leads to the discussion of future research opportunities in section 5.5.

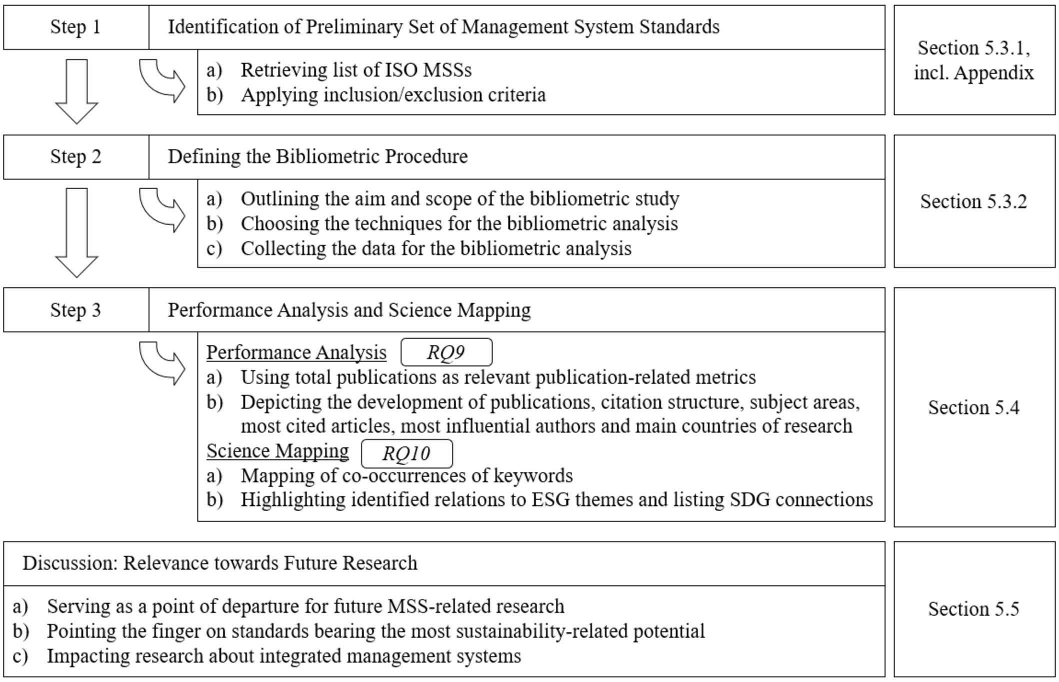


Figure 15. Applied Research Methodology

Source: Own elaboration.

5.3.1 Step 1 – Identification of Preliminary Set of MSSs

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[10]), and

[10] "A Type A MSS contains requirements against which an organisation can claim conformance, whereas a Type B MSS does not. (…) Management Standards (MS) support governance and leadership functions, at all levels." (ISO, 2022c).

if the standard is only applicable for specific sectors (marked as ‘Sector Applicability’) 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.

5.3.2 Step 2 – Defining the Bibliometric Procedure

Bibliometrics basically describes a set of methods that can be used for quantitatively analysing academic literature stored in big bibliographic databases and its changes over time (Cobo et al., 2011; Gutiérrez-Salcedo et al., 2018). Thus, it represents an academic science directed at assessing the research done in any field (Gutiérrez-Salcedo et al., 2018). Since bibliometric procedures serve as objective evaluation criterion, they represent increasingly valued tools among scholars (Gutiérrez-Salcedo et al., 2018; 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., 2018). 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., 2018). 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 chapter intends to explore the maturity of contributions about MSSs (RQ9) as well as the standards' relationships to sustainability (RQ10), both main bibliometric procedures are applied. Thereby, the procedure proposed by Donthu et al. (2021) is followed. These authors propose (i) firstly to define the aim and scope of the bibliometric search, (ii) secondly to choose techniques to be used for the analysis, (iii) thirdly to collect the data, and (iv) fourthly to run the bibliometric analysis and report its findings (task iv is done in step 3, which is depicted in the results section).

(i) 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 (RQ9) and to identify how research about MSSs relates to sustainability (RQ10)[11].

(ii) Regarding performance analysis (directed at RQ9), 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 (directed at RQ10), 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).

[11] 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. However, the time periods of different versions are visualised in the results section.

(iii) 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) in order to identify differences in publication patterns about the MSS itself and the MSS's underlying topic. 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.

5.3.3 Step 3 – Preliminary Explanations on Performance Analysis and Science Mapping

The performance analysis and science mapping are conducted in section 5.4, 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[12], 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 RQ9). 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 visualised – whereby the authors highlight the keywords related to the ESG concept in different colours, based on Thomson Reuters' (2017) ESG framework conception shown in Table 27 – and ISO's (2022d) mapping of the standard's relation to the SDGs is shown (directed at RQ10).

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

[12] 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.

cluster in the visualisation[13]. 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.

Table 27. Thomson Reuters' ESG Framework Conception

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 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.

Source: Adapted from Thomson Reuters (2017).

[13] For the two most widely researched standards, namely ISO 9001 and ISO 14001, keywords must occur at least 5 times to be visualised. For the remaining MSSs, the threshold is reduced to 3. Different variances of a keywords are merged and in the visualisation the denotation of the MSS itself is excluded.

5.4 Findings

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.

5.4.1 Individual Results

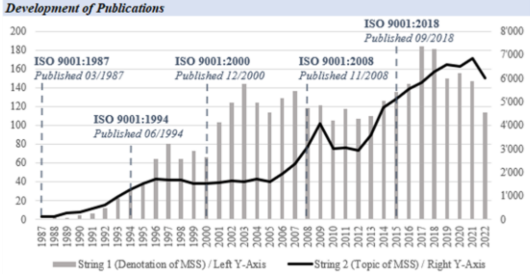
5.4.1.1 ISO 9001

ISO 9001 is not only the most widely diffused ISO MSS (refer to Table 26), 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 visualised in Figure 16 reveals relations to all three ESG pillars. This observation aligns with empirical research on the impact of QMSs on ESG performance (see e.g., Ronalter, Bernardo, & Romaní, 2023).

ISO 9001 - Quality Management Systems

Content: Specifies the requirements for a quality management system when an organization needs to demonstrate its ability to consistently provide products that meet customer and applicable statutory and regulatory requirements, and aims to enhance customer satisfaction and assurance of regulatory requirements.

Development of Publications



String 1: "ISO 9001*" **String 2:** "quality management*"

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Karapetrovic, S.	38	1.1%
Casadesús, M.	36	1.1%
Sampaio, M.	22	0.7%
Santos, G.	17	0.5%
Bernardo, M.	16	0.5%
Average		**0.8%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	44	1.3%
≥ 50 Citations	87	2.6%
≥ 25 Citations	185	5.5%
≤ 25 Citations	3008	89.8%
0 Citations	27	0.8%
Total	**3351**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
United States	322	9.6%
Germany	256	7.6%
Spain	220	6.6%
United Kingdom	149	4.4%
Portugal	127	3.8%
Average		**6.4%**

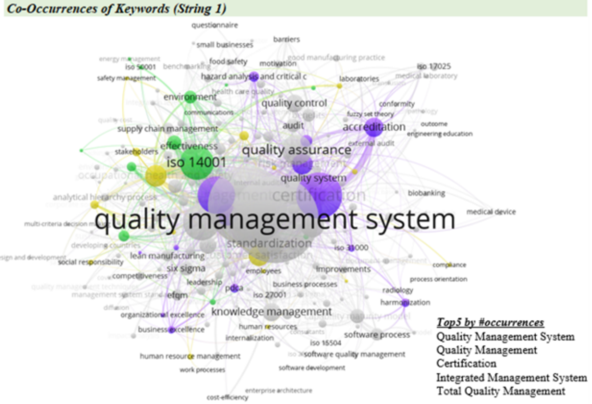
Subject Area (String 1)

Subject	in %
Engineering	24.1%
Business, Management and Acc.	18.9%
Computer Science	7.8%
Decision Science	7.2%
Materials Science	6.3%
Total	**64.3%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Kim, D.-Y., Kumar, V., Kumar, U.	2012	423	Relationship between quality management practices and innovation	Journal of Operations Management
Gates-Rector, S., Blanton, T.	2019	422	The Powder Diffraction File: a quality materials characterization database	Powder Diffraction
Sadikoglu, E., Zehir, C.	2010	404	Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance	International Journal of Production Economics
Robinson, C.J., Malhotra, M.K.	2005	365	Defining the concept of supply chain quality management and its relevance to academic and industrial practice	International Journal of Production Economics
Heras-Saizarbitoria, I., Boiral, O.	2013	303	ISO 9001 and ISO 14001: Towards a Research Agenda on Management System Standards	International Journal of Management Reviews

Co-Occurrences of Keywords (String 1)



Top5 by #occurrences
Quality Management System
Quality Management
Certification
Integrated Management System
Total Quality Management

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

Contributions to the SDGs according to ISO

Figure 16. Bibliometric Overview on ISO 9001

Source: Own elaboration.

5.4.1.2 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 is possible). Further, Figure 17 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 27).

Figure 17. Bibliometric Overview on ISO 10377

Source: Own elaboration.

5.4.1.3 ISO 10393

This standard about consumer product recall has been published in 2013, and there has been no research about the standard yet. Figure 18 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 27).

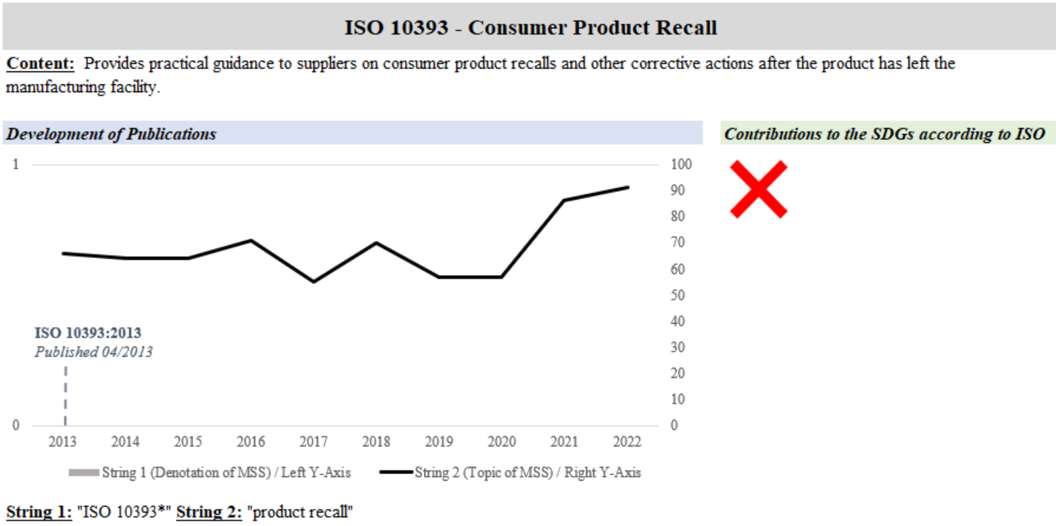


Figure 18. Bibliometric Overview on ISO 10393

Source: Own elaboration.

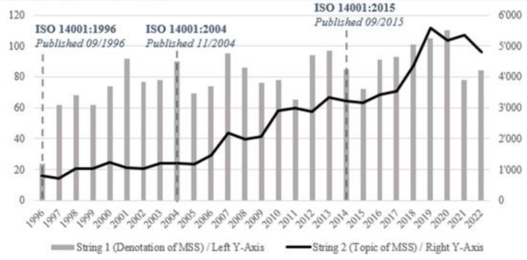
5.4.1.4 ISO 14001

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 26). In accordance, research maturity is high. The topic of environmental management shows increasing academic publications in the past two decades – as visualised in Figure 19. 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 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 (see e.g., Ronalter, Bernardo, & Romaní, 2023).

ISO 14001 - Environmental Management Systems

Content: Specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance and to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability.

Development of Publications



String 1: "ISO 14001*" **String 2:** "environmental management*"

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Karapetrovic, S.	24	1.1%
Casadesús, M.	24	1.1%
Heras-Saizarbitoria, I.	21	1.0%
Bernardo, M.	14	0.6%
Iraldo, F.	14	0.6%
Average		**0.9%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	130	6.0%
≥ 50 Citations	158	7.2%
≥ 25 Citations	168	7.7%
≤ 25 Citations	1001	45.9%
0 Citations	723	33.2%
Total	**2180**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
United States	360	16.5%
Spain	159	7.3%
Brazil	126	5.8%
United Kingdom	125	5.7%
Malaysia	110	5.0%
Average		**8.1%**

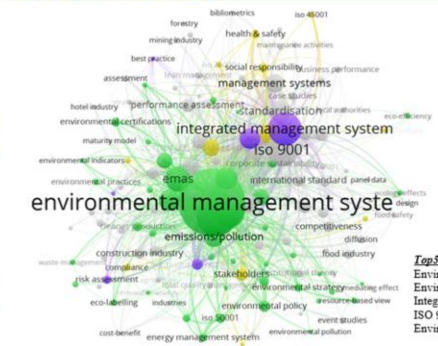
Subject Area (String 1)

Subject	in %
Engineering	19.1%
Environmental Science	18.5%
Business, Management and Acc.	17.6%
Social Sciences	8.4%
Energy	7.9%
Total	**71.5%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Melnyk, S.A., Sroufe, R.P., Calantone, R.	2003	876	Assessing the impact of environmental management systems on corporate and environmental performance	Journal of Operations Management
Delmas, M.A., Toffel, M.W.	2008	628	Organizational responses to environmental demands: Opening the black box	Strategic Management Journal
King, A.A., Lenox, M.J., Terlaak, A.	2005	579	The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard	Academy of Management Journal
Hillary, R.	2004	533	Environmental management systems and the smaller enterprise	Journal of Cleaner Production
Eltayeb, T.K., Zailani, S., Ramayah, T.	2011	500	Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes	Resources, Conservation and Recycling

Co-Occurrences of Keywords (String 1)



Top5 by #occurrences
Environmental Management System
Environmental Management
Integrated Management System
ISO 9001
Environmental Performance

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

Contributions to the SDGs according to ISO

Figure 19. Bibliometric Overview on ISO 14001

Source: Own elaboration.

5.4.1.5 ISO 16000-40

Although the topic of indoor air quality shows growing publication numbers in academia according to Figure 20, 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 (see ‘workforce’ theme in Table 27).

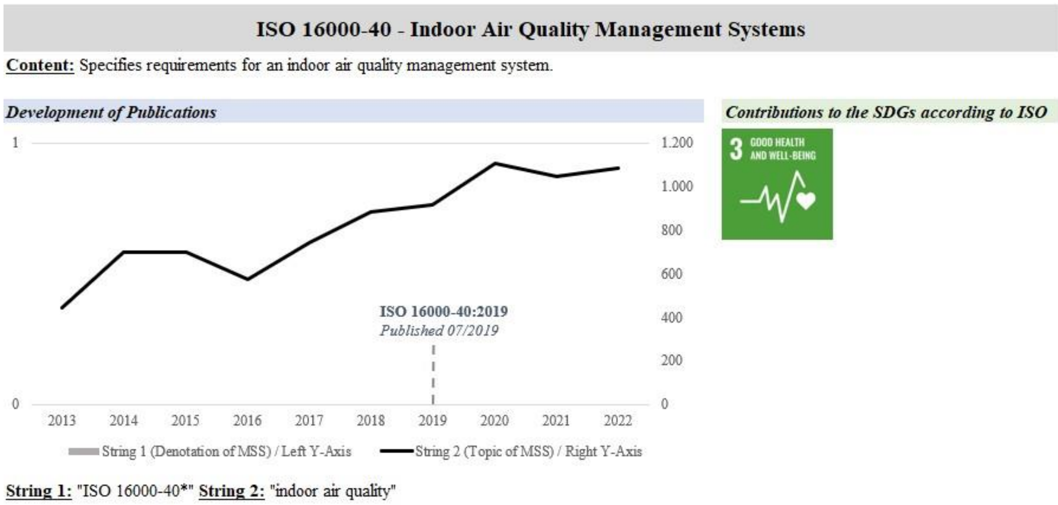


Figure 20. Bibliometric Overview on ISO 16000-40

Source: Own elaboration.

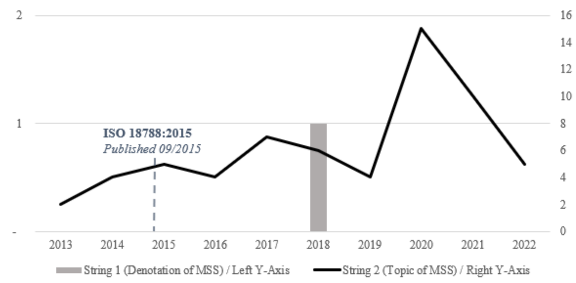
5.4.1.6 ISO 18788

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 21 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).

ISO 18788 - Management Systems for Private Security Operations

Content: Provides a framework for establishing, implementing, operating, monitoring, reviewing, maintaining and improving the management of security operations.

Development of Publications



Contributions to the SDGs according to ISO

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

Publication (String 1)

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

Figure 21. Bibliometric Overview on ISO 18788

Source: Own elaboration.

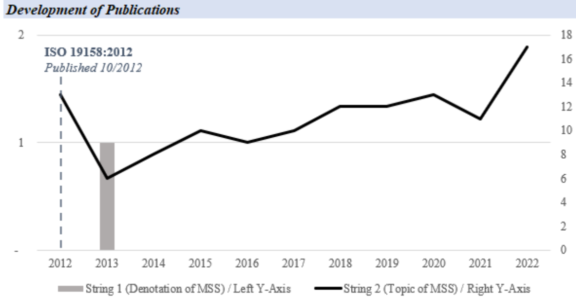
5.4.1.7 ISO 19158

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 22. ISO states that the standard is related to industry, innovation, and infrastructure (SDG 9).

ISO 19158 - Geographic Information

Content: Provides a framework for quality assurance specific to geographic information. Enables a customer to satisfy itself that its suppliers, both internal and external, are capable of delivering geographic information to the required quality.

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 19158*" **String 2:** ["geographic information" AND "quality assurance"]

Publication (String 1)

Authors	Year	#Citations	Title	Journal
Jakobsson, A., Hopfstock, A., Beare, M., Patrucco, R.	2013	2	Quality management of reference geo-information	ISPRS Archives

Figure 22. Bibliometric Overview on ISO 19158

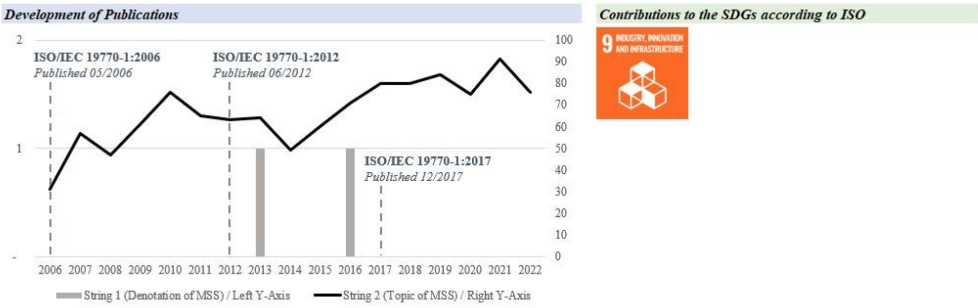
Source: Own elaboration.

5.4.1.8 ISO/IEC 19770-1

This ISO standard about IT asset management is in existence since 2006. However, Figure 23 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).

ISO/IEC 19770-1 - IT Asset Management Systems

Content: Specifies requirements for an IT asset management system within the context of the organization.



String 1: "ISO/IEC 19770*" **String 2:** ["IT asset management*" OR "IT assets" OR "managing IT"]

Publications (String 1)

Authors	Year	#Citations	Title	Journal
Waedt, K., Ciriello, A., Parekh, M., Bajramovic, E.	2016	15	Automatic assets identification for Smart Cities: Prerequisites for cybersecurity risk assessments	IEEE 2nd International Smart Cities Conference - Proceedings
Albert, B.E., Dos Santos, R.P., Werner, C.M.	2013	8	Software ecosystems governance to enable IT architecture based on software asset management	IEEE International Conference on Digital Ecosystems and Technologies

Figure 23. Bibliometric Overview on ISO/IEC 19770-1

Source: Own elaboration.

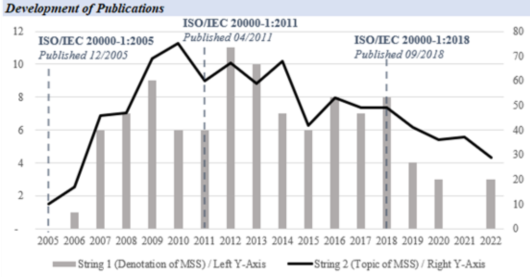
5.4.1.9 ISO/IEC 20000-1

ISO/IEC 20000-1 specifies requirements for IT service management systems (ITSMS), a topic with decreasing publications in the past ten years according to Figure 24. In accordance, also publications about the standard are decreasing. In general, 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’.

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.

Development of Publications



String 1: "ISO/IEC 20000*" **String 2:** "IT service management*"

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Cater-Steel, A.	16	15.7%
Barafort, B.	1	1.0%
Toleman, M.	1	1.0%
Mas, A.	9	8.8%
Mesquida, A.L.	9	8.8%
Average		**7.1%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	0	0.0%
≥ 50 Citations	2	2.0%
≥ 25 Citations	5	4.9%
≤ 25 Citations	72	70.6%
0 Citations	23	22.5%
Total	**102**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Australia	17	16.7%
Luxembourg	15	14.7%
Spain	15	14.7%
Germany	14	13.7%
United States	9	8.8%
Average		**13.7%**

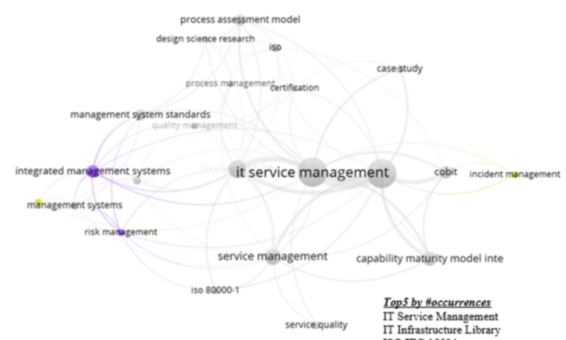
Subject Area (String 1)

Subject	in %
Computer Science	48.5%
Mathematics	18.1%
Business, Management and Acc.	8.8%
Engineering	8.2%
Decision Sciences	6.4%
Total	**90.0%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Winniford, M., Conger, S., Erickson-Harris, L.	2009	91	Confusion in the ranks: IT service management practice and terminology	Information Systems Management
Willson, P., Pollard, C.	2009	72	Exploring IT governance in theory and practice in a large multi-national organisation in Australia	Information Systems Management
Barafort, B., Mesquida, A.-L., Mas, A.	2017	49	Integrating risk management in IT settings from ISO standards and management systems perspectives	Computer Standards and Interfaces
Barafort, B., Renault, A., Picard, M., Cortina, S.	2008	47	A transformation process for building PRMs and PAMs based on a collection of requirements - Example with ISO/IEC 20000	8th Int. SPICE Conference on Software Process Improv. and Capability Determination
Melendez, K., Dávila, A., Pessoa, M.	2016	30	Information technology service management models applied to medium and small organizations: A systematic literature review	Computer Standards and Interfaces

Co-Occurrences of Keywords (String 1)



Top5 by #occurrences
IT Service Management
IT Infrastructure Library
ISO/IEC 15504
Service Management
Capability Maturity Model Integration

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

Contributions to the SDGs according to ISO

Figure 24. Bibliometric Overview on ISO/IEC 20000-1

Source: Own elaboration.

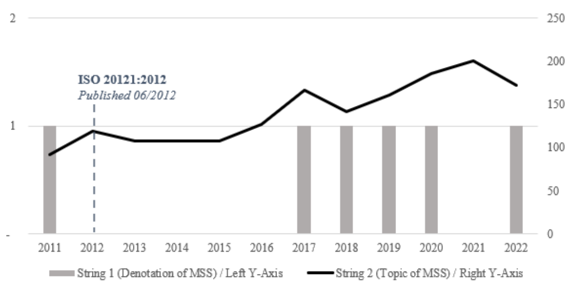
5.4.1.10 ISO 20121

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 25, only six articles deal 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.

ISO 20121 - Event Sustainability Management Systems

Content: Specifies requirements for an event sustainability management system for any type of event or event-related activity, and provides guidance on conforming to those requirements.

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 20121*" **String 2:** ["event management*" OR "event sustainability management*"]

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Toniolo, S., Mazzi, A., Fedele, A., Aguiari, F., Scipioni, A.	2017	20	Life Cycle Assessment to support the quantification of the environmental impacts of an event	Environmental Impact Assessment Review
Musgrave, J., Pelham, F.	2011	20	Will sustainability change the business model of the event industry?	Worldwide Hospitality and Tourism Themes
Arfò, S., Matarazzo, A., Patrizia Saccone, A.	2020	2	ISO 20121 Applied to Taomoda®Week for the Enhancement of Territorial Resources Towards the Circular Economy	Procedia Environmental Science, Engineering and Management
Sánchez-Hervás, D., Martinez, S.H.	2022	0	Acts and sustainable events in the most responsible organizations in Spain	Human Review. International Humanities Review
Machado, A., Vareiro, L., Sousa, B., Figueira, V., Lavandoski, J.	2022	0	Green Marketing Trends in Specific Contexts of Tourism and Music Festivals: Preliminary Insights	Smart Innovation, Systems and Technologies

Figure 25. Bibliometric Overview on ISO 20121

Note: Since the most cited article was published in the year before the publication of the standard, the depicted timeline has been enlarged.

Source: Own elaboration.

5.4.1.11 ISO 22301

The recent Covid-19 pandemic depicted clearly the importance of business continuity management as governance principle (see e.g., Fabeil et al., 2020; Le & 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 26. ISO relates the standard to six different SDGs, and the science mapping visualises that the few research articles about the standard already indicate its strong governance relationship.

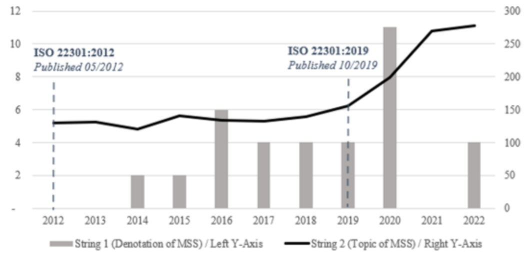
5.4.1.12 ISO 26000

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 this standard for social responsibility management systems (SRMS) appears to be stagnating – see Figure 27. With 224 publications about the standard since 2010, a medium research maturity can be derived. Further, the large number of related SDGs and the outcomes of the science mapping reveal a strong sustainability relationship of the standard.

ISO 22301 - Business Continuity Management Systems

Content: Specifies requirements to implement, maintain and improve a management system to protect against, reduce the likelihood of the occurrence of, prepare for, respond to and recover from disruptions when they arise.

Development of Publications



String 1: "ISO 22301*" **String 2:** ["business continuity" OR "corporate resilience" OR "corporate recovery"]

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Păunescu, C.	3	8.1%
Bakar, Z.A.	2	5.4%
Bogdanovic, Z.	2	5.4%
Bruzza, M.	2	5.4%
Despotovic-Zrakic, M	2	5.4%
Average		**5.9%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	0	0.0%
≥ 50 Citations	0	0.0%
≥ 25 Citations	0	0.0%
≤ 25 Citations	23	62.2%
0 Citations	14	37.8%
Total	**37**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Indonesia	4	10.8%
Greece	3	8.1%
Malaysia	3	8.1%
Romania	3	8.1%
Russia	3	8.1%
Average		**8.6%**

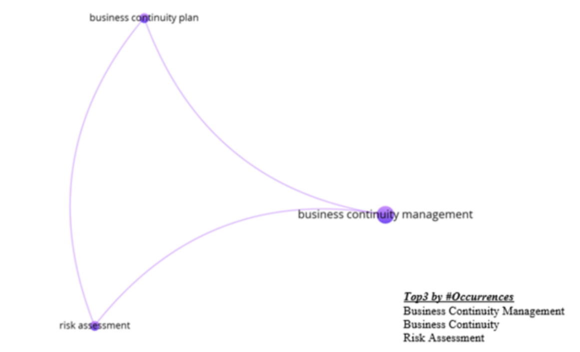
Subject Area (String 1)

Subject	in %
Engineering	19.1%
Computer Science	16.2%
Business, Management and Acc.	13.2%
Energy	7.4%
Mathematics	7.4%
Total	**63.3%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Păunescu, C., Popescu, M.C., Blid, L.	2018	12	Business impact analysis for business continuity: Evidence from Romanian enterprises on critical functions	Management and Marketing
Bakar, Z.A., Yaacob, N.A., Udin, Z.M.	2015	12	The effect of business continuity management factors on organizational performance: A conceptual framework	International Journal of Economics and Financial Issues
Suresh, N., Sanders, G.L., Braunscheidel, M.J.	2020	11	Business Continuity Management for Supply Chains Facing Catastrophic Events	IEEE Engineering Management Review
Păunescu, C., Argatu, R.	2020	11	Critical functions in ensuring effective business continuity management. Evidence from romanian Rompanies	Journal of Business Economics and Management
Ee, H.	2014	8	Business continuity 2014: From traditional to integrated Business Continuity Management	Journal of business continuity & emergency planning

Co-Occurrences of Keywords (String 1)



Top3 by #Occurrences
Business Continuity Management
Business Continuity
Risk Assessment

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

Contributions to the SDGs according to ISO

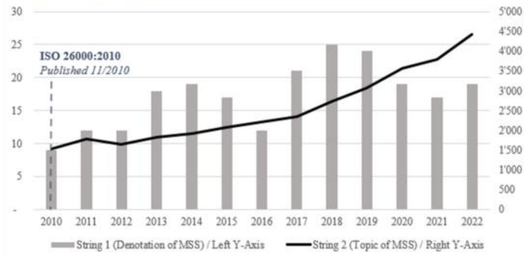
Figure 26. Bibliometric Overview on ISO 22301

Source: Own elaboration.

ISO 26000 - Social Responsibility

Content: Intends to assist organizations in contributing to sustainable development. It is intended to encourage them to go beyond legal compliance, recognizing that compliance with law is a fundamental duty of any organization and an essential part of their social responsibility.

Development of Publications



String 1: "ISO 26000*" **String 2:** "social responsibility"

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Castka, P.	8	3.6%
Moratis, L.	7	3.1%
Balzarova, M.A.	6	2.7%
Mulej, M.	5	2.2%
Zhao, W.	5	2.2%
Average		**2.8%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	7	3.1%
≥ 50 Citations	13	5.8%
≥ 25 Citations	32	14.3%
≤ 25 Citations	122	54.5%
0 Citations	50	22.3%
Total	**224**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
United States	19	8.5%
Spain	18	8.0%
United Kingdom	16	7.1%
China	15	6.7%
Canada	11	4.9%
Average		**7.1%**

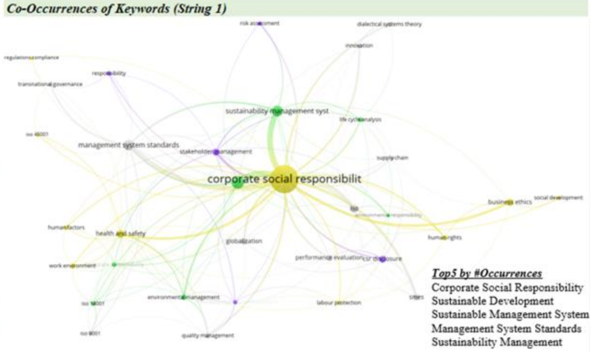
Subject Area (String 1)

Subject	in %
Business, Management and Acc.	19.1%
Social Sciences	16.2%
Engineering	13.2%
Environmental Science	7.4%
Economics, Econometrics and Fin.	7.4%
Total	**63.3%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Castka, P., Balzarova, M.A.	2008	185	ISO 26000 and supply chains-On the diffusion of the social responsibility standard	International Journal of Production Economics
Calabrese, A., Costa, R., Levialdi, N., Menichini, T.	2019	138	Integrating sustainability into strategic decision-making: A fuzzy AHP method for the selection of relevant sustainability issues	Technological Forecasting and Social Change
Benoît-Norris, C., Vickery-Niederman, G., Valdivia, S., (...), Ciroth, A., Mazijn, B.	2011	134	Introducing the UNEP/SETAC methodological sheets for subcategories of social LCA	International Journal of Life Cycle Assessment
Hahn, R.	2013	130	ISO 26000 and the standardization of strategic management processes for sustainability and corporate social responsibility	Business Strategy and the Environment
Helms, W.S., Oliver, C., Web, K.	2012	106	Antecedents of settlement on a new institutional practice: Negotiation of the ISO 26000 standard on social responsibility	Academy of Management Journal

Co-Occurrences of Keywords (String 1)



Top5 by #Occurrences
Corporate Social Responsibility
Sustainable Development
Sustainable Management System
Management System Standards
Sustainability Management

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

Contributions to the SDGs according to ISO

Figure 27. Bibliometric Overview on ISO 26000

Source: Own elaboration.

5.4.1.13 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 28, 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 27). Further, some governance-related keywords are shown in the science mapping such as 'best practices' (see 'management' theme in Table 27).

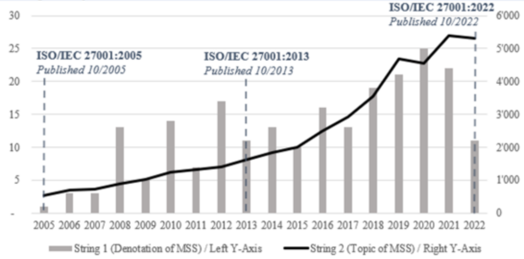
5.4.1.14 ISO 28000

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 29, 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 four keywords, out of which 'risk assessment' can be interpret as governance related.

ISO/IEC 27001 - Information Security Management Systems

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

Development of Publications



String 1: "ISO/IEC 27001*" **String 2:** ("information security" OR "cyber security")

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Piattini, M.	9	4.0%
Barafort, B.	8	3.6%
Mellado, D.	7	3.1%
Fernández-Medina, E.	6	2.7%
Mas, A.	6	2.7%
Average		**3.2%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	0	0.0%
≥ 50 Citations	2	0.9%
≥ 25 Citations	5	2.2%
≤ 25 Citations	148	66.1%
0 Citations	69	30.8%
Total	**224**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Indonesia	22	9.8%
Spain	22	9.8%
Germany	19	8.5%
Portugal	13	5.8%
Luxembourg	10	4.5%
Average		**7.7%**

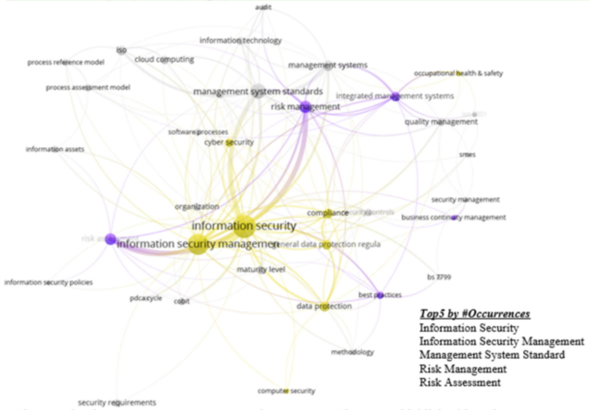
Subject Area (String 1)

Subject	in %
Computer Science	39.4%
Engineering	15.9%
Decision Science	11.7%
Business, Management and Acc.	9.3%
Social Sciences	7.0%
Total	**83.3%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Julisch, K., Hall, M.	2010	61	Security and control in the cloud	Information Security Journal
Rebelo, M., Santos, G., Silva, R.	2014	54	Conception of a flexible integrator and lean model for integrated management systems	Total Quality Management and Business Excellence
Barafort, B., Mesquida, A.-L., Mas, A.	2017	49	Integrating risk management in IT settings from ISO standards and management systems perspectives	Computer Standards and Interfaces
Fenz, S., Goluch, G., Ekelhart, A., Riedl, B., Weippl, E.	2007	47	Information security fortification by ontological mapping of the ISO/IEC 27001 standard	Proceedings - 13th Pacific Rim International Symposium on Dependable Computing
Mellado, D., Fernández-Medina, E., Piattini, M.	2010	35	Security requirements engineering framework for software product lines	Information and Software Technology

Co-Occurrences of Keywords (String 1)



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

Contributions to the SDGs according to ISO

❌

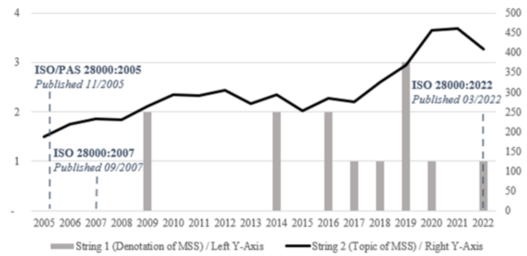
Figure 28. Bibliometric Overview on ISO/IEC 27001

Source: Own elaboration.

ISO 28000 - Security Management Systems

Content: Specifies requirements for a security management system, including aspects relevant to the supply chain.

Development of Publications



String 1: "ISO 28000*" **String 2:** "security management"

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Sorooshian, S.	3	23.1%
Chin, C.Y.	2	15.4%
Ing, W.H.	2	15.4%
Zimon, D.	1	7.7%
Blos, M.F.	1	7.7%
Average		**13.8%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	0	0.0%
≥ 50 Citations	0	0.0%
≥ 25 Citations	1	7.7%
≤ 25 Citations	8	61.5%
0 Citations	4	30.8%
Total	**13**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Malaysia	3	23.1%
Greece	2	15.4%
Italy	2	15.4%
Australia	1	7.7%
Brazil	1	7.7%
Average		**13.8%**

Subject Area (String 1)

Subject	in %
Computer Sciences	22.2%
Engineering	22.2%
Business, Management and Acc.	18.5%
Decision Sciences	18.5%
Social Sciences	11.1%
Total	**92.5%**

Co-Occurrences of Keywords (String 1)

Top4 by #Occurrences
Supply Chain Management
Risk Assessment
Security Management
Critical Infrastructure

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

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Zimon, D., Madzik, P.	2020	35	Standardized management systems and risk management in the supply chain	International Journal of Quality and Reliability Management
Blos, M.F., Hoeflich, S.L., Dias, E.M., Wee, H.-M.	2016	11	A note on supply chain risk classification: Discussion and proposal	International Journal of Production Research
Islam, D.M.Z., Zunder, T.H.	2014	10	The necessity for a new quality standard for freight transport and logistics in Europe	European Transport Research Review
Sapori, E., Sciutto, M., Sciutto, G.	2014	9	A quantitative approach to risk management in critical infrastructures	Transportation Research Procedia
Hermoso-Orzáez, M.J., Garzón-Moreno, J.	2022	5	Risk management methodology in the supply chain: a case study applied	Annals of Operations Research

Contributions to the SDGs according to ISO

Figure 29. Bibliometric Overview on ISO 28000

Source: Own elaboration.

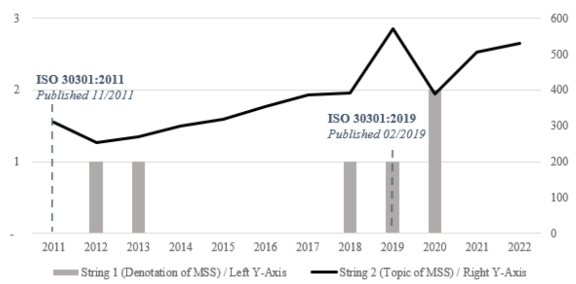
5.4.1.15 ISO 30301

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 30, the standard can be related to industry, innovation, and infrastructure (SDG 9).

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.

Development of Publications



Contributions to the SDGs according to ISO

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

Figure 30. Bibliometric Overview on ISO 30301

Source: Own elaboration.

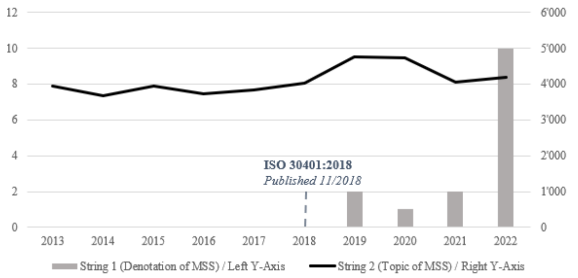
5.4.1.16 ISO 30401

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 31 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).

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.

Development of Publications



Contributions to the SDGs according to ISO

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

Top5 Publications by #Citations (String 1)

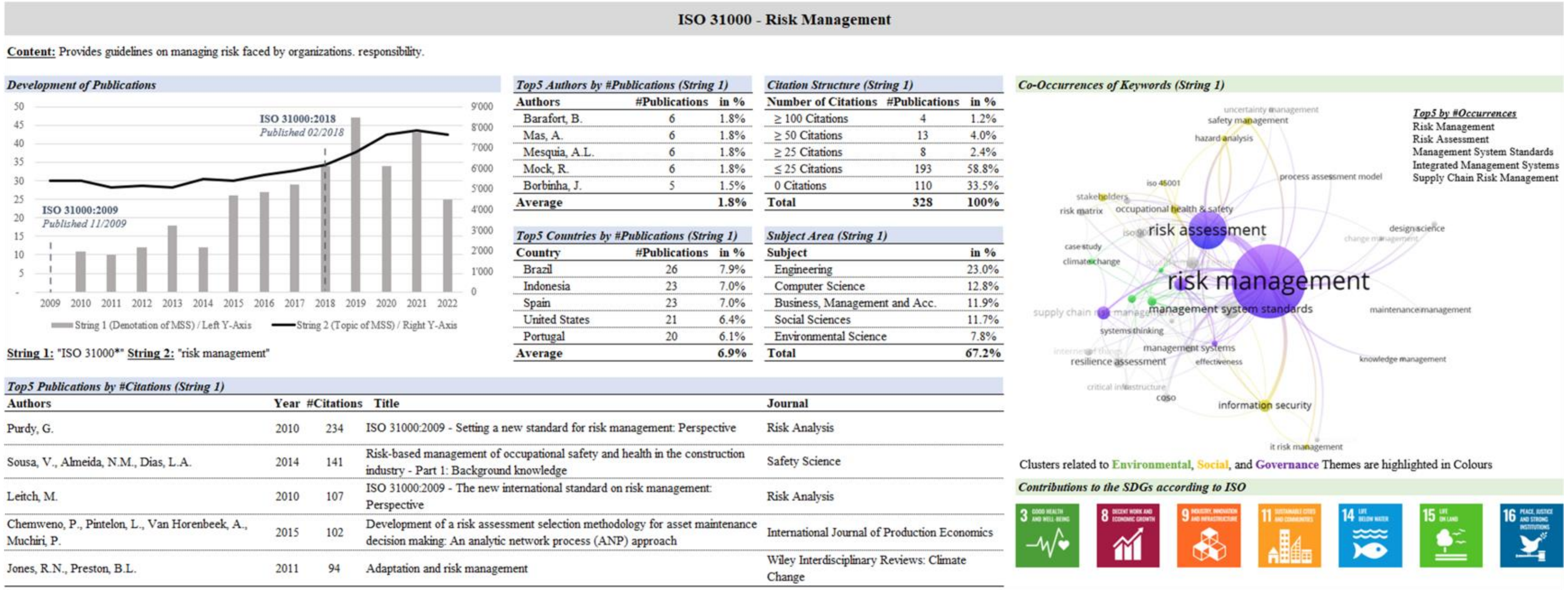
Authors	Year	#Citations	Title	Journal
Pawlowsky, P., Pflugfelder, N.S., Wagner, M.H.	2021	11	The ISO 30401 knowledge management systems standard – a new framework for value creation and research?	Journal of Intellectual Capital
Kudryavtsev, D., Sadykova, D.	2019	9	Towards architecting a knowledge management 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., Khamaksorn, 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

Figure 31. Bibliometric Overview on ISO 30401

Source: Own elaboration.

5.4.1.17 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 32 depicts that by now the standard only has been researched to a medium extent.



Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Barafort, B.	6	1.8%
Mas, A.	6	1.8%
Mesquia, A.L.	6	1.8%
Mock, R.	6	1.8%
Borbinha, J.	5	1.5%
Average		**1.8%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	4	1.2%
≥ 50 Citations	13	4.0%
≥ 25 Citations	8	2.4%
≤ 25 Citations	193	58.8%
0 Citations	110	33.5%
Total	**328**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Brazil	26	7.9%
Indonesia	23	7.0%
Spain	23	7.0%
United States	21	6.4%
Portugal	20	6.1%
Average		**6.9%**

Subject Area (String 1)

Subject	in %
Engineering	23.0%
Computer Science	12.8%
Business, Management and Acc.	11.9%
Social Sciences	11.7%
Environmental Science	7.8%
Total	**67.2%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Purdy, G.	2010	234	ISO 31000:2009 - Setting a new standard for risk management: Perspective	Risk Analysis
Sousa, V., Almeida, N.M., Dias, L.A.	2014	141	Risk-based management of occupational safety and health in the construction industry - Part 1: Background knowledge	Safety Science
Leitch, M.	2010	107	ISO 31000:2009 - The new international standard on risk management: Perspective	Risk Analysis
Chemweno, P., Pintelon, L., Van Horenbeek, A., Muchiri, P.	2015	102	Development of a risk assessment selection methodology for asset maintenance decision making: An analytic network process (ANP) approach	International Journal of Production Economics
Jones, R.N., Preston, B.L.	2011	94	Adaptation and risk management	Wiley Interdisciplinary Reviews: Climate Change

Figure 32. Bibliometric Overview on ISO 31000

Source: Own elaboration.

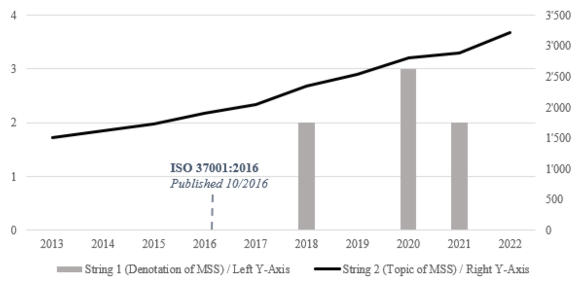
5.4.1.18 ISO 37001

In 2016, ISO published a standard about anti-bribery management systems – a topic 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 33, 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 enabler of increased governance structures around anti-bribery.

ISO 37001 - Anti-Bribery Management Systems

Content: Specifies requirements and provides guidance for establishing, implementing, maintaining, reviewing and improving an anti-bribery management system.

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 37001*" **String 2:** ["anti-bribery" OR "bribery" OR "corruption"]

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Veselovská, L., Závadský, J., Závadská, Z.	2020	6	Mitigating bribery risks to strengthen the corporate social responsibility in accordance with the ISO 37001	Corporate Social Responsibility and Environmental Management
Cardoni, A., Kiseleva, E., De Luca, F.	2020	4	Continuous auditing and data mining for strategic risk control and anticorruption: Creating "fair" value in the digital age	Business Strategy and the Environment
Haron, H., Ismail, I., Ibrahim, D.N., (...), Abdullah, A., Gui, A.	2018	2	The Development of Anti Bribery Management System: A Preliminary Study	Proceedings of 2018 International Conference on Information
Méan, J.-P., Gehring, H.	2018	2	Implementing ISO 37001 to manage your Bribery Risks	Global Trade and Customs Journal
Peltier-Rivest, D.	2020	1	Corruption at Rolls-Royce: can it happen again?	Journal of Financial Crime

Figure 33. Bibliometric Overview on ISO 37001

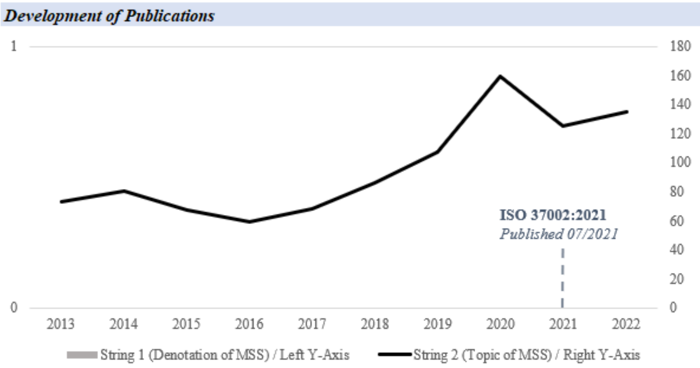
Source: Own elaboration.

5.4.1.19 ISO 37002

Closely related to the topic of bribery/corruption, ISO 37002 deals with the issue of whistleblowing. Despite Figure 34 showing less academic attention for this issue, ISO relates the standard to the same SDGs as ISO 37001 (i.e., SDGs 8, 11, and 16), and the topic itself can clearly be related to the governance pillar.

ISO 37002 - Whistleblowing Management Systems

Content: Gives guidelines for establishing, implementing and maintaining an effective whistleblowing management system based on the principles of trust, impartiality and protection.



String 1: "ISO 37002*" **String 2:** "whistleblowing"

Figure 34. Bibliometric Overview on ISO 37002

Source: Own elaboration.

5.4.1.20 ISO 37101

ISO 37101 is titled *"Sustainable development in communities – Management system for sustainable development – Requirements with guidance for use"* 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 visualised in Figure 35, the topic itself receives an increasing number of publications. However, the standard itself has not been research yet since its publication in 2016.

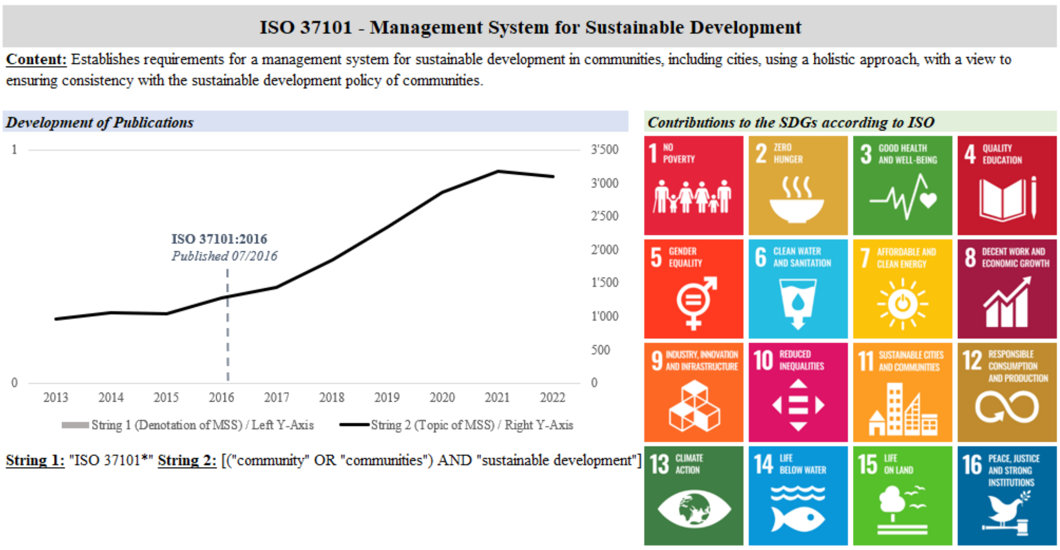


Figure 35. Bibliometric Overview on ISO 37101

Source: Own elaboration.

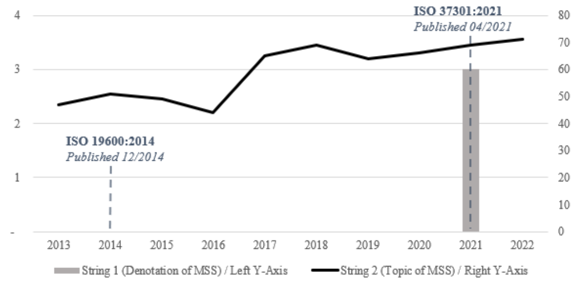
5.4.1.21 ISO 37301

The standard deals with the governance-issue of compliance management systems. As visible in Figure 36, 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.

ISO 37301 - Compliance Management Systems

Content: Specifies requirements and provides guidelines for establishing, developing, implementing, evaluating, maintaining and improving an effective compliance management system within an organization.

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 37301*" OR "ISO 19600*" **String 2:** ["compliance management*" OR "compliance system" OR "business compliance" OR "corporate compliance"]

Publications (String 1)

Authors	Year	#Citations	Title	Journal
Kwong, C.W., Mak, S.L., Li, C.H.	2021	1	Evaluation of the tactics for small- and medium-sized toy factories in China to deal with European and US toy safety requirements	International Journal of Engineering Business Management
Kwong, C.W., Mak, S.L., Li, C.H.	2021	0	Effectiveness of the Tactics for Small and Medium-sized Toy Factories in China in Dealing with European and US Toy Safety Req.	2021 International Conference on Industrial Engineering and Eng. Man.
Westhausen, H.-U.	2021	0	About the calculation of the compliance value and its practical relevance	Ekonomika

Figure 36. Bibliometric Overview on ISO 37301

Source: Own elaboration.

5.4.1.22 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 37.

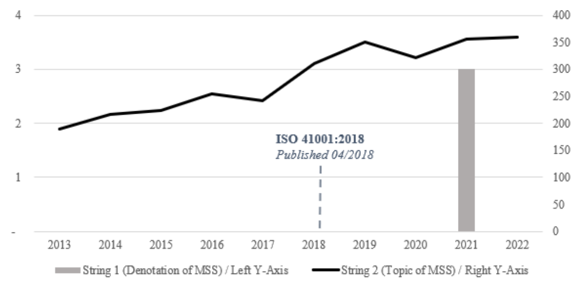
5.4.1.23 ISO 44001

ISO 44001 about collaborative business relationship management systems has only been considered in one publication listed in Scopus – see Figure 38. 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 25).

ISO 41001 - Facility Management Systems

Content: Specifies requirements for a facility management system.

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 41001*" **String 2:** ["facility management*" OR "facilities management*"]

Publications (String 1)

Authors	Year	#Citations	Title	Journal
Dzulkifli, N., Sarbini, N.N., Ibrahim, I.S., (...), Yahaya, F.M., Nik Azizan, N.Z.	2021	8	Review on maintenance issues toward building maintenance management best practices	Journal of Building Engineering
Martínez Beltrán, E., Capuz Rizo, S.	2021	0	Normative and bibliographic analysis on facility management focused on construction project management	Proceedings from the Int. Congress on Project Management and Engineering
Kaur, T. and Solomon, P.	2021	0	Sustainability in the new remote and hybrid worlds of work: Reduced workspace usage impacts in Indian technology firms	Strategic Direction

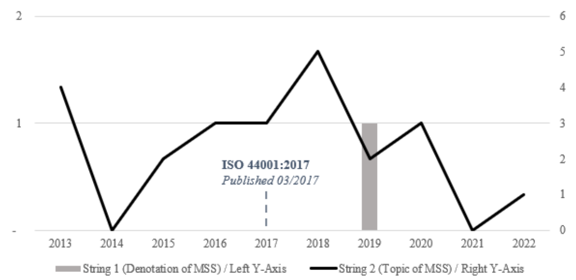
Figure 37. Bibliometric Overview on ISO 41001

Source: Own elaboration.

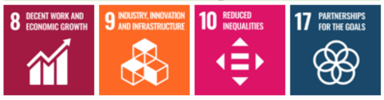
ISO 44001 - Collaborative Business Relationship Management Systems

Content: Specifies requirements for the effective identification, development and management of collaborative business relationships within or between organizations.

Development of Publications



Contributions to the SDGs according to ISO



String 1: "ISO 44001*" **String 2:** ["business relationship management*" OR "collaborative business relationship*"]

Publication (String 1)

Authors	Year	#Citations	Title	Journal
Shelton, K.H., Merchant, C., Lynch, J.	2020	1	The Adopting Together Service: how innovative collaboration is meeting the needs of children in Wales waiting the longest to find a family	Adoption and Fostering

Figure 38. Bibliometric Overview on ISO 44001

Source: Own elaboration.

5.4.1.24 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 39 include the non-ISO-MSS (OHSAS 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.

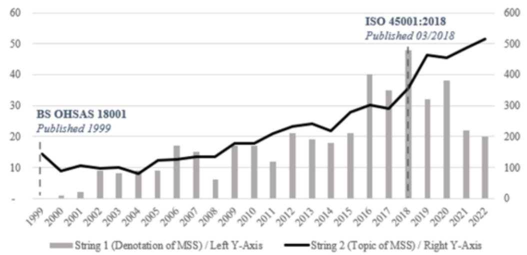
5.4.1.25 ISO 46001

Scopus lists a very large number of publications dealing with water management and water efficiency – with a continuously increasing degree of interest among scholars, as visible in Figure 40. 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 to 14), this standard should be in the focus of future research studies.

ISO 45001 - Occupational Health and safety Management Systems

Content: Specifies requirements for an occupational health and safety (OH&S) management system, and gives guidance for its use, to enable organizations to provide safe and healthy workplaces by preventing work-related injury and ill health, as well as by proactively improving its OH&S performance.

Development of Publications



String 1: ["ISO 45001*" OR "OHSAS 18001*"] **String 2:** ["occupational health and safety" OR "occupational health & safety"]

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Tint, P.	10	2.3%
Reinhold, K.	8	1.8%
Sampaio, P.	8	1.8%
Santos, G.	7	1.6%
Domingues, P.	6	1.4%
Average		**1.8%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	12	2.8%
≥ 50 Citations	22	5.0%
≥ 25 Citations	28	6.4%
≤ 25 Citations	222	50.9%
0 Citations	152	34.9%
Total	**436**	**100%**

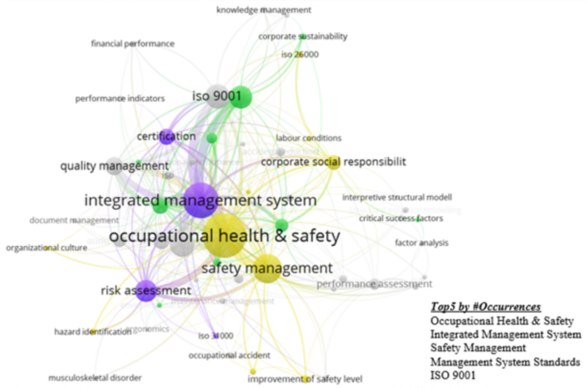
Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Brazil	38	8.7%
Spain	35	8.0%
Italy	27	6.2%
United States	26	6.0%
Portugal	24	5.5%
Average		**6.9%**

Subject Area (String 1)

Subject	in %
Engineering	26.8%
Business, Management and Acc.	14.1%
Environmental Science	8.4%
Medicine	7.6%
Social Science	7.0%
Total	**63.9%**

Co-Occurrences of Keywords (String 1)



Top5 by #Occurrences
Occupational Health & Safety
Integrated Management System
Safety Management
Management System Standards
ISO 9001

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

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Tsai, W.-H., Chou, W.-C.	2009	301	Selecting management systems for sustainable development in SMEs: A novel hybrid model based on DEMATEL, ANP, and ZOGP	Expert Systems with Applications
Jørgensen, T.H., Remmen, A., Mellado, M.D.	2006	250	Integrated management systems - Three different levels of integration	Journal of Cleaner Production
Zeng, S.X., Shi, J.J., Lou, G.X.	2007	232	A synergetic model for implementing an integrated management system: an empirical study in China	Journal of Cleaner Production
Salomone, R.	2008	195	Integrated management systems: experiences in Italian organizations	Journal of Cleaner Production
Santos, G., Mendes, F., Barbosa, J.	2011	163	Certification and integration of management systems: The experience of Portuguese small and medium enterprises	Journal of Cleaner Production

Contributions to the SDGs according to ISO

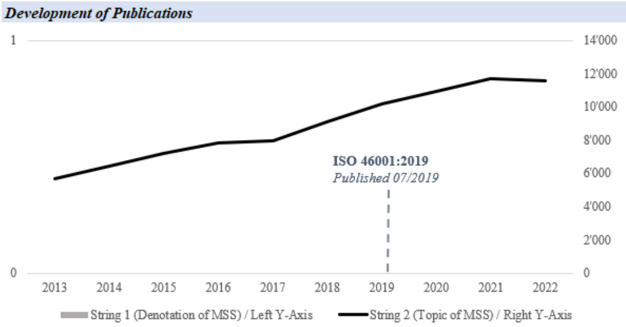
Figure 39. Bibliometric Overview on ISO 45001

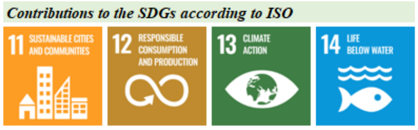
Note: The timeline and search string include the non-ISO-MSS (BS OHSAS 18001) due to its worldwide diffusion and its structural comparability to ISO MSSs.

Source: Own elaboration.

ISO 46001 - Water Efficiency Management Systems

Content: Specifies requirements and contains guidance for its use in establishing, implementing and maintaining a water efficiency management system. It is applicable to organizations of all types and sizes that use water. It is focused on end-use consumers.





String 1: "ISO 46001*" **String 2:** ["water management*" OR "water efficiency"]

Figure 40: Bibliometric Overview on ISO 46001

Source: Own elaboration.

5.4.1.26 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 41 depicts a strong relation to the environmental dimension. However, the ISO 50001 standard for EnMS 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).

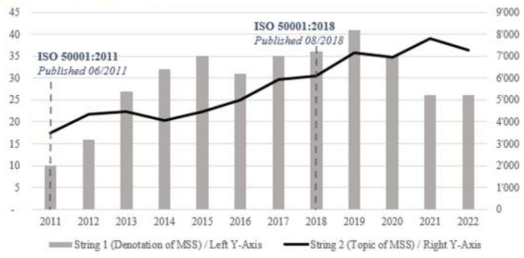
5.4.1.27 ISO 55001

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 42, 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.

ISO 50001 - Energy Management Systems

Content: Specifies requirements for establishing, implementing, maintaining and improving an energy management system (EnMS). The intended outcome is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance and the EnMS.

Development of Publications



String 1: "ISO 50001*" **String 2:** ["energy management*" OR "energy performance"]

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Therkelsen, P.	8	2.3%
Scheihing, P.	7	2.0%
Siciliano, G.	5	1.4%
Vosloo, J.C.	5	1.4%
Björkman, T.	4	1.1%
Average		**1.7%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	2	0.6%
≥ 50 Citations	5	1.4%
≥ 25 Citations	20	5.7%
≤ 25 Citations	198	56.6%
0 Citations	125	35.7%
Total	**350**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
United States	51	14.6%
Germany	45	12.9%
Colombia	30	8.6%
Brazil	20	5.7%
Italy	18	5.1%
Average		**9.4%**

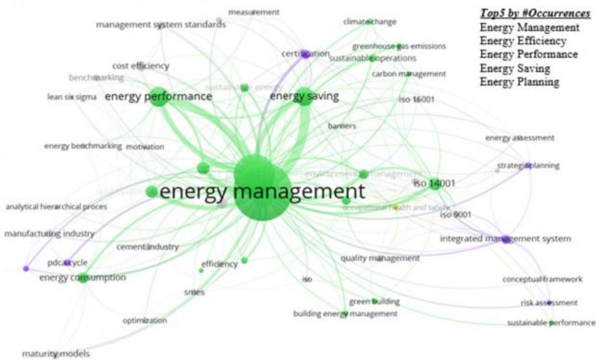
Subject Area (String 1)

Subject	in %
Energy	19.1%
Engineering	16.2%
Environmental Science	13.2%
Computer Science	7.4%
Business, Management and Acc.	7.4%
Total	**63.3%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Giacone, E., Mancò, S.	2012	129	Energy efficiency measurement in industrial processes	Energy
Marinakis, V., Doukas, H., Karakosta, C., Psarras, J.	2013	120	An integrated system for buildings' energy-efficient automation: Application in the tertiary sector	Applied Energy
Ates, S.A., Durakbasa, N.M.	2012	96	Evaluation of corporate energy management practices of energy intensive industries in Turkey	Energy
Antunes, P., Carreira, P., Mira da Silva, M.	2014	80	Towards an energy management maturity model	Energy Policy
Introna, V., Cesarotti, V., Benedetti, M., Biagiotti, S., Rotunno, R.	2014	79	Energy Management Maturity Model: An organizational tool to foster the continuous reduction of energy consumption in companies	Journal of Cleaner Production

Co-Occurrences of Keywords (String 1)



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

Contributions to the SDGs according to ISO

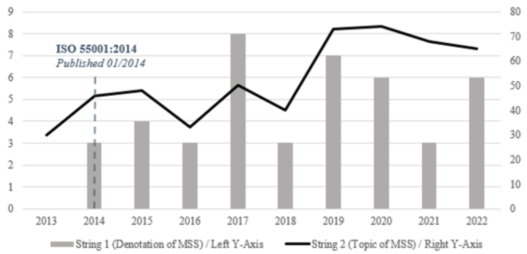
Figure 41. Bibliometric Overview on ISO 50001

Source: Own elaboration.

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

Development of Publications



String 1: "ISO 55001*" **String 2:** ("asset management" AND "physical")

Top5 Authors by #Publications (String 1)

Authors	#Publications	in %
Gomišček, B.	3	7.0%
Maletič, D.	3	7.0%
Maletič, M.	3	7.0%
da Silva, R.F.	3	7.0%
de Souza, G.F.M.	3	7.0%
Average		**7.0%**

Citation Structure (String 1)

Number of Citations	#Publications	in %
≥ 100 Citations	0	0.0%
≥ 50 Citations	0	0.0%
≥ 25 Citations	1	2.3%
≤ 25 Citations	24	55.8%
0 Citations	18	41.9%
Total	**43**	**100%**

Top5 Countries by #Publications (String 1)

Country	#Publications	in %
Brazil	7	16.3%
United Arab Emirates	6	14.0%
Spain	5	11.6%
Australia	4	9.3%
Indonesia	4	9.3%
Average		**12.1%**

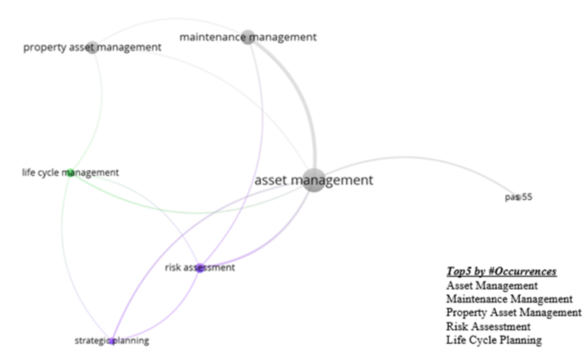
Subject Area (String 1)

Subject	in %
Engineering	40.2%
Energy	9.8%
Environmental Science	8.5%
Computer Science	7.3%
Decision Science	6.1%
Total	**71.9%**

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Maletič, D., Maletič, M., Al-Najjar, B., Gomišček, B.	2018	27	Development of a model linking physical asset management to sustainability performance: An empirical research	Sustainability (Switzerland)
Maletič, D., Maletič, M., Al-Najjar, B., Gomišček, B.	2020	14	An analysis of physical asset management core practices and their influence on operational performance	Sustainability (Switzerland)
Hodkiewicz, M.R.	2015	13	The development of ISO 55000 series standards	Lecture Notes in Mechanical Engineering
Pais, 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
Wijnia, Y., de Croon, J.	2015	7	The asset management process reference model for infrastructures	Lecture Notes in Mechanical Engineering

Co-Occurrences of Keywords (String 1)



Top5 by #Occurrences
Asset Management
Maintenance Management
Property Asset Management
Risk Assessment
Life Cycle Planning

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

Contributions to the SDGs according to ISO

Figure 42. Bibliometric Overview on ISO 55001

Source: Own elaboration.

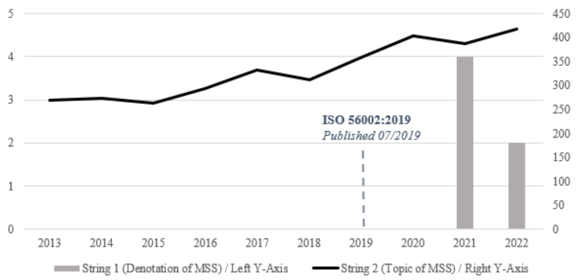
5.4.1.28 ISO 56002

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 amongst scholars – as visible in Figure 43.

ISO 56002 - Innovation Management Systems

Content: Provides guidance for the establishment, implementation, maintenance, and continual improvement of an innovation management system for use in all established

Development of Publications



Contributions to the SDGs according to ISO

String 1: "ISO 56002*" **String 2:** "innovation management*"

Top5 Publications by #Citations (String 1)

Authors	Year	#Citations	Title	Journal
Khan, P.A., Johl, S.K., Johl, S.K.	2021	32	Does adoption of ISO 56002-2019 and green innovation reporting enhance the firm sustainable development goal performance? An	Business Strategy and the Environment
Yams, N.B., Richardson, V., Shubina, G.E., Albrecht, S., Gillblad, D.	2021	9	Integrated ai and innovationmanagement: The beginning of a beautiful friendship	Technology Innovation Management Review
Hyland, J., Karlsson, M.	2021	6	Towards a management system standard for innovation	Journal of Innovation Management
Melendez, K., Dávila, A.	2022	0	Innovation Management in IT Industry	Journal of Technology Management and Innovation
Morel, L., Claire, J.	2021	0	Innovation Management: A new serious game aligned with ISO 56002:2019 - Innovation Management System	Proceedings of the 23rd Int. Conference on Engineering and

Figure 43. Bibliometric Overview on ISO 56002

Source: Own elaboration.

5.4.2 Consolidated Results

The consolidated look at the development of publications about the standards since the start of the century in Figure 44 (left side) visualises three clusters regarding the research maturity:

- **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 26) 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).

- **Medium (17.9%):** There appears to be certain academic interest in ISO 50001, ISO 31000, ISO 45001 (replaced 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 Top-7 most diffused certified ones with > 20,000 valid certificates worldwide (refer to Table 26).

- **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).

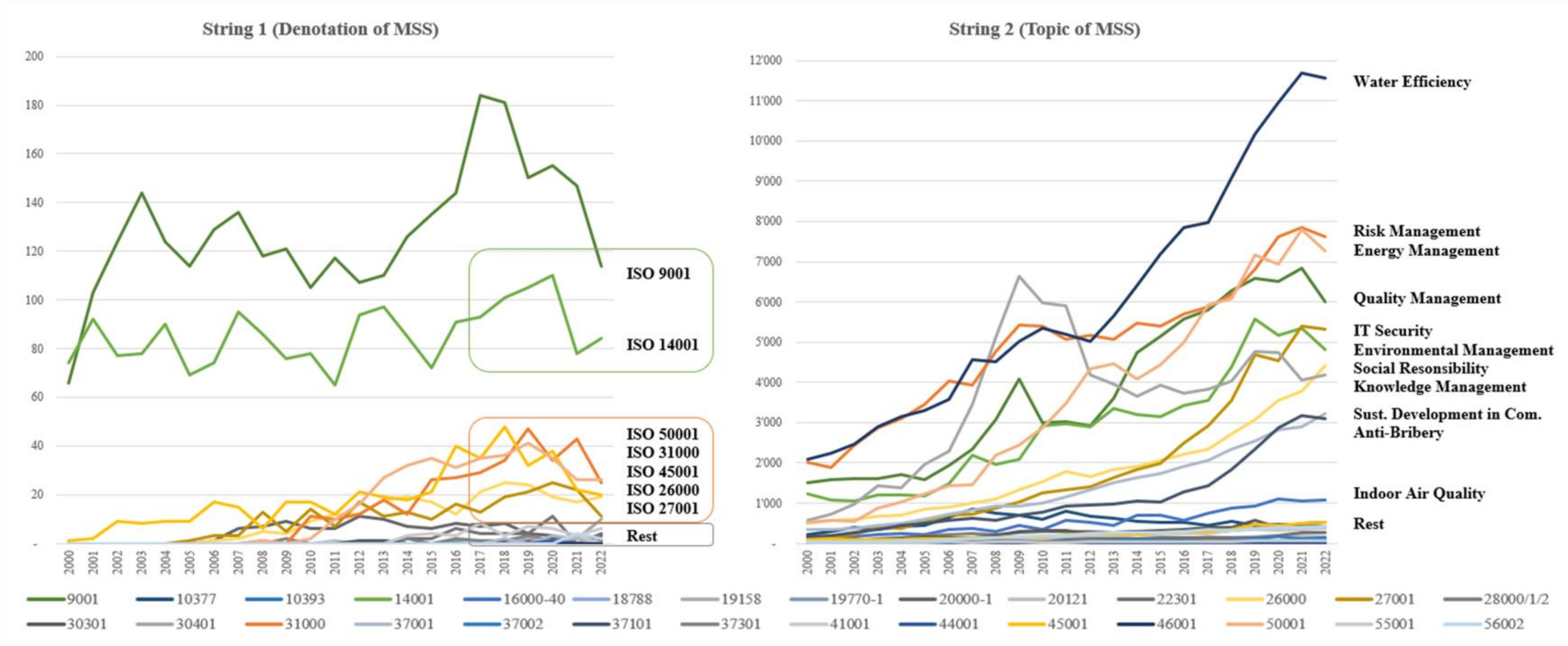


Figure 44. Number of Publications for String 1 (Denotation of MSS) and String 2 (Topic of MSS) for all MSSs from Step 1 (Period 2000–2022)

Note: 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 colour for the same standard.

Source: Own elaboration.

These clusters are confirmed by the performance analyses shown in the MSSs' individual Figures 16 to 43. Table 28[14] derives the degree of research maturity (not existent, very low, low, medium, high) for each MSS based on the bibliometric indicators elaborated in section 5.4.1.

Hence, RQ9 about research maturity of ISO standards is answered as follows: The maturity of academic research about ISO MSSs must be evaluated on an individual 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 16 to 43 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. Table 29[15] summarises these results and derives the extent of the relationship to sustainability (theoretically, low, medium, strong).

Consequently, RQ10 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.

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[14] In Ronalter, Poltronieri, and Gerolamo (2023), there is one single table (labelled as 'Table 4') synthesising the outcomes for both RQ9 as well as RQ10. However, due to the formatting guidelines for this doctoral thesis, this table has been split into Table 28 and Table 29 in order to increase the readability.

[15] See footnote 14.

Table 28. Synthesis of Bibliometric Analysis regarding Identified Research Maturity

ISO Standard	Year of Publication	Selected Indicators of Research Maturity							Identified Research Maturity (RQ9)
		#Contributions since Publication		Δ in Contributions between 2016-2021		Top-5 (String 1)			
		String 1	String 2	String 1	String 2	Authors (average)	Countries (average)	≥25 Citat-ions (in %)	
ISO 9001	1987	3,351	99,145	2.1%	22.8%	0.8%	6.4%	9.4%	High
ISO 10377	2013	0	5,018	-/-	-10.9%	-/-	-/-	-/-	Not existent
ISO 10393	2013	0	681	-/-	21.1%	-/-	-/-	-/-	Not existent
ISO 14001	1996	2,180	68,951	-14.3%	56.2%	0.9%	8.1%	20.9%	High
ISO 16000-40	2019	0	4,155	-/-	82.9%	-/-	-/-	-/-	Not existent
ISO 18788	2015	1	561	-/-	150.0%	-/-	-/-	0%	Very low
ISO 19158	2012	1	121	-/-	22.2%	-/-	-/-	0%	Very low
ISO/IEC 19770-1	2006	2	1,130	-/-	28.2%	-/-	-/-	0%	Very low
ISO/IEC 20000-1	2005	102	854	-100%	-30.2%	7.1%	13.7%	6.9%	Low
ISO 20121	2012	6[1]	1,690[1]	0%	58.3%	16.7%	20.0%	0%	Very low
ISO 22301	2012	37	1,830	-100%	101.5%	5.9%	8.6%	0%	Low
ISO 26000	2010	224	32,874	41.7%	71.5%	2.8%	7.1%	23.2%	Medium

Table 28. (continued)

ISO Standard	**Year of Publication**	**Selected Indicators of Research Maturity**							**Identified Research Maturity (RQ9)**
		#Contributions since Publication		Δ in Contributions between 2016-2021		Top-5 (String 1)			
		String 1	String 2	String 1	String 2	Authors (average)	Countries (average)	≥25 Citat-ions (in %)	
ISO/IEC 27001	2005	224	42,222	37.5%	117.4%	3.2%	7.7%	3.1%	Medium
ISO 28000	2005	13	5,410	-100%	62.0%	13.8%	13.8%	0%	Very low
ISO 30301	2011	6	4,579	-/-	43.1%	16.7%	20.0%	0%	Very low
ISO 30401	2018	15	21,765	-/-	8.9%	9.3%	13.3%	0%	Very low
ISO 31000	2009	328	84,608	59.3%	37.4%	1.8%	6.9%	7.6%	Medium
ISO 37001	2016	7	17,761	-/-	51.5%	14.3%	17.1%	0%	Very low
ISO 37002	2021	0	260	-/-	111.9%	-/-	-/-	-/-	Not existent
ISO 37101	2016	0	16,022	-/-	149.5%	-/-	-/-	-/-	Not existent
ISO 37301	2014	3	548	-/-	56.8%	-/-	-/-	0%	Very low
ISO 41001	2018	3	1,698	-/-	39.8%	-/-	-/-	0%	Very low
ISO 44001	2017	1	14	-/-	-100%	-/-	-/-	0%	Very low
ISO 45001[2]	1999	436	5,529	-45%	60.9%	1.8%	6.9%	14.2%	Medium

Table 28. (continued)

ISO Standard	**Year of Publication**	**Selected Indicators of Research Maturity** #Contributions since Publication		Δ in Contributions between 2016-2021		Top-5 (String 1)			**Identified Research Maturity (RQ9)**
		String 1	String 2	String 1	String 2	Authors (average)	Countries (average)	≥25 Citat-ions (in %)	
ISO 46001	2019	0	44,387	-/-	48.9%	-/-	-/-	-/-	Not existent
ISO 50001	2011	350	66,990	-16.1%	56.3%	1.7%	9.4%	7.7%	Medium
ISO 55001	2014	43	497	0.0%	106.1%	7.0%	12.1%	2.3%	Low
ISO 56002	2019	6	1,568	-/-	31.6%	16.7%	20.0%	16.7%	Very Low

[1] 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).

[2] 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: Own elaboration.

Table 29. Synthesis of Bibliometric Analysis regarding Identified Sustainability Relation

ISO Standard	Year of Publication	Sustainability Relationships: Related SDGs (ISO, 2022d)	Sustainability Relationships: Related ESG pillars (Science Mapping)[1]	Identified Sustainability Relation (RQ10)
ISO 9001	1987	1, 9, 12, 14	E, S (-), G	Medium
ISO 10377	2013	-/-	-/-	Theoretically yes
ISO 10393	2013	-/-	-/-	Theoretically yes
ISO 14001	1996	1-4, 6-9, 12-15	E (+), S, G	Strong
ISO 16000-40	2019	3	-/-	Low
ISO 18788	2015	16	-/-	Low
ISO 19158	2012	9	-/-	Low
ISO/IEC 19770-1	2006	9	-/-	Low
ISO/IEC 20000-1	2005	9	S (-), G (-)	Low
ISO 20121	2012	3, 5-13, 16	-/-	Strong
ISO 22301	2012	6-9, 11, 16	G (+)	Strong
ISO 26000	2010	1-16	E (-), S (+), G (-)	Strong
ISO/IEC 27001	2005	-/-	S (+), G	Medium
ISO 28000	2005	8, 9, 11	G (-)	Medium
ISO 30301	2011	9	-/-	Low
ISO 30401	2018	4, 8	-/-	Low
ISO 31000	2009	3, 8, 9, 11, 14-16	E (-), S (-), G (+)	Strong
ISO 37001	2016	8, 11, 16	-/-	Medium
ISO 37002	2021	8, 11, 16	-/-	Medium
ISO 37101	2016	1-16	-/-	Strong
ISO 37301	2014	8, 11, 16	-/-	Medium
ISO 41001	2018	4, 9-15	-/-	Medium
ISO 44001	2017	8-10, 17	-/-	Medium
ISO 45001[3]	1999	3, 5, 8-11, 16	E (-), S (+), G	Strong

Table 29. (continued)

ISO Standard	Year of Publication	Sustainability Relationships		Identified Sustainability Relation (RQ10)
		Related SDGs (ISO, 2022d)	Related ESG pillars (Science Mapping)[1]	
ISO 46001	2019	11-14	-/-	Strong
ISO 50001	2011	7, 11-13	E (+), G (-)	Strong
ISO 55001	2014	6- 9, 11-13	E (-), G (-)	Medium
ISO 56002	2019	4, 8, 9	-/-	Medium

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

Source: Own elaboration.

To summarise, chapter 5 reveals that most MSSs did not yet receive much attention by scholars (RQ9), and the majority of standards shows medium to strong relationships to sustainability (RQ10). 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, for example, ISO 46001 (water management) or ISO 37001 (anti-bribery management). 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 44), Scopus does not list any contributions that focus on these two 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 45 sorts the 28 MSSs along their identified research maturity (RQ9; x-axis) as well as their identified strength of sustainability relationship (RQ10; y-axis) and results in four quarters with varying importance: (1) urgent-agent zone, (2) adequate zone, (3) 'nothing to do' zone, as well as (4) excess zone.

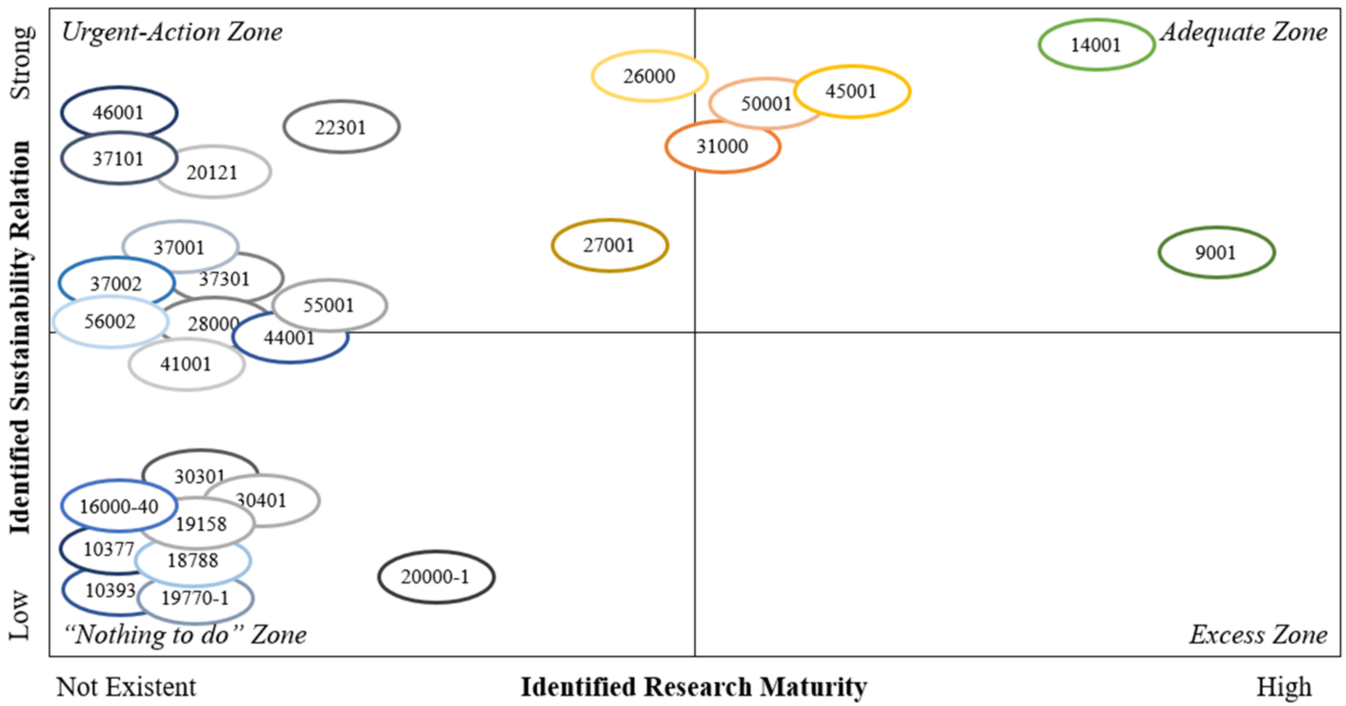

Figure 45. Action Plan for Research about MSSs in the Light of CS

Note: The colouring is in alignment with Figure 44.

Source: Own elaboration.

5.5 Discussion

Chapter 5 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 to outline 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 (RQ9), 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 (RQ10). The results are shown on an individual (Figures 16 to 43) as well as on a consolidated basis (Tables 28 and 29, Figures 44 and 45) and reveal 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 reveal low to no research contributions) – albeit the standards’ topics themselves might already be of great interest to academics in other areas. Looking at Figure 44, 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 standardise and formalise 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 study 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 characterised 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, chapter 5 points the finger on standards bearing the most sustainability-related potential.

Thirdly, the results impact research about integrated management systems. As visible in the bibliometric figures, IMS represents a very popular keyword in the science mapping of multiple MSSs (see e.g., Figures 16, 19, or 24). In fact, integrating MSs is considered to be the best management practice for organisations having multiple MSs in place (Bernardo, 2014), which makes it an important governance issue. The SLR about IMS and sustainability from chapter 2 proposed the research question of elaborating which MSSs should be incorporated into an IMS to enhance its ability of fostering sustainability (Ronalter & Bernardo, 2023). The outcomes of chapter 5 give an (partial) 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 into an IMS (see e.g., Karapetrovic & Casadesús, 2009; To et al., 2012) in order to reduce redundancies and to use possible synergy effects (see e.g., Karapetrovic, 2002; Wilkinson & 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 (see e.g., Rebelo et al., 2014b) and discussing the order and level of management standards implementation (see e.g., Kafel & Casadesus, 2016) is needed – which should take into account the broad range of MSSs presented in this chapter.

5.6 Conclusions

Chapter 5 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 (RQ9). Furthermore, the science mapping visualised how scholars relate the MSSs at hand to environmental, social, and governance 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 (RQ10). The answers to both RQs resulted in an action plan for research about MSSs in the light of corporate sustainability.

5.6.1 Managerial and Policy Implications

Chapter 5 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, organisations 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 MSs integration when adopting multiple additional standards directed at improving the level of corporate sustainability.

Moreover, the findings of this study 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 associated companies to use and implement the right MSSs. And international organisations – such as UN, World Economic Forum, European Commission, and so on – could establish international programmes to foster research and practical initiatives seeking to use the MSSs as real artefacts to achieve SDGs and ESG agenda.

5.6.2 Academic Implications

As discussed in section 5.5, 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 & 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.

5.6.3 Limitations and Future Research

The limitations of chapter 5 are especially related to the applied methodology. In fact, the standardisation 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 colouring (Thomson Reuters, 2017) influenced the results. Future work should try to overcome these limitations by introducing certain corrective factors and enlarging the research scope.

Despite research capable of overcoming this study's limitations, future research should consider three rationales. First, 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. Second, based on the literature at hand (refer to section 5.2.2) 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. Third, the issue of how to integrate standards into an IMS that covers either a broad or a firm-individual range of sustainability needs represents an interesting issue for future investigations.

CHAPTER 6. A CONCEPTUAL RESEARCH ON THE CONTRIBUTION OF INTEGRATED MANAGEMENT SYSTEMS TO THE CIRCULAR ECONOMY[16]

[16] This chapter has been adapted from Ronalter et al. (2022).

Abstract

Companies worldwide strive to become more sustainable. In this context, the circular economy gains importance as alternative system as opposed to the linear economy. Since executive mangers around the world work with management systems to guide and improve organisational operations, this study aims to explore how integrated MSs as business tools can contribute to the adoption of CE principles at the corporate level.

To achieve this objective, a systematic literature review is performed, which results in a synthesis sample of 18 academic papers. The findings reveal how MSs contribute to CE adoption and, therefore, demonstrate that managers can use IMS to foster CE implementation. In addition, the findings highlight the importance of institutional intervention in the transition from a linear towards a circular designed economy.

The work contributes to academia by linking the concepts of IMS and CE, synthesising the current academic knowledge at hand, and proposing a comprehensive research agenda that sets the path for future academic investigations. In a practical perspective, it contributes also to managers since it emphasises how IMS can be used to incorporate circular business thinking into operations management.

Keywords: Circular Economy (CE); Integrated Management Systems (IMS); Research Agenda; Sustainability; Systematic Literature Review (SLR).

6.1 Introduction

In 1970, the renowned US economist Milton Friedman argued that the sole purpose of businesses is to generate profit for shareholders in his internationally renowned essay *"The Social Responsibility of Business Is to Increase Its Profits"* (Friedman, 1970). Since then, humanity experienced a worldwide economic boost that went hand in hand with the exploitation of natural resources as well as the destruction of the environment and its wildlife population (see e.g., IRP, 2019; WWF, 2020). Further, the so-called 'Earth Overshoot Day' – which marks the date on which mankind's demand for ecological resources within a given year exceeds what the earth can regenerate in that year – moved from the end of December to the end of July (Global Footprint Network, 2021). This movement makes it abundantly clear that the current economic system – which mainly follows a "take-make-dispose" thinking (Otekenari, 2020, p. 497) – is not sustainable, because it does not support "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNWCED, 1987, p. 54).

In this context, the paradigm of the circular economy might represent a constructive solution since it rejects the take-make-dispose thinking and, instead, follows a "take-make-distribute-use-recover" approach (Prieto-Sandoval et al., 2017, p. 90). Although there is no agreed-on definition of CE (Hartley et al., 2020; Kirchherr et al., 2017), it can broadly be described as an economic strategy that transforms the current predominantly linear production and consumption pattern (raw materials are collected, transformed into products, and after their use eventually discarded as waste; traditional waste management approaches with a focus on resource recovery are applied) into a circular one (waste becomes a resource for the next production cycle through efficient material recirculation in the form of reuse, refurbishment, remanufacturing, and recycling) (Singh & Ordoñez, 2016).

Therefore, it aims to reduce both virgin materials input as well as waste output by closing loops of resource flows (Haas et al., 2015). Conclusively, the concept of CE addresses multiple stakeholders by facing economic challenges and fostering social well-being as well as environmental protection (Hopkinson et al., 2020; Jawahir & Bradley, 2016). However, translating such sustainability principles into organisational action represents a challenge as it requires commitment, leadership, and a systems approach with appropriate management tools (Azapagic, 2003; Galuppo et al., 2019). Furthermore, also issues such as regulations and legislations mandating CE, the promotion of CE-related knowledge, and competitor pressure towards CE represent crucial factors for the adoption of CE principles (Moktadir et al., 2020).

Regarding other stakeholder needs – such as quality or safety demands –, the business leaders of committed companies often rely on management systems to address stakeholders' interests in a systematic way (Poltronieri et al., 2018). MSs are a set of procedures to be followed to achieve stakeholder satisfaction concerning specific demands – such as quality, environmental, or occupational health and safety – and are aimed at the continuous improvement of operations and procedures. Their adoption results in various benefits such as improved systematisation, more profitability, enhanced stakeholder relationships, and organisational culture improvements – depending on the type of implemented MS (see e.g., Bernardo et al., 2015; Tarí et al., 2012). In regard to CE, academics support the viewpoint that MSs – which represent a "process of systematising how things are done" (Mahesh & Kumar, 2016, p. 578) – might lead a pathway for its successful implementation at the organisational level (Muradin & Foltynowicz, 2019; Sharma et al., 2020).

In companies that operate multiple MSs, the need emerges to integrate them into a single system to use possible synergy effects and reduce redundancies (Griffith & Bhutto, 2009; Karapetrovic, 2002). This integration eventually results in an integrated management system that can provide a holistic approach for corporate sustainability management (Asif et al., 2013; Gianni et al., 2017) and, according to Poltronieri et al. (2019), companies that invest in the integration of their MSs actually obtain better sustainable performance.

In conclusion, both IMS and CE follow a multi-stakeholder approach and, due to its systematic as well as holistic approach, IMS might be a suitable business tool to foster CE implementation within companies. Despite this derived theoretical connection, the amount of academic research focusing on IMS and its impact on CE implementation in corporations is scarce. Hence, scholars emphasise the urge for further in-detail research on MSs and their role in increasing organisations' circularity (see e.g., Kristensen et al., 2021;

Marrucci et al., 2019). In accordance with this research problem, chapter 6 aims to answer the following research questions:

RQ11: How far advanced is research about IMS' contribution to CE implementation?

RQ12: In regard to research about IMS' contribution to CE implementation, which knowledge gaps still exist that should be investigated in future research?

Hence, **the goal of chapter 6 is to explore how IMS as business tools contribute to the adoption of CE principles at the corporate level and to identify existing knowledge gaps**. To achieve this aim, a systematic literature review is conducted. The work's results contribute to academia mainly in two ways. On the one hand, they deliver a comprehensive overview of this specific research stream. On the other hand, they illustrate how IMS can serve as a valuable business tool for companies to foster the implementation of the CE and incorporate circular business thinking into operations management. Moreover, the issues and questions formulated in the proposed research agenda lead the pathway for future academic studies.

Chapter 6 is structured as follows. Section 6.2 offers extended background on IMS and CE. Section 6.3 explains the methodology used. Section 6.4 outlines the results obtained and includes the research agenda, in which the future research questions are presented. Section 6.5 delivers the conclusions.

6.2 Literature Review

In this section, the concepts of IMS and CE are briefly presented and explained by means of an exploratory literature review. In addition, common elements between both concepts are outlined.

6.2.1 Integrated Management Systems

As companies operate in dynamic environments with continuously changing business circumstances (Oliveira, 2013; Rebelo, Santos, & Silva, 2016), organisations must satisfy the needs of various stakeholder groups – such as customers, suppliers, employees, and investors – in numerous and changing areas related to quality, environment, or occupational health and safety, amongst others (Domingues et al., 2016). To deal with such needs systematically in both internal and external organisational contexts, companies implement MSs (Rebelo, Santos, & Silva, 2016), whose main elements are often – but not only – described in management system standards. These MSSs are voluntary guidelines and codes developed and published by national as well as international bodies, the most famous one being the International Organization for Standardization (ISO, 2022b; Karapetrovic & Jonker, 2003). MSSs are used by companies to formalise and systematise managerial activities, and they govern the implementation of MSs (Boiral & Heras-Saizarbitoria, 2015). In other words, MSSs describe the formal codes and MSs represent the outcome – i.e., the practical business tools that result when implementing these theoretical guidelines. Companies that are compliant with the requirements of normative MSSs can be certified, if the standard allows it (Oliveira, 2013; Santos et al., 2011).

MSSs often focus on certain topics and, consequently, the corresponding MSs are specific in their function – such as, for example, quality MSs based on ISO 9001, environmental MSs based on ISO 14001, or organisational health and safety MSs based on ISO 45001. Nonetheless, many MSSs share similarities such as the management policy, planning, implementation, operation, evaluation, improvement, and analysis (Rebelo et al., 2014a; Samy et al., 2015). The ISO, for example, implemented a common structure – referred to as HLS – in its new and updated MSSs since 2015.

Hence, corporations that operate multiple function-specific MSs are motivated to integrate them into a single system in order to reduce redundancies and use possible synergy effects (Griffith & Bhutto, 2009). This integration starts with a complete understanding of the standards and systems (Samy et al., 2015) and, then, subsequently puts all MSs and practices into a single system (Nunhes et al., 2017). In the end, organisations can manage their business operations through a single IMS instead of multiple, parallel, function-specific MSs (Samy et al., 2015). However, many corporations experience struggles and challenges when integrating MSs (Souza & Alves, 2018) due to certain difficulties – such as a misunderstanding of the integration concept (Nunhes et al., 2017; Simon et al., 2012), lack of financial and human resources (Asif et al., 2009; Rebelo et al., 2014a), or insufficient managerial and administrative support (Simon et al., 2012).

IMS adoption represents a current issue of the 21st century (Kauppila et al., 2015) as it is considered to be both the best management practice for organisations having multiple MSs in place (Bernardo, 2014) as well as a starting point for achieving business excellence (Ahidar et al., 2019). Therefore, MSs integration is a crucial strategic decision regarding an organisation's competitiveness (Rebelo, Santos, & Silva, 2016) that leads to numerous tangible as well as intangible advantages (Rebelo et al., 2015; Samy et al., 2015) – such as, for example, reduced costs in management, insurance, and operations (Jørgensen et al., 2006; Khanna et al., 2010; Llonch et al., 2018; Santos et al., 2011; Simon et al., 2011), or organisational culture improvements (Nunhes et al., 2017; Simon et al., 2012; Zutshi & Sohal, 2005). Furthermore, IMS implementation also results in multiple environmental improvements like increased environmental performance (Poltronieri et al., 2019), better allocation and utilisation of resources (Salomone, 2008; Zeng et al., 2007; Zutshi & Sohal, 2005), or better adoption of cleaner production technologies, which leads to improved sustainable innovation (Hernandez-Vivanco et al., 2018). In addition, companies that successfully operate an IMS can implement additional standards and systems with greater ease (Buse et al., 2013; Farahani & Chitsaz, 2010; Okboyev & Ashurkulov, 2020).

6.2.2 Circular Economy

The concept of the CE represents a vision for a global economy that is operating restoratively and regeneratively by intention and design (Ellen MacArthur Foundation, 2015; Wastling et al., 2018). The concept's paradigm basically focuses on preventing the depletion of resources and closing energy as well as material loops (Rincón-Moreno et al., 2021) – i.e., using products, components, and materials over multiple life cycles – at the micro (e.g., companies, products, and consumers), meso (e.g., industrial symbiosis), and macro level (e.g., cities, regions, and countries) (Prieto-Sandoval, Jaca, & Ormazabal, 2018; Yuan et al., 2006). It addresses environmental protection (Hopkinson et al., 2020; Jawahir & Bradley, 2016) by mitigating problems such as resource scarcity, climate change impacts, greenhouse gas emissions, waste and pollution, usage of hazardous substances, or depletion of biodiversity (Bastein et al., 2013; Geissdoerfer et al., 2017; Korhonen, Nuur, et al., 2018). Consequently, CE practices show relevance for achieving several targets of the UN'S sustainable development goals – such as, for example, promoting sustained, inclusive, and sustainable economic growth or ensuring sustainable consumption and production patterns (Schroeder et al., 2019).

The CE approach is based on numerous ideas and concepts like performance economy, industrial ecology, industrial ecosystems, industrial symbiosis, eco-efficiency, cleaner production, and cradle-to-cradle (Kalmykova et al., 2018; Korhonen, Honkasalo, & Seppälä, 2018; Korhonen, Nuur, et al., 2018). Moreover, the 6R principles of material and energy – namely reduce, reuse, recycle, recover, redesign, and remanufacture – play dominant roles in the practical application of the CE (Govindan & Hasanagic, 2018). At the organisational level, the transition from the current linear to a possible future circular economy relies on companies adopting and incorporating CE principles in their business models. This forces them to rethink their current business models and design strategies (Bocken et al., 2016; Centobelli et al., 2020) as they must transform the way they create, deliver, and capture value (Frishammar & Parida, 2019; Lewandowski, 2016). Further, existing studies highlight that in particular environmental innovation in the design of sustainable products and services is crucial (Demirel & Danisman, 2019; Prieto-Sandoval, Ormazabal, et al., 2018).

Since the steps required for the transition towards the CE are still poorly understood, the implementation of circular business models represents a huge challenge (Frishammar & Parida, 2019). Especially, because tools and criteria for circularity measurement are not based on a common set of standards (Haas et al., 2015; Rincón-Moreno et al., 2021), but rather a huge diversity of existing approaches (Kalmykova et al., 2018) and a lack of standard indicators to track progress prevail (Corona et al., 2019; Iacovidou et al., 2017). In other words, the diffusion of the CE is burdened by the existence of multiple diverging approaches (Kalmykova et al., 2018), and it is difficult to assist companies in their transition from a linear to a circular business model because there is no uniform methodology to benchmark or assess the progress (Rincón-Moreno et al., 2021).

First attempts have been made to tackle these obstacles related to missing uniformity. For example, MSSs that focus on the CE have been developed at the national level, such as the British BS 8001:2017 or the French XP X 30-901. The creation of these MSSs aligns with academics' opinion that institutional leadership is pivotal for CE implementation in terms of organising governance, promoting CE, defining legislations and voluntary standards, as well as recognising CE-compliant companies (Alonso-Almeida et al., 2020; Moktadir et al., 2020; Prieto-Sandoval, Ormazabal, et al., 2018; Wagner, 2020).

6.2.3 Common Elements between IMS and CE

Based upon the exploratory LR on IMS and CE, six common elements can be identified, which are displayed in Table 30. In view of these common elements, it is likely that both concepts share certain connections that might reveal synergy potential, of which companies should take advantage of. Hence, researching in-detail the relationships between IMS implementation and CE adoption at the corporate level represents an academic imperative, which chapter 6 follows.

Table 30. Common Elements between CE and IMS

Elements	IMS	CE	Main References
1. Multi-Stakeholder Approach	Both concepts are rooted in the multi-stakeholder approach.		Ellen MacArthur Foundation (2015); Poltronieri et al. (2018)
2. Systematisation	IMS represents a management tool for systematically satisfying needs.	CE implementation demands uniformity and processes of how things are done.	Bernardo et al. (2015); Kalmykova et al. (2018); Samy et al. (2015)
3. Institutional Guidance	MSSs are developed by standardisation institutions and help organisations to improve their way of working. IMS are mainly based on these MSSs.	CE promotion and implementation requires institutional guidance.	Prieto-Sandoval, Ormazabal, et al. (2018); Wagner (2020)
4. Adopting new Ways of Working	Companies with IMS have greater ease to adopt new standards and management systems, which guide their ways of working.	Companies must adopt CE principles and rethink their business models as well as ways of working.	Bocken et al. (2016); Buse et al. (2013); Centobelli et al. (2020); Okboyev and Ashurkulov (2020)
5. Sustainable Innovation	IMS fosters continuous improvement, including sustainable innovation.	CE implementation demands sustainable innovation.	Bernardo (2014); Hernandez-Vivanco et al. (2018); Prieto-Sandoval, Ormazabal, et al. (2018)
6. Environmental Dimension Improvements	IMS are business tools that enable companies to achieve numerous environmental benefits.	CE aims at achieving positive environmental impacts.	Hopkinson et al. (2020); Jawahir and Bradley (2016); Zutshi and Sohal (2005)

Source: Own elaboration.

Based on the extended background about IMS and CE as well as the identified common elements between both concepts, chapter 6 aims to answer the following two questions: How far advanced is research about IMS' contribution to CE implementation (RQ11), and what knowledge gaps are existing (RQ12)?

6.3 Methodology

With impetus to answer the RQs, this study adopts a SLR as methodology. In general, LRs enable academics to summarise, evaluate, and progress the current state of scientific knowledge in a certain field of interest (Cowell, 2012; Denyer & Tranfield, 2009; Rowley & Slack, 2004; Tranfield et al., 2003). Further, they ultimately unravel still existing research gaps and allow to present respective future research opportunities in an organised way (Fischl et al., 2014). Thus, performing a LR appears to suit the research objective best.

Since a LR's quality strongly depends on the applied literature search process (vom Brocke et al., 2009), it is recommended to follow a systematic procedure to increase the validity, reliability, and relevance of the LR (Tranfield et al., 2003; vom Brocke et al., 2009). This is because non-systematic review processes might fail to provide a sufficient set of scientific articles, leading to a weak assessment base (Fischl et al., 2014), whereas a systematic approach contains a high degree of transparency and, therefore, ensures the opportunity to replicate and validate the findings through its thoroughness in documenting the literature search and review process (Denyer & Tranfield, 2009; vom Brocke et al., 2009). Hence, this study answers RQ11 and RQ12 based upon a SLR.

Despite the multiplicity of existing methodologies for conducting SLRs (see e.g., Durach et al., 2017; Nightingale, 2009; Okoli, 2015), this work follows the approach elaborated by vom Brocke et al. (2009) due to its clear and recipe-alike structure that consists of five phases: (1) scope definition, (2) topic conceptualization, (3) literature search process, (4) literature analysis and synthesis, and (5) synthesis of future research questions.

As visualised in Figure 46, steps (1), (2), and (3) are depicted in the following paragraphs, and steps (4) and (5) are performed in sections 6.4.1 and 6.4.2, respectively.

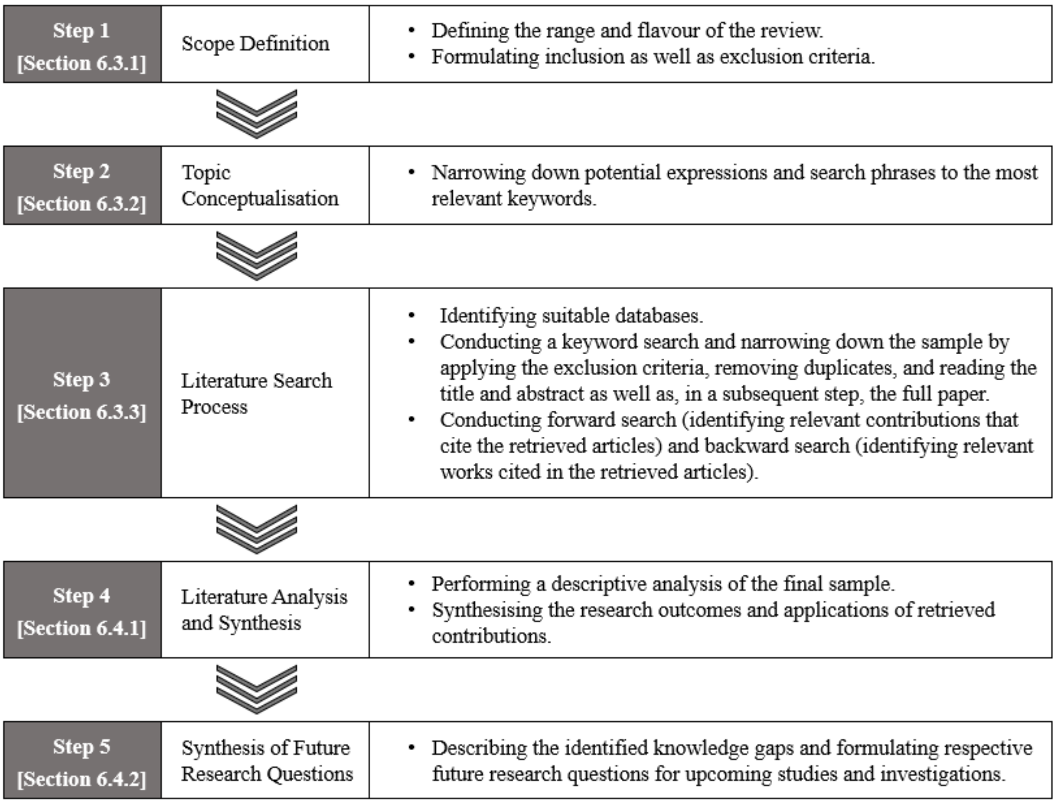

Figure 46. Applied Research Methodology

Source: Own elaboration with adaptations from vom Brocke et al. (2009).

6.3.1 Scope Definition

In this first phase, the range of the review is defined. This represents "a necessary first step of clarification in any literature review, which bears implications for the later search process" (vom Brocke et al., 2009, p. 7). Therefore, the structure and taxonomy as proposed by Cooper (1988) and visualised in Table 31 is applied.

Due to the nature of the research questions covered – i.e., 'what has been done yet' (RQ11) and 'what has still to be done' (RQ12) – this study's SLR focuses on the categories 'research outcomes' and 'applications' as they are the most promising in view of the underlying context. Considering the goal, this work's objective demands to synthesise the existing set of literature as well as to examine central issues regarding the relationships between IMS and CE. Regarding the organisation, the synthesis sample in this study is organised historically, as can be seen in Table 33.

Table 31. Scope Definition Taxonomy

Characteristics	Categories			
a. Focus	Research Outcomes	Research Methods	Theories	Applications
b. Goal	Integration	Criticism	Central Issues	
c. Organisation	Historical	Conceptual	Methodological	
d. Perspective	Neutral Representation	Espousal of Position		
e. Audience	Specialised Scholars	General Scholars	Practitioners/ Politicians	General Public
f. Coverage	Exhaustive	Exhaustive & Selective	Representative	Central/Pivotal

Source: Adapted from Cooper (1988).

Further, the methodologies applied (see Table 33, column 'research characteristics'), and the conceptual perspective (see Table 33, column 'research focus') are considered carefully and, therefore, also these categories play a certain role in the organisation of this study's SLR.

The perspective of the reviewer can be either neutral or espoused to a certain position (Cooper, 1988). In this paper, the literature and findings are presented in a neutral way without any prejudiced positions. This is also due to the targeted audience, which are both specialised as well as general scholars and, in addition, practitioners. The audience represents the fifths characteristic in Table 31 and determines the writing style.

Regarding the last characteristic, the degree of coverage of the literature, this study adopts an 'exhaustive & selective' approach. It is exhaustive in the sense that it aims to include the entirety of academic literature (or at least almost all of it) that connects MSSs and MSs – as basis of IMS – and IMS adoption itself to CE implementation and, therefore, the SLR is not limited to certain time periods, document types, or methodologies. However, it is also selective since the SLR considers certain language constraints (English).

6.3.2 Topic Conceptualisation

The second phase, as proposed by vom Brocke et al. (2009), deals with narrowing down potential expressions and search phrases to the most relevant keywords. In other words, researchers must discover and select search phrases that are commonly used in the field of interest (Fischl et al., 2014). This represents a complicated step, because too loose search phrases can lead to too many results – which makes it hard for reviewers to identify the relevant ones – and, in contrast, too narrow search phrases bear the risk of excluding important publications (Osterrieder et al., 2020). Further, the selection of keywords has a strong impact on the review's completeness and quality (Baker, 2000). Suitable keywords around the concepts of IMS and CE are derived based upon the explanatory LR in section 6.2 as well as the authors' existing vocabulary. The used keywords are consolidated in the string displayed in Table 32. General terms such as 'sustainability' or 'sustainable development' are not used in the string as these terms are too broad and this study intends to focus on CE. To the best of the authors' knowledge, these combined keywords and a following forward as well as backward search should be suitable and sufficient to retrieve an adequate assessment base of contributions that cover the scope of this SLR.

6.3.3 Literature Search Process

Vom Brocke et al. (2009) suggests performing a literature search process consisting of four sub-steps, namely (i) accumulating relevant journals that cover the academic field of interest, (ii) identifying databases that contain these journals, (iii) conducting a keyword search, and (iv) using the derived articles as starting point for conducting forward and backward search. However, regarding (i) and (ii), the authors also "would agree that it rather makes sense to query scholarly databases allowing for a topic-based search" (vom Brocke et al., 2009, p. 8). Since there are many journals worldwide that considers sustainability-related topics such as CE and/or management-related topics such as IMS, this SLR follows this comment of directly starting with sub-step (ii). Therefore, the scientific databases Web of Science and Scopus are used.

Regarding sub-steps (iii) and (iv), vom Brocke et al. (2009) emphasises to evaluate the retrieved sample continuously to limit the amount of literature identified to only those publications that are relevant to the topic at hand. This study follows this advice by removing duplicates, reading the title as well as abstract and, in a subsequent step, also reading the full paper.

Table 32. SLR Outcome

Scope Definition		
Inclusion criteria	All publication years, all document types, all methodologies	
Exclusion criteria	Only contributions in English are considered	
Topic Conceptualisation		
String	[[["management system*" OR "integrated management system*" OR "standardized management system*" OR "normalized management system*"] AND ["ISO" OR "QMS" OR "EMS" OR "OHSAS" OR "ISMS" OR "EnMS"]] AND ["circular economy" OR "circle economy" OR "industrial ecology" OR "circularity" OR "circle" OR "closed loops" OR "circular"]]]	
Literature Search Process		
Time Frame of Search	1991[1] - July 2021	
Databases	Scopus	Web of Science
Fields	Title, abstract, keywords	Topic
Results of String	97 Papers	30 Papers
Baseline Sample[2]	108	
Reading Title & Abstract	29	
Reading Full Paper	14	
Forward/Backward Search	4	
Synthesis Sample	18	

[1] The oldest paper detected dates back to 1991.

[2] After applying inclusion/exclusion criteria and removing duplicates.

Source: Own elaboration.

Table 32 summarises the application of the SLR. As visible, after applying the exclusion criteria and removing duplicates, the (iii) keyword search resulted in 108 papers. Reading the title and abstract reduced the baseline sample to 29 papers. This phase excluded many papers, because they did not consider the keywords used in the string in the sense of this study – e.g., EMS as abbreviation for environmental management system – but rather concerned topics such as “closed-loop control of shipboard integrated power system” (Wu et al., 2020, p. 1), “electromagnetic wave shielding (EMS)” (Sim et al., 2019, p. 144), or “phenomena in the electromechanical systems

(EMS)" (Nuraliev et al., 2020, p. 1). Such 'abbreviation duplicates' are common in academia and cannot be fully prevented by the choice of keywords. Reading the full articles in a subsequent step further reduced the sample to 14 papers.

The (iv) forward and backward search added up 4 papers that have not been in the baseline sample, thus leading to the final synthesis sample of 18 papers. The retrieved contributions are thoroughly analysed and discussed in the following findings section.

6.4 Findings

In this section, steps (4) 'literature analysis and synthesis' as well as (5) 'synthesis of future research questions' are presented (vom Brocke et al., 2009). Therefore, the final synthesis sample of 18 contributions is analysed descriptively as well as synthesised thematically in a first step. In a second step, future RQs are derived, whereby further academic papers surrounding the topics of IMS and CE are taken into account to ensure that this work aligns with current research.

6.4.1 Literature Analysis and Synthesis

6.4.1.1 Descriptive Analysis

The SLR concluded in July 2021 resulted in 18 papers, which are listed in Table 33. The papers have been published from 2016 onwards, which underlines that this field of research is still a relatively young research branch. As visible in Figure 47, which visualises the descriptive analysis, the recently increasing number and positive trendline of reported contributions emphasise the importance of the area. The 18 works have been published by 12 different journals, which underlines that the topic at hand is of great interest to a broad range of audience.

Regarding the research characteristics, most papers are based on empirical research. As shown in Figure 47, a total of 14 papers (78%) relies on empirical methods such as surveys (n = 7), case studies (n = 3), and qualitative data gathering in the form workshops, expert panels, or mixed approaches (n = 4). As visible in Figure 47, most empirical research has been conducted in Europe (n = 9) and Asia (n = 4).

The four conceptual articles (22%) are review papers, one of them is even a systematic one. Marrucci et al. (2019) performed a SLR about CE and EMS, resulting in 19 papers. However, the research focus differed from the RQs investigated in this study, because Marrucci et al. (2019) focused on the level of integration between sustainable consumption and production (SCP) tools and CE. Thereby, EMS represented only one of several SCP tools. In addition, these authors considered contributions at the micro, meso, as well as macro level, whereas this study explores relationships in the organisational context. Therefore, only five articles from the synthesis sample of Marrucci et al. (2019) are also included in this work’s final sample.

Regarding the research focus, most papers investigate EMS (n=14). Further, 3 papers deal with special circular economy MSSs, which actually also result in kind of environmental MSs. However, due to this study’s focus on CE, they have been separately marked as circular economy management systems (CEMS). Only one paper does not involve EMS or CEMSs but, instead, focuses on ITSMS. It is important to point out that only 5 papers out of 18 (28%) considered multiple types of standards and systems, thereby combining EMS with QMS, OHSMS, EnMS, or SRMS.

In conclusion, the analysis visualised in Figure 47 allows to derive that the current state of research in this young, important, and emerging area calls for more academic studies that connect and combine various multiple management systems and standards to the concept of CE, preferably in the framework of an IMS (see e.g., Kristensen et al., 2021). Further, as empirical studies represent the dominating approach in this developing research branch, a conceptual study that synthesises the dots of previous research outcomes and lays out the path for future investigations appears to be a valuable addition to the existing literature.

Table 33. Synthesis Sample from SLR about IMS and CE

Author (Year)	Publication Characteristics	Research Characteristics				Research Focus		
	Journal	Type[2]	Sample Size	Method[3]	Country	Type of MS	Main Topic	Thematic Tendency
Petek et al. (2016)	Computer Aided Chemical Engineering	E	n = 1	CS	Slovenia	EMS, QMS, SRMS, EnMS	Total site resource efficiency system	Environmental benefits
Milazzo et al. (2017)	Procedia Environmental Science, Engineering and Management	E	n = 1	CS	Italy	EMS	ISO 14001 certification as approach to the CE and industrial sustainability	Environmental benefits
Fonseca et al. (2018)	Sustainability	E	n = 99	Survey	Portugal	EMS	Assessment of CE adoption within companies	Environmental benefits
Pamfilie et al. (2018)	Amfiteatru Economic	E	n = 74	Survey	Romania	EMS, QMS, OHSMS	CE implementation in the hotel industry	Environmental benefits
Pauliuk (2018)[1]	Resources, Conversation & Recycling	C	n/a	LR	n/a	CEMS	Critical review of the BS8001:2017	Institutional guidance
Pesce et al. (2018)	Sustainability	E	n = 72	Workshop	China	EMS	SWOT analysis for ISO 14001 certifications	Environmental benefits

Table 33. (continued)

Author (Year)	Publication Characteristics	Research Characteristics				Research Focus		
	Journal	Type[2]	Sample Size	Method[3]	Country	Type of MS	Main Topic	Thematic Tendency
Prieto-Sandoval, Ormazabal, et al. (2018)[1]	Business Strategy and The Environment	E	n = 11	Delphi Method	Spain	EMS	Key elements for CE implementation in companies	Mix, incl. institutional guidance and sustainable innovation
Kiefer et al. (2019)	Business Strategy and The Environment	E	n = 197	Survey	Spain	EMS	Drivers and barriers of eco-innovation	Sustainable innovation
Marrucci et al. (2019)	Journal of Cleaner Production	C	n = 35	Systematic LR	n/a	EMS	Sustainable consumption and production tools for CE implementation	Environmental benefits
Muradin and Foltynowicz (2019)	Amfiteatru Economic	C	n/a	LR	n/a	CEMS	Overview on the BS8001:2017 and XP X 30-901	Institutional guidance
Pomponi and Moncaster (2019)[1]	Proceedings of the Institution of Civil Engineers	C	n/a	Critical Review	n/a	CEMS	Critical review of the BS8001:2017 in the construction industry	Institutional guidance

Table 33. (continued)

Author (Year)	Publication Characteristics	Research Characteristics				Research Focus		
	Journal	Type[2]	Sample Size	Method[3]	Country	Type of MS	Main Topic	Thematic Tendency
Ahmad et al. (2020)	International Journal of Manpower	E	n = 1	CS	Bangladesh	ITSMS	Challenges for ISO 20000 certifications	Environmental benefits
Jabbour et al. (2020)[1]	Journal of Environmental Management	E	n = 86	Survey	Brazil	EMS, QMS	Relations among stakeholder pressure, CE business models, and firms' sustainable performance	Environmental benefits
Jain et al. (2020)	Business Strategy and The Environment	E	n = 280	Survey	India	EMS	Effects of institutional pressures on CE performance through EMS	Institutional guidance
Scarpellini, Marín-Vinuesa, et al. (2020)	Sustainability Accounting, Management and Policy Journal	E	n = 87	Survey	Spain	EMS, EnMS	Environmental capabilities applied for CE implementation in companies	Environmental benefits
Scarpellini, Valero-Gil, et al. (2020)	Business Strategy and The Environment	E	n = 89	Survey	Spain	EMS, EnMS	Management capabilities for eco-innovation	Sustainable innovation

Table 33. (continued)

Author (Year)	Publication Characteristics	Research Characteristics				Research Focus		
	Journal	Type[2]	Sample Size	Method[3]	Country	Type of MS	Main Topic	Thematic Tendency
Sharma et al. (2020)	Environmental Science and Pollution Research	E	n = 15	DEMATEL Method	India	EMS	Electronic waste management in a circular economy	Environmental benefits
Kristensen et al. (2021)	Journal of Cleaner Production	E	1] n = 25 2] n = 277 3] n = 2	1] Interview 2] Survey 3] Focus Group	Denmark	EMS	Opportunities for integrating CE initiatives into the EMS	Environmental benefits

[1] Paper selected through backward/forward search, [2] E = Empirical, C = Conceptual, [3] CS = Case Study, LR = Literature Review

Source: Own elaboration.

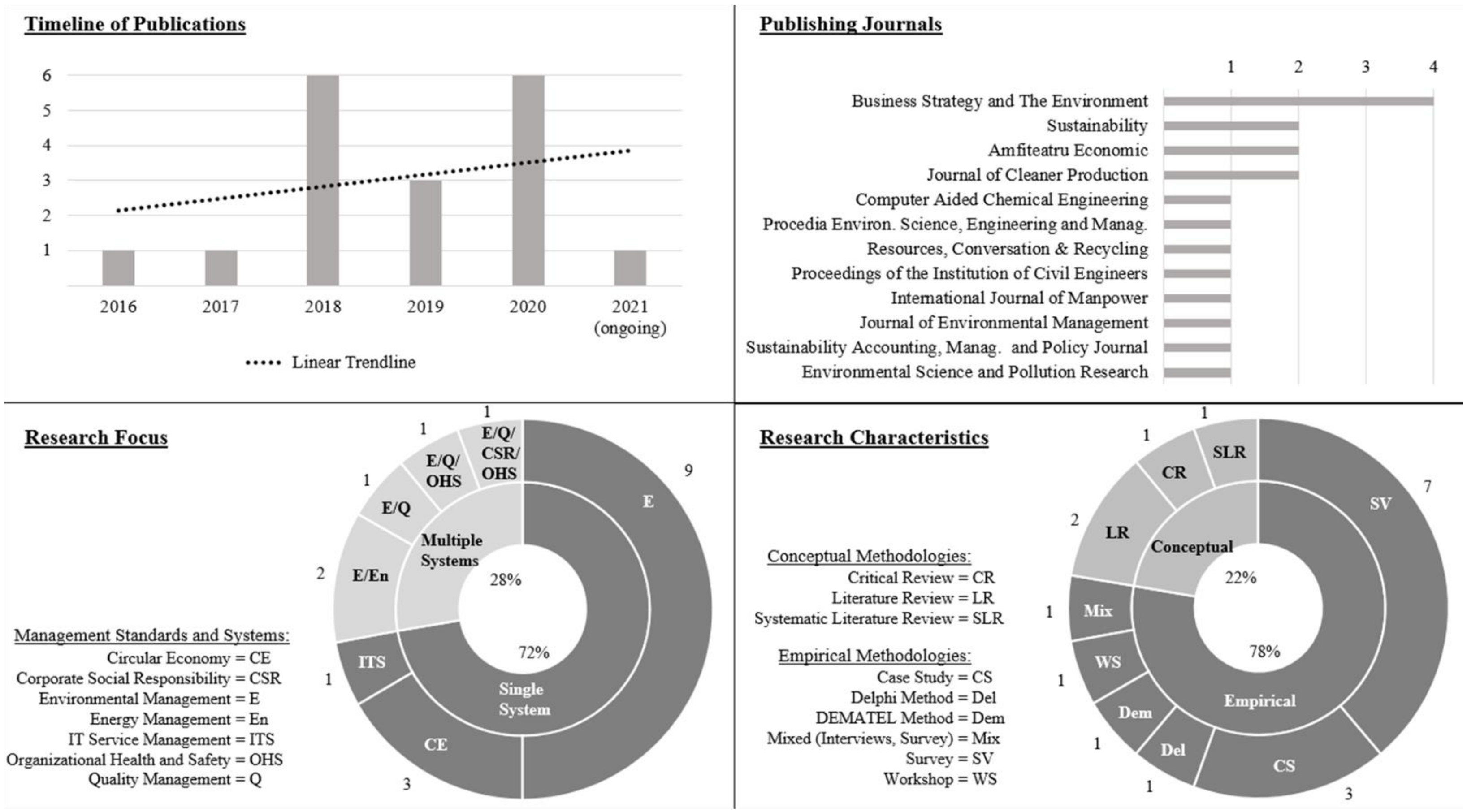

Figure 47. Overview Descriptive Analysis

Source: Own elaboration.

6.4.1.2 Thematic Results

The synthesis sample reveals thematic tendencies that are in accordance with some of the common elements identified between IMS and CE in section 6.2. Hence, the contributions mainly deal with institutional guidance to define common definitions, sustainable innovation to introduce CE-related business activities, and benefits in the environmental dimension.

The pivotal role of institutions in CE implementation by developing new standards as well as recognising CE-compliant companies and products (Prieto-Sandoval, Ormazabal, et al., 2018) is supported by Muradin and Foltynowicz (2019), who highlight the importance of creating an agreed-on global vision on CE in order to transit from the linear to a circular economy. In view of the current multiplicity of CE definitions and measurement indicators, they underline the need for global standardisation and, furthermore, they do see MSSs as a potential solution. By presenting and comparing the British BS 8001:2017 and French XP X 30-901 MSSs, the authors show that there have been first movements regarding standardising the CE definition at a national level, but they also emphasise the urge for creating globally valid CE standards.

Pauliuk (2018) critically analyses the BS8001:2017 and lists clarification of terms, CE principles formulation and their integration into business development processes, as well as the description of necessary changes as strengths. However, the author sees a lack of linkage between CE and sustainability as well as the vague guidance on monitoring CE strategy implementation as weaknesses. In conclusion, the author presents a dashboard of quantitative CE indicators. In addition, Pomponi and Moncaster (2019) reviewed the BS8001:2017 in the context of the construction industry and declared it to have limited application in the built environment. Due to the standard's inclusiveness, the authors question its suitability for promoting "real change" (p. 111) and conclude – in regard to the context of buildings – that the standard fails to deal with the complexity and does not offer effective approaches for the reduction of waste and environmental impact.

Jain et al. (2020) investigate the effect of external institutional pressures and internal motivation on CE performance. Thereby, the authors explore the mediating role of environmental MSs and state that they can be used as business tool to effectively deal with coercive as well as mimetic institutional pressures. To conclude, academics emphasise the importance of institutional guidance when it comes to fostering CE adoption and recommend the development of suitable MSSs that can be integrated by organisations.

Furthermore, eco-innovation is seen as an important part of CE (Prieto-Sandoval, Ormazabal, et al., 2018), and several eco-innovation inputs as well as outcomes are directly or indirectly related to CE implementation (Scarpellini, Valero-Gil, et al., 2020). Scarpellini, Valero-Gil, et al. (2020) conclude that environmental MSs can play "an important role in the implementation of eco-innovation" (p. 1859) and affirm that they help to develop the right circumstances under which "environmental capabilities can be deployed to implement CE-related activities in businesses" (p. 1859). However, the authors point out that there is an ongoing debate whereas environmental MSs really positively affect eco-innovation or not. Exemplarily, Kiefer et al. (2019) investigate how resources, competences, and dynamic capabilities drive or hinder eco-innovation in Spanish industrial SMEs and state that ecological certifications – such as ISO 14001 or EMAS – act as a barrier for eco-innovation. In conclusion, despite sustainable innovation is seen as crucial, there is no universal consensus on the impact of integrating environmental MSs on companies' eco-innovation capabilities.

Regarding achieving environmental benefits connected to the CE, multiple authors highlight the importance of environmental MSs. Sharma et al. (2020) emphasise the need to transform into a CE in regard to electrical products and, therefore, perform a literature review to identify key enablers for electronic waste management. By applying the decision-making trial and evaluation laboratory (DEMATEL) methodology – a method to identify cause-effect chain components in complex systems – with 11 participants, the authors rank 10 identified key enablers and show that EMS is the most important one to influence the others. Conclusively, management systems are the most significant driver and enabler for creating electronic waste management in the CE. In addition, Marrucci et al. (2019) investigate linkages between CE and SCP tools – such as EMS, green public procurement, eco-design directive, ecolabel, energy label, and environmental technology verification – based on a literature review and conclude that environmental MSs and eco-design have the "highest level of integration with CE” (p.1). This positive relationship between EMS and CE is validated by Kristensen et al. (2021), who also state that environmental MSs can be used to align and manage CE principles at the organisational level in order to strengthen the systematic implementation of the CE. Further, Pamfilie et al. (2018) consider the ISO 14001 standard as the closest standard from the ISO family when it comes to the CE and, in conclusion, see the adaption of the ISO 14001 as “an indicator of the degree of preparation for the circular economy” (p. 403). Milazzo et al. (2017) even declare ISO 14001 to be “a useful tool for implementing the circular economy in the perspective of industrial sustainability, with the adoption of new business models” (p. 120) after performing a case study in an Italian steel producing company.

Based on a survey among 87 companies in Spain, Scarpellini, Marín-Vinuesa, et al. (2020) confirm relationships between the circular scope of firms and (1) the adoption of EMS in accordance with ISO 14001, EMAS, ISO 50001, and ISO 14006 standards (guidelines for incorporating eco-design), (2) the environmental accounting and management capabilities, (3) the levels of CSR and accountability, and (4) the level of stakeholders’ pressure. The authors consider the adoption of EMS as a specific business capability and reveal a positive impact of EMSs on the adoption of CE-related practices and, therefore, on the level of CE in companies. Another survey among 86 Brazilian companies performed by Jabbour et al. (2020) confirms that both QMS and EMS “have an influence on the adoption of CE principles” (p. 9). Fonseca et al. (2018) use a survey among 99 Portuguese corporations to map the motivations and potential actions for promoting the circular economy. They conclude that the level of CE adoption is impacted in a positive way by the status of EMS certification.

However, MSSs for environmental MSs – such as the widely spread ISO 14001 – do not represent a fast-track for achieving CE in their current form. In fact, Pesce et al. (2018) revealed during a workshop with 72 representatives from Chinese companies that there are concerns about the possibility to integrate the ISO 14001 with sustainability tools such as life cycle assessment, CSR, and CE.

Moreover, not only environmental MSs are said to contribute to the CE but also further MSs, such as ITSMS. Ahmad et al. (2020) support the view that electronics waste generation and energy consumption are crucial, and the authors conclude that ISO 20000 for ITSMSs helps to manage CE issues.

Thus, although most studies found in the SLR only tried to connect environmental MSs to CE, Ahmad et al. (2020) show that also other MSSs can positively affect CE and, therefore, are worth investigating. Consequently, it can be concluded that not only environmental MSSs such as ISO 14001 have CE-compliant or CE fostering points, but even MSs like ITSMS, QMS, or OHSMS might positively impact CE implementation to a certain extent. Exemplarily, Petek et al. (2016) created a total site resource efficiency system that aims at developing the CE and that integrates ISO 14001 for EMS, EMAS, and ISO 50001 for EnMS regarding the environmental dimension, but also ISO 9001 for QMS regarding the economic and ISO 26000 for SRMS regarding the social dimension of sustainability.

In sum, existing academic literature highlights that various MSs and their integration are positively connected to CE-related benefits in the environmental pillar, whereas the social and economic components of sustainability find less attention in the context of the circular economy.

6.4.2 Synthesis of Future Research Questions

Based upon the literature analysis outlined in the previous section, it can be concluded that by now academics have not explicitly focused on how the integration of MSs can contribute to adopting the CE at the corporate level. In fact, despite a few academics that connected multiple MSs to the CE (see e.g., Pamfilie et al., 2018; Petek et al., 2016), research rather focused on single MSSs or MSs and their connection to CE principles. As demonstrated above, these systems and standards positively impact CE adoption in companies (see e.g., Marrucci et al., 2019; Milazzo et al., 2017; Sharma et al., 2020), and since their integration bears multiple additional benefits – such as greater ease to adopt new standards (see e.g., Buse et al., 2013), fostering sustainable innovation (see e.g., Hernandez-Vivanco et al., 2018), and environmental improvements (see e.g., Zutshi & Sohal, 2005) – this present study concludes that IMS represents a business tool that contributes to CE adoption and that more studies directed at the integration impact are needed. Moreover, contributions on CE-specific MSSs appear to be underrepresented in the literature. To pave the way for further research in such direction, in the following knowledge gaps are synthesised and respective future RQs are formulated. Figure 48 summarises all these FRQs in a research agenda, which is designed in accordance with the common elements identified in section 6.2.

6.4.2.1 Systematisation

Whereas the implementation of CE principles at the organisational level is hampered by a lack of uniformity and concrete processes (see e.g., Frishammar & Parida, 2019; Iacovidou et al., 2017; Kalmykova et al., 2018), integrated management systems – which are based on MSSs and MSs – enable executive managers to satisfy stakeholder needs systematically (see e.g., Poltronieri et al., 2018; Rebelo, Santos, & Silva, 2016). Concluding, CE-specific standards might represent a potential solution (see e.g., Muradin & Foltynowicz, 2019). Thus, the question emerges how existing CE MSSs such as the British BS 8001:2017 and French XP X 30-901 MSSs can be integrated into existing IMS. While answering this question, focus should be laid on integration barriers that might appear. Since the concept of the CE requires companies to rethink their business models (see e.g., Bocken et al., 2016; Centobelli et al., 2020; Lewandowski, 2016), the implementation and integration of CE-specific MSs might be even more impeded by known barriers such as obstacles related to the corporate culture (see e.g., Wilkinson & Dale, 2000; Zeng et al., 2010).

FRQ9: How can CE-specific standards and systems be integrated into existing IMS, and what are integration barriers?

Furthermore, considering the various critics for the existing national CE standards (see e.g., Pauliuk, 2018; Pomponi & Moncaster, 2019), it represents an academic imperative to explore how CE-specific voluntary MSSs must be designed to ensure feasibility, broad applicability, and – in particular – ‘real change’ (see criticism of Pomponi and Moncaster, 2019). Investigating this issue could help satisfying the need for a global agreed-on vision of CE and a common set of standards for its implementation within companies (Muradin & Foltynowicz, 2019). For answering this complex question, researchers might consider reviews and critical assessments of existing MSSs.

FRQ10: How must a CE MSS be designed to foster ‘real change’?

6.4.2.2 Institutional Guidance

The creation of CE-related MSSs by standardisation bodies aligns with the demand for institutions to organise governance and develop voluntary standards (see e.g., Prieto-Sandoval, Ormazabal, et al., 2018). But creating such standards is only half of the solution, because also their diffusion plays a crucial role. Statistics on the most widely spread ISO standards reveal that there are only few standards that spread on a global scale. In 2021, the three most common standards were ISO 9001 for QMS with 1,077,884 valid certificates, ISO 14001 for EMS with 420,433 certificates, and ISO 45001 for OHSMS with 294,420 certificates. The standard at the end of Top-10 – namely ISO 22301 for business continuity management systems – only counted 2,559 valid certificates (refer to Table 26, adapted from ISO, 2022b). Albeit this might partially be due to the specific scope of most standards as well as their perceived usefulness by companies, these figures underline the difficulty to foster the international diffusion of standards.

Further, they support the call for institutional guidance to promote the CE at the micro level (see e.g., Alonso-Almeida et al., 2020). Regarding this promotion, the question evolves, if policy makers should recognise companies’ compliance with certain CE MSSs. For example, by giving away awards or grants. Such recognition could lead to competitive advantages for compliant companies and, consequently, work as an incentive for the adoption and diffusion of such voluntary standards. Thus, specific standards and systems for the circular economy could help to deal effectively with coercive as well as mimetic institutional pressure, such as other MSs do (see e.g., Jain et al., 2020).

Both the implications of standards for global governance and their international diffusion are topics with several knowledge gaps and open discussions (see e.g., Heras-Saizarbitoria & Boiral, 2013), and this paper raises attention to the urge of connecting these issues related to institutional guidance with standards that are explicitly directed at the CE.

FRQ11: Should policy makers recognise companies that are compliant to certain CE MSSs?

6.4.2.3 Adopting New Ways of Working

Implementing the CE concept at the corporate level requires companies to rethink their business models and, therefore, their way of working – i.e., the firms' approaches for how to create, deliver, and capture value (see e.g., Bocken et al., 2016; Centobelli et al., 2020; Lewandowski, 2016). Since companies that are already operating an IMS tend to have greater ease to adopt new systems and standards (see e.g., Farahani & Chitsaz, 2010; Okboyev & Ashurkulov, 2020), there is potential for synergy effects – such as strategic synergy, organisational structural-resource-cultural synergy, and documentation synergy (Zeng et al., 2007) – and competitive benefits. However, there are no academic studies at hand that prove or disprove this relationship for CE-specific standards. Hence, it is of interest to explore if CE MSSs such as the British BS 8001:2017 or the French XP X 30-901 can be easier adopted and implemented by companies with IMS as opposed to firms that operate all their systems separately.

FRQ12: Have companies with IMS greater ease to adopt CE-related standards and systems?

Further, there is proof needed, whether – and how – standards for CE can support companies in rethinking their way to create value. In this context, operating an IMS might help organisations to incorporate such fundamental change in business thinking at all organisational layers. In fact, multiple academics perceive IMS as efficient business tool to pave the way towards sustainable development (see e.g., Jørgensen, 2008) as it provides a structure for integrating sustainability-related concepts into business practices (see e.g., Asif et al., 2013; Siva et al., 2016). Thus, the IMS as holistic approach for corporate sustainability management (Asif et al., 2013; Gianni et al., 2017) might become a powerful business tool for managers to retrieve real change out of CE-specific standards and systems.

FRQ13: Does CE MSSs integration support companies in rethinking the way they create value?

6.4.2.4 Sustainable Innovation

Despite the believe that sustainable innovation and its outcomes are pivotal for the CE, there is an ongoing debate if management systems, standards, and certifications are positively connected to such innovation or not (see e.g., Kiefer et al., 2019; Prieto-Sandoval, Ormazabal, et al., 2018; Scarpellini, Valero-Gil, et al., 2020). Since multiple researchers declare QMS (see e.g., Cuerva et al., 2014; Shi et al., 2019), EMS (see e.g., Amores-Salvadó et al., 2015; Hojnik & Ruzzier, 2016), and OHSMS (see e.g., Yang et al., 2021) to support sustainability-related innovations, academic curiosity demands to also research if CE systems increase such innovation. Some authors already proposed innovation-related models that contain multiple MSs (see e.g., Calik & Bardudeen, 2016; Maier et al., 2015) and, in this context, the question can be derived if adding CEMSs – based on standards like BS 8001:2017 or XP X 30-901 – to an existing IMS can foster the sustainable innovation performance in companies.

FRQ14: Does the integration of CE-specific standards and systems into an existing IMS foster the sustainable innovation performance of corporations?

6.4.2.5 Environmental Dimension Improvements

When it comes to benefits in the environmental dimension, most research detected in the SLR focused on environmental MSs (see e.g., Fonseca et al., 2018; Milazzo et al., 2017; Pesce et al., 2018). However, academics call for more in-detail research (see e.g., Prieto-Sandoval, Ormazabal, et al., 2018; Scarpellini, Valero-Gil, et al., 2020). Since other MSs such as ITSMS (see e.g., Ahmad et al., 2020) also positively affect CE implementation, there is the urge to identify which particular MSs and MSSs – besides EMS based on ISO 14001 or EMAS – have an impact on CE adoption in companies. Here, some less adopted sustainability-themed niche-standards like ISO 46001 (water efficiency), ISO 20121 (sustainable events), or ISO 22301 (business continuity) might be suitable. Further, considering environmental threats companies increasingly face – such as the climate change and its consequences – also risk management standards like ISO 31000 could be of severe and increasing importance. Moreover, some guidance principles and guidelines might bear potential, such as ISO 20400 (sustainable procurement), IWA 19 (guidance principles for the sustainable management of secondary materials), or ISO 14009 (guidelines for incorporating material circulation in design and development).

FRQ15: Which existing guidance/guidelines, MSSs and MSs foster CE adoption?

Moreover, in view of the environmental benefits arising from MSs integration (see e.g., Zeng et al., 2007; Zutshi & Sohal, 2005), particular focus should be on the question to what extent the integration level impacts CE-related benefits. In this context, investigations should explore if companies with multiple MSs in place might reveal improved environmental performance solely due to benefits of certain MSs (see e.g., Tarí et al., 2012), due to synergy effects that appear when having multiple MSs in place (see e.g., Casadesús et al., 2011), or if the reason is based on the integration of these multiple, function-specific MSs (see e.g., Bernardo et al., 2015; Sampaio et al., 2012).

FRQ16: To what extent does the integration level impact CE-related environmental benefits?

6.4.2.6 Multi-Stakeholder Approach

The synthesis of the thematic results of the SLR's final sample revealed that previous studies on MSs and their integration have focused especially on CE-related benefits in the environmental pillar. However, also economic actors and the society benefit from CE adoption (Geissdoerfer et al., 2017). Thus, extending the research focus seems reasonable and aligns with the multi-stakeholder approach, on which both IMS and CE are rooted (see introductory section 6.1). Reducing waste, closing material loops, and increasing product longevity (as basic concepts of the CE) will likely influence economic indicators such as profitability, revenue generation, and cost reduction (Rossi et al., 2020), thereby impacting stakeholders – such as, for example, suppliers, shareholders, and distributors. In addition, social changes are essential for CE transition (Walzberg et al., 2021), and circularity indicators related to job creation and cultural change (Geissdoerfer et al., 2017) show that employees and communities are further important stakeholders.

Hence, the CE concept does not only address environmental protection but also social well-being and economic challenges (Hopkinson et al., 2020; Jawahir & Bradley, 2016). Moreover, also the concept of IMS is not only connected to environmental but also social and economic benefits (see e.g., Bernardo et al., 2015). In conclusion, future CE-related research on management systems, standards, and their integration should include the social and economic dimension:

FRQ17: Does the integration of MS contribute to CE-related benefits in the economic dimension?

FRQ18: Does the integration of MS contribute to CE-related benefits in the social dimension?

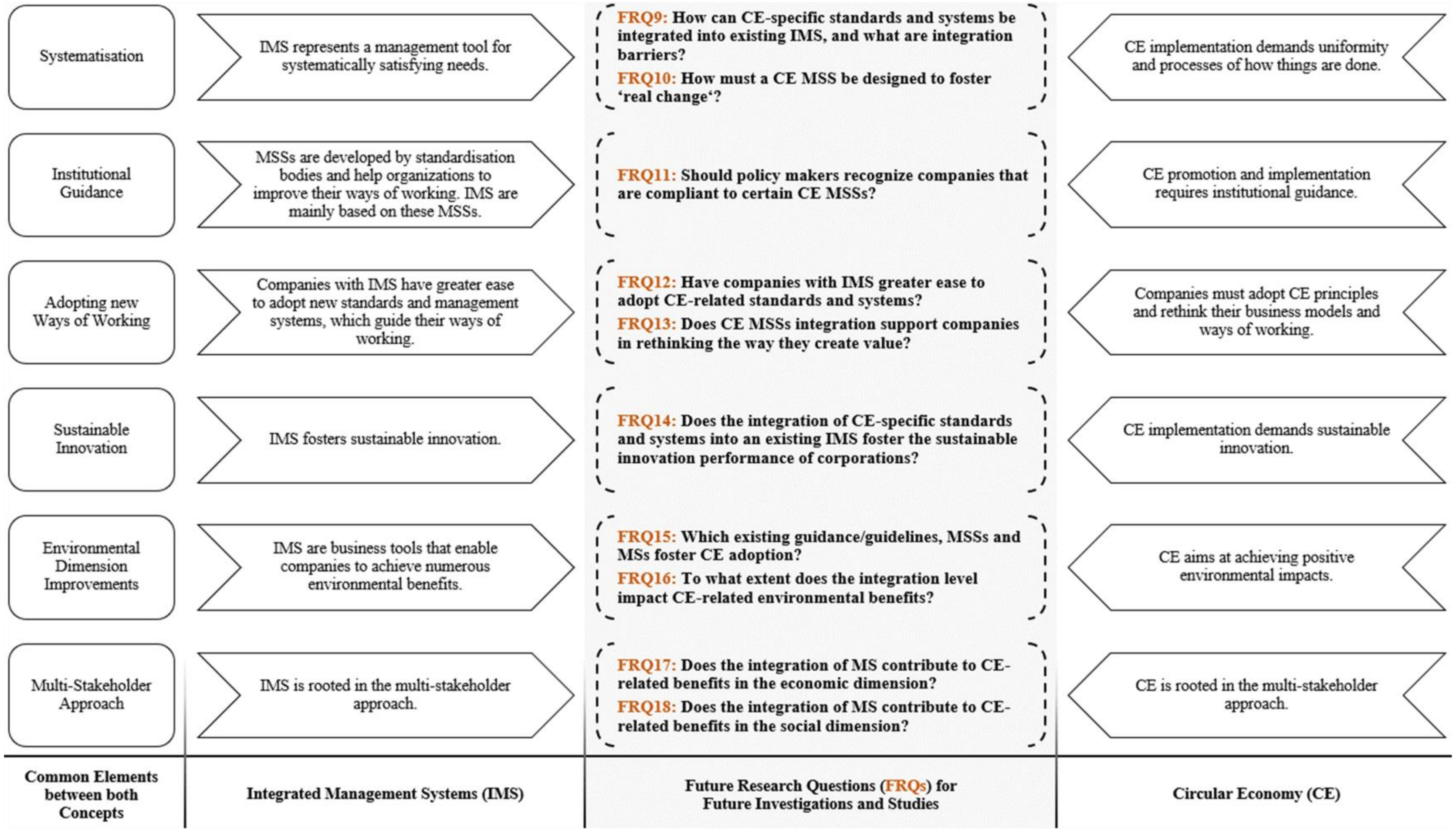

Figure 48. Proposed Future Research Agenda clustered by Common Elements between IMS and CE

Source: Own elaboration.

6.5 Conclusions

Chapter 6 seeks to connect the concept of IMS to the CE. Since such a connection seems to be absent in literature, this work aims firstly to assess the current state of academic research and secondly to pave the way for more detailed future studies by proposing a comprehensive research agenda, which is designed in accordance with common elements between both concepts.

The findings of this study are based upon a SLR on the relationship between the concept of IMS – which is based on MSSs and MSs – and the CE. The review results in a synthesis sample of 18 academic contributions, which mainly deal with institutional guidance to define common definitions, sustainable innovation to introduce CE-related business activities, and benefits in the environmental dimension. The literature analysis shows that MSSs can help to overcome many adoption difficulties that the CE faces, such as hampered diffusion due to numerous diverging approaches (see e.g., Kalmykova et al., 2018), the lack of standard indicators for circularity measurement (see e.g., Corona et al., 2019), and missing uniform transition support for companies (see e.g., Rincón-Moreno et al., 2021).

Hence, it comes as no surprise that the most famous standardisation body, the ISO, has standards for the CE under development (ISO, 2018). Moreover, increased sustainable innovation capabilities (see e.g., Hernandez-Vivanco et al., 2018; Scarpellini, Valero-Gil, et al., 2020) and various benefits in regard to CE-related environmental performance (see e.g., Jabbour et al., 2020; Poltronieri et al., 2019; Salomone, 2008) are important aspects that the concept of IMS contributes to transitioning from a current linear to a future circular economy.

Further, chapter 6 reveals that this particular field of research is still a relatively young research branch, whose importance is underlined by the increasing number of recently published contributions. Multiple knowledge gaps are still existing, which are tackled in the proposed research agenda by formulating 10 FRQs in regard to (1) systematisation, (2) institutional guidance, (3) adopting new ways of working, (4) sustainable innovation, (5) environmental dimension improvements, and (6) multi-stakeholder approach.

Regarding the latter one, this study urges future works to not only concentrate on environmental benefits of CE adoption but also to consider economic and social impacts on stakeholders when fostering CE-principles implementation by integrating MSs. Further, a certain focus lays on CE-specific standards – such as the British BS 8001:2017 or the French XP X 30-901 – as well as on the integration of MSs.

6.5.1 Practical Implications

Regarding practical implications, the findings reveal how management systems contribute to CE adoption and, therefore, demonstrate that executive managers can use IMS as business tools to foster CE implementation at the corporate level. Due to the blurred understanding of CE principles, especially primary stakeholder groups – such as employees, suppliers, and customers – might benefit from the high degree of systematisation that goes along with IMS implementation as well as with IMS' ability to guide the way of working. In addition, the study outlines the importance of institutional guidance as well as the development of globally valid CE-focused MSSs, thus providing policy makers with valuable insights.

6.5.2 Academic Implications

The main contribution of this research to academia is the theoretical elaboration of the link between the integration of MSs and the CE concept. By retrieving and synthesising the state-of-the-art academic knowledge at hand, the study provides an unbiased and comprehensive overview on this particular research stream that can serve as starting point for other researchers. Moreover, the proposed research agenda sets a concrete path for future academic investigations and studies.

6.5.3 Limitations and Future Research

Chapter 6 is limited by the databases used in the SLR, as they might not entail all relevant contributions on the topic under investigation. In addition, the inclusion/exclusion criteria crafted as well as the string applied and, consequently, the number of papers available for analysis represent limitations. Future research should be directed at the knowledge gaps and research questions outlined in the research agenda. However, this list is not exclusive. Further empirical research is needed to prove or disprove the conclusions made in previous conceptual and empirical studies. Therefore, the consistency of findings should be checked by using different data generation methods, both qualitative as well as quantitative ones (methods triangulation).

CHAPTER 7. CONCLUSIONS

The aim of this thesis was to contribute with novel knowledge about how formalising and systematising managerial activities in the form of management systems fosters sustainability at the corporate level, with a focus on the integration of multiple MSs. In this course, chapters 2 to 6 applied empirical as well as conceptual research methodologies in order to address five specific thesis objectives. Eventually, chapter 7 now develops the overall conclusions of the doctoral thesis.

Therefore, the chapter is structured as follows. First, the conclusions of chapters 2 to 6 are shortly summarised in alignment with the five thesis objectives. Second, joint conclusions are elaborated. Third, the main contributions of the doctoral thesis are consolidated. Fourth, overall managerial, policy, as well as academic implications are stated. Fifth, the work's main limitations are listed. Finally, future research opportunities are proposed.

7.1 Summarised Conclusions

Besides the separate discussion of results and drawing of conclusions in the individual chapters 2 to 6, this section recapitulates the outcomes in alignment with the five thesis objectives initially shown in Table 1 in the introductory chapter. The summarised conclusions are complemented by Table 34, which provides a comprehensive overview of the answers to all 12 research questions dealt with in this work.

The first thesis objective was **to synthesise identified links between the integration of MSs and sustainability, to identify existing knowledge gaps, and, eventually, to put the links between both concepts into a justified relationship context** (chapter 2).

When it comes to the synthesis of existing academic literature about the relationships between IMS and sustainability, it can be concluded that this still young and emerging research stream is predominantly populated by academics that view IMS to be a driver of sustainability (see e.g., Samy et al., 2015; Siva et al., 2016). Thereby, the literature at hand merely considers IMSs that consist of more than just quality, environmental, and/or organisational health and safety MSs. Further, it was exposed that there are numerous conceptual articles that propose IMS-centred sustainability frameworks that lack empirical proof regarding their feasibility and practicability (see e.g., Asif et al., 2013; Gianni et al., 2017), and the existing empirical contributions are often limited in terms of small sample sizes, single countries, and particular industries (see e.g., de Nadae et al., 2021; Fasoulis & Rafet, 2019). Moreover, current research does not link IMS to the adoption of sustainability concepts at the economic level.

Conclusively, knowledge gaps appear in four research directions: (1) unfolding conceptually derived models in practice, (2) producing large-scale and cross-regional studies that focus on the impact of IMS on each TBL pillar, (3) exploring IMS components beyond QMS, EMS, and OHSMS that contribute to CSP enhancements, and (4) investigating how IMS helps organisations to incorporate fundamentals of economic-level sustainability concepts. This conclusion of chapter 2 shaped the structure of the doctoral thesis, whose objectives 2 to 5 aimed at advancing research in knowledge gaps (2) to (4).

Eventually, chapter 2 concludes a vice-versa relationship between IMS and sustainability. The initially implemented MSs are identified as sustainable actions themselves, which eventually create the urge of integration. This integration then paves the way towards improved sustainable development in a subsequent step. Eventually, the resulting IMS itself represents a sustainable business tool – therefore being labelled as SIMS.

The second thesis objective was **to prove through a cross-regional empirical study that QMS and EMS represent powerful business tools to achieve enhanced ESG performance** (chapter 3).

Analysing ESG data for more than 4,200 firms proved that operating with QMSs and/or EMSs leads to statistically significant better environmental, social, as well as governance performance. Hence, it is concluded that both MSs are suitable business tools for addressing sustainability-related stakeholder demands. Thereby, the identified individual strengths of both MSs should be considered – especially, when it comes to using both simultaneously (as done in an IMS, for example). Combining QMSs and EMSs leads to statistically significant improved ESG performance as compared to the sole adoption of a QMS. However, the combination leads to slightly – albeit not significantly – improved scores in the environmental and social pillars and minor performance losses in the governance dimension as compared to implementing only an EMS.

The third thesis objective was **to empirically evidence that companies operating with certified ISO 9001 QMS, ISO 14001 EMS, and/or ISO 45001 OHSMS create statistically significant higher financial benefits for shareholders, as compared to firms without such certifications** (chapter 4).

Based on balanced datasets of more than 1,300 firms that span a time range of one decade (2010 to 2019), was revealed that certain combinations of ISO certified MSs are associated with statistically significant higher return on equity and dividend per share yields, respectively. However, for single certifications no increased shareholder-centred variables were confirmed.

Thus, it is concluded that running only one MS is inferior to operating with numerous different MSs in terms of financial performance. This outcome supports the viewpoint that for single ISO management systems the costs incurred with certification and operation of the standard might offset the positive impact on firm performance (see e.g., Wang & Mao, 2020), while companies having multiple systems in place might experience additional performance advantages that stem from synergy effects (see e.g., Casadesús et al., 2011; Ferrón-Vílchez & Darnall, 2016) and/or integration benefits (see e.g., Bernardo et al., 2015).

The fourth thesis objective was **to present existing MSSs published by ISO, thereby outlining their academic research status and highlighting their relation to the SDGs as well as to ESG themes** (chapter 5).

Based on bibliometric techniques, it is concluded that numerous MSSs are yet outside the scope of scholars. In fact, 75% of the standards revealed low to no research contributions since their publication date (at least in regard to academic contributions indexed in Scopus). However, the standards' underlying topics themselves were in some cases already of great interest to academics in other research areas. Hence, there is catch-up potential in the area of investigating MSSs/MSs-research.

Regarding the relation of an ISO MSSs to corporate sustainability, the conclusion is drawn that albeit such relationships must be evaluated on an individual case-by-case basis, in total 19 out of 28 standards (68%) show medium to strong connections to sustainability. The action plan developed in Figure 45 intends to guide future research about MSSs in the light of CS by ranking the standards' research maturity to their sustainability relation. This eventually highlights which MSSs contain the best prospects in this research stream.

The fifth thesis objective was **to explore how IMS as business tool can contribute to the adoption of CE principles at the corporate level and to identify existing knowledge gaps** (chapter 6).

The analysis of existing literature led to the conclusion that MSSs/MSs and their integration can help overcoming many of the adoption difficulties that the CE still faces – such as missing uniform transition support for companies (see e.g., Frishammar & Parida, 2019), the lack of standard indicators for circulatory measurements (see e.g., Corona et al., 2019), and the hampered diffusion due to numerous diverging CE approaches (see e.g., Kalmykova et al., 2018). Moreover, the IMS concept contributes to the CE transition through providing increased sustainable innovation capabilities and numerous CE-related environmental performance benefits (see e.g., Fonseca et al., 2018; Milazzo et al., 2017).

Knowledge gaps appear in six common elements between IMS and CE: (1) systematisation, (2) institutional guidance, (3) adopting new ways of working, (4) sustainable innovation, (5) environmental dimension improvements, and (6) multi-stakeholder approach.

Table 34. Consolidated Answers to this Thesis’ Research Questions

Research Question	Answer
RQ1: How far advanced is research that links the integration of MSs to the incorporation of the TBL approach in organisational management?	It is a still young research branch with the following characteristics: - Academics predominantly view IMS to be a driver of sustainability. - Multiple IMS-centred sustainability frameworks have been proposed. However, many of them lack empirical proof. - Empirical research is often limited in terms of small sample sizes, single countries, and specific industries. - IMS research merely considers components beyond QMS, EMS, and/or OHSMS. - Current research does not depict how IMS as business tool can contribute to companies’ adoption of economical sustainability concepts.
RQ2: In regard to research that links the integration of MSs to the incorporation of the TBL approach in organisational management, which knowledge gaps still exist that should be investigated in future research?	Knowledge gaps appear in four research directions: (1) Unfolding conceptually derived models in practice. (2) Producing large-scale and cross-regional studies that focus on the impact of IMS on each TBL pillar. (3) Exploring IMS components beyond QMS, EMS, and OHSMS that contribute to CSP enhancements. (4) Investigating how IMS helps organisations to incorporate fundamentals of economic-level sustainability concepts. Chapter 2 formulates eight FRQs suitable for addressing these knowledge gaps, refer to Table 6.
RQ3: Is IMS simply an antecedent of sustainability, or is there a vice-versa relationship between both concepts?	IMS and sustainability share a vice-versa relationship: - MSs are sustainable business tools, and the proliferation of multiple MSs within a firm creates the urge of integration. - Integration paves the way towards increased sustainable development. - Integrated MSs themselves represent sustainable tools (SIMS).

Table 34. (continued)

Research Question	**Answer**
RQ4: Do companies that operate QMSs and/or EMSs achieve statistically significant higher ESG scores than firms without such MSs?	Operating with QMSs or EMSs in general leads to statistically significant higher ESG scores. However, there are some exceptions related to specific regions, company sizes, and industries.
RQ5: Which ESG issues are positively impacted by the implementation of QMSs and/or EMSs?	Both MSs share common strengths (community, management, and shareholder score), but also possess individual advantages: - QMS: Product responsibility score. - EMS: Resource use, emissions, environmental innovation, workforce, human rights, and CSR strategy score.
RQ6: Do companies that apply both QMSs and EMSs simultaneously achieve higher ESG performance than firms that operate with only one of these MSs?	Combining both MSs leads to statistically significant improved ESG performance compared to operating only with QMSs alone. Moreover, the combination leads to slightly – and not significantly – improved scores in the environmental and social pillars as well as to minor performance losses in the governance dimension compared to operating only with EMSs.
RQ7: Do shareholders of companies that operate either ISO-certified QMS, EMS, or OHSMS enjoy statistically significant higher financial benefits?	Operating with ISO 9001 certified QMS, ISO 14001 certified EMS, or ISO 45001 certified OHSMS (or OHSAS 18001, respectively) on a sole basis does not result in increased financial benefits for shareholders, as measured by return on equity and dividend per share yield. This suggests that, from an economic perspective, the performance benefits of running a certified MS are offset by its inherent costs.
RQ8: Does the combination of ISO-certified QMS, EMS, and/or OHSMS lead to statistically significant higher financial benefits for shareholders?	Combining ISO 9001 certified QMS with either ISO 14001 certified EMS (double certification) or ISO 45001 certified OHSMS (or OHSAS 18001, respectively; double certification) results in statistically higher return on equity. Further, any combination (double and triple certification) leads to an increased dividend yield. This suggests that, from an economic perspective, operating with multiple MSs enables managers to capitalise on synergy effects and integration benefits – and, thereby, fulfil their fiduciary duty of maximising shareholder wealth.

Table 34. (continued)

Research Question	Answer
RQ9: How mature is academic research about existing ISO MSSs?	The maturity of academic research about ISO MSSs must be evaluated on an individual case-by-case basis. In sum, only 7.1% of the standards are attested a high research maturity, 17.9% reveal a medium research extent, and 75.0% of MSSs are related to low or even null research contributions (based on Scopus as academic database).
RQ10: To what extent are ISO MSSs related to the SDGs and certain ESG themes?	The relationship of an ISO standard to corporate sustainability must be evaluated on an individual case-by-case basis. In total, nine out of 28 standards (32.1%) reveal strong connections to sustainability. Further, 10 MSSs are attested a medium relation (35.7%). The remaining nine standards show low (or even only theoretical) relations (32.1%).
RQ11: How far advanced is research about IMS' contribution to CE implementation?	It is a still emerging research stream with the following characteristics: - Empirical studies represent the dominating approach. - There is the need of academic studies that connect and combine multiple MSSs and MSs to the CE concept, favourable in the framework of an IMS. - Existing literature focuses on CE-related benefits in the environmental pillar, whereas the social and economic components of sustainability find less attention.
RQ12: In regard to research about IMS' contribution to CE implementation, which knowledge gaps still exist that should be investigated in future research?	Knowledge gaps appear in six common elements between IMS and CE: (1) Systematisation. (2) Institutional guidance. (3) Adopting new ways of working. (4) Sustainable innovation. (5) Environmental dimension improvements. (6) Multi-stakeholder approach. Chapter 6 formulates 10 FRQs suitable for addressing these knowledge gaps, refer to Figure 48.

Source: Own elaboration.

7.2 Joint Conclusions

In reference to the thesis research model visualised in Figure 2 in the introductory chapter, the three major joint conclusions of the research done in chapters 2 to 6 are the following.

(1) There is indeed a vice-versa relationship between (integrated) management systems and sustainability. This connection holds true at the corporate level (firm-individual relations in all three TBL pillars), could be enlarged to the macroeconomic level (for example, in the framework of the circular economy), and impacts the achievement of the societal target of fostering sustainable development (with the SDGs representing the guiding model).

(2) At the corporate level, the impacts of MSs adoption (i) vary among different MSs such as QMS, EMS, and OHSMS, (ii) partially depend on company characteristics like firm size, location, and industry, and (iii) differ regarding companies' strategic decision to either adopt only a single MSs or to operate with multiple systems simultaneously. As backed by the theoretical and empirical outcomes of this study, this doctoral thesis recommends firms to implement numerous MSs tailored to their individual needs and to integrate them.

(3) Finally, the joint conclusion is drawn that the research stream about (integrated) management systems and sustainability is still in development. For example, research about MSs and ESG scores is nearly absent, contributions about standards and their relation to the SDGs are scarce, and other scholars did not yet dare to connect MSSs/MSs underlying nature, their capacities, or their evidenced benefits to macroeconomic ideas. To this end, this doctoral thesis provides pioneering work that enhances academic knowledge and motivates fellow researchers to follow this pathway.

7.3 Main Contributions

This thesis makes multiple key contributions to academic research surrounding the integration of management systems in relation to sustainable development. The main contributions relate to motivated research scope expansions, conceptual advancements, and empirical proofs.

(1) **Motivated research scope expansion:** Chapter 5 (Ronalter, Poltronieri, & Gerolamo, 2023) contributes to academia by deriving an action plan for research about MSSs in the light of CS, which is based on the identified research maturity and sustainability relation of the ISO MSSs currently in existence. This intends to motivate research scope expansions – i.e., future investigations related to MSs and their integration should be pushed beyond the still narrow boundaries that keep academic focus mainly on QMS, EMS, and OHSMS.

    This narrow focus of current IMS research is also mentioned in the other chapters. In sum, when it comes to researching how IMS should be structured for being capable of covering a broad range of sustainability-related issues, this thesis argues that researchers must start taking into account additional (niche) standards.

(2) **Conceptual advancements:** Chapter 2 (Ronalter & Bernardo, 2023) and chapter 6 (Ronalter et al., 2022) contribute to academia by providing a synthesis of existing literature regarding the connections between IMS and sustainability in general as well as between IMS and the circular economy in particular, respectively. In this course, the chapters add novelty by justifying the existence of a vice-versa relationship between IMS and SD, on the one hand, as well as outlining the common elements between IMS and CE, on the other hand. Moreover, both chapters outline existing knowledge gaps and formulate corresponding future research questions.

    In addition, chapter 3 (Ronalter, Bernardo, & Romaní, 2023) opened up sustainability-related research to investigating all three ESG pillars simultaneously as opposed to focusing on a single individual dimension (as commonly done in current literature), and also chapter 5 (Ronalter, Poltronieri, & Gerolamo, 2023) tapped into the research gap of relating standards and systems to the ESG concept as well as to the SDGs.

In sum, chapters 2 and 6 provide conceptual advancements as they (i) provide an unbiased and comprehensive overview on two particular research streams that serve as starting point for fellow scholars, (ii) propose research agendas that set concrete paths for future academic investigations and studies, and (iii) theoretically elaborate links between IMS and sustainability (relationship context elaborated) as well as the circular economy (common elements derived). Further, chapters 3 and 5 take a pioneering step in (iv) showing how sustainability-related research might be designed to focus on environmental, social, and governance aspects simultaneously.

(3) **Empirical proofs:** Chapter 3 (Ronalter, Bernardo, & Romaní, 2023) and chapter 4 (to be submitted) contribute to academia by tackling the knowledge gap relating to large-scale, cross-regional empirical studies.

Chapter 3 contributes by connecting MSs directly to the ESG concept and quantitatively investigating the relationship between QMS/EMS adoption and firm-individual ESG scores. Thereby, the chapter also adds knowledge about MSs in the context of the stakeholder theory, as it shows that their implementation relates to increased capabilities in managing CSP-relevant organisation/stakeholder relations (such as workforce, customers, and community).

Chapter 4 contributes by taking on a shareholder viewpoint (complementary to the stakeholder theory from chapter 3) and researching to which extent performance benefits gained from MSs certifications (ISO 9001, ISO 14001, and ISO 45001 / OHSAS 18001) are translated to firm financial benefits for company owners. In this course, superiority of multiple certifications is evidenced, as single certifications are without any statistically significant impact. Further, besides ROE also DY is considered as shareholder-centred financial variable, which has not yet been used as indicator in academic literature.

Hence, chapters 3 and 4 contribute with empirical proof to the ongoing debate about the impact of MSs adoption on the three pillars of the TBL approach. Thereby, this doctoral thesis argues in favour of positive impacts stemming from individual MSs adoption on the environmental and social dimension (stakeholder viewpoint), but rather limited implications to the economic development of firms (shareholder viewpoint). Instead, for economically capitalising on the operation of MSs, the work suggests running and integrating numerous complementary standards and systems. In this course, both chapters shed light on how the combination of multiple MSs relates to organisations' performance in each TBL pillar.

7.4 Implications

Based on the findings and outcomes of the doctoral thesis, this section synthesises the major implications relating to managerial practices, policy making, and academic research.

7.4.1 Managerial Implications

Considering the emphasis on sustainability in today's business world and its corresponding influence on corporate success (see e.g., Hoffman, 2018; Weidinger, 2014), knowledge on how to improve CSP will likely become a competitive advantage for organisations and beneficial for their stakeholders (see e.g., Cantele & Zardini, 2018; Kahupi et al., 2021; Laszlo & Zhexembayeva, 2017). To this end, four major managerial implications can be derived:

(1) Managers should be aware of the TBL-related advantages of (integrated) MSs when formalising their managerial activities and keep in mind the vice-versa relationship between IMS and sustainability.

(2) Corporate executives should consider the implementation of MSs as valuable tool for responding to CSP demands of stakeholders. Thereby, they must be aware of the MSs-specific impact on particular ESG-related issues – especially, when combining multiple systems within the framework of a single IMS.

(3) From an economic viewpoint, managers should weight the benefits received from MSs adoption against their costs. Executives are motivated to strive for the combination and integration of multiple systems and standards in order to capitalise on synergy effects and integration benefits. This way, the economic pillar of the TBL approach can be balanced with the environmental and social aspects, which are (positively) impacted by the implementation of MSs.

(4) Finally, depending on firm-individual needs and circumstances, companies should be open for adopting standards beyond QMS, EMS, and OHSMS in order to take advantage of best practices / standardisation possibilities aimed at further areas critical to sustained corporate success – such as business continuity (ISO 22301), compliance management (ISO 37301), or information security (ISO/IEC 27001).

7.4.2 Policy Implications

Besides corporations, the outcomes of this work might also impact other players like governments and regulatory bodies. The three key takeaways regarding policy implications are the following:

(1) Companies consider regulators being the stakeholder group with the strongest influence on their environmental sustainability efforts (Deloitte, 2021). As this doctoral thesis' argues in favour of (I)MSs' capabilities to increase CSP, in a first step governments and regulatory bodies should take advantage of their position and promote the international diffusion of (as well as enhanced compliance to) management systems and standards.

(2) The fostering of international diffusion should be done under the aspect that most ISO MSSs relate to one or more of the SDGs (ISO, 2022d), meaning their adoption will support companies in fulfilling their crucial part in the 2030 agenda. Without firms striving for achieving the SDGs, the targets will most likely be missed.

(3) In a subsequent step, policymakers should closely watch which industries and sectors are shifting towards greater sustainability due to sufficient stakeholder pressure and which sectors require additional institutional action to improve their ESG practices. Focus should be put on coercive and regulatory forces being well-balanced to support the global diffusion of standards (see e.g., Braun, 2019; Delmas & Montes-Sancho, 2011). This might be through to multiple channels, such as incentivizing the adoption of certain MSs, financially rewarding particular MSSs certifications, or subsidising research about MSs adoption and corresponding sustainability-impacts.

7.4.3 Academic Implications

Chapters 2 to 6 produced several academic implications. The three main implications are summarised below:

(1) The thesis provides a comprehensive overview of current research on MSSs, MSs, and their integration in relation to numerous sustainability-related topics in alignment with the TBL approach. This provides scholars newly entering this research branch with a solid starting point, and the identified knowledge gaps as well as corresponding future research proposals (see especially chapters 2 and 6) act as source of guidance for upcoming investigations of experienced researchers.

(2) The large-scale empirical analyses about the adoption of MSs and the impact on the economic, social, and environmental performance add valuable knowledge on the discussion about MSs and TBL-related impacts. As shown in chapter 3, QMSs and EMSs are suitable tools for enhancing ESG scores on both an individual basis as well as in a combined form. In contrast, chapter 4 neglects positive relations of single

certification on shareholder-centred firm financial performance and, instead, argues in favour of adopting multiple standards in order to economically capitalise on MSs. Based on these outcomes, fellow scholars should engage in detailed studies exploring the reasons behind the impact of synergy effects and integration aspects on the three TBL dimensions.

(3) Thirdly, this work argues that future research should also be directed at standards and systems beyond QMS, EMS, and OHSMS, because there are probably multiple other (niche) standards and systems fruitful for further developing the topic of IMS and its relationship to sustainability. To this end, especially chapter 5 sheds light on less known but promising MSSs, and the action plan visualised in Figure 45 seeks to provide corresponding guidance.

7.5 Limitations

The limitations related to this doctoral thesis are predominantly related to the applied research methods, as commented in each chapter.

Regarding the SLRs (chapters 2 and 6) as well as the bibliometric approach (chapter 5), the databases used for retrieving academic contributions, the developed search strings, and the inclusion/exclusion criteria drafted for filtering the initial dataset might have led to samples that did not include all relevant papers. Further, the science mapping (chapter 5) in Figures 16 to 43 and the subsequent synthesis of identified sustainability relations in Table 29 are biased by the applied ESG framework of Thomson Reuters (2017), because ESG database providers use their own methodologies (Avetisyan & Hockerts, 2017) and, thus, conceptualise their ESG dimensions differently (Saadaoui & Soobaroyen, 2018). For the quantitative analyses (chapter 3 and 4), the database and applied statistical methods represent certain limitations. Further, the analysed empirical data lacks information about the integration level for companies operating with more than one MS.

The corresponding sections in chapters 2 to 6 elaborate on the individual limitations of the applied methodologies in more detail.

7.6 Future Research

Future research should overcome the limitations posted in section 7.5 as well as in the corresponding sub-sections in the conclusions of chapters 2 to 6, respectively. In addition, it should be directed at the proposals for future investigations derived in chapters 2 to 6.

In principle, the research agenda formulated in chapter 2 (refer to Table 6), which served as pathway for structuring the doctoral thesis, still holds true. Despite chapters 3 to 6 having contributed to some of the existing knowledge gaps, these gaps are by far not filled completely. However, the findings of this thesis help sharpening certain aspects of the knowledge gaps at hand.

Firstly, empirical studies are needed to unfold conceptually created models in practice (see e.g., Asif et al., 2013; Gianni et al., 2017). Albeit this thesis does not provide any chapter focusing on this aspect, its findings nevertheless provide the input that this research stream should control for the organisational context of firms. Conclusively, it should be tested whether different integration models are to be created for certain countries, firm sizes, and industries. Further, such models should be enlarged and take into account business areas beyond quality, environmental, and organisational health and safety – depending on the specific needs of individual companies.

Secondly, although this work provided two large-scale, cross-regional empirical studies on the impact of MSs adoption on the different TBL dimensions, more in-detail analyses are needed. In accordance with demands formulated by other authors, such as Wang and Mao (2020), this work claims that the precise reasoning behind identified impacts on sustainability performance must be further researched. To this end, current literature so far lacks to control for the level of integration and maturity of the IMS when performing large-scale empirical analyses. However, future research should put in focus issues surrounding the integration of MSs – such as the integration level (see e.g., Abad et al., 2014; Jørgensen et al., 2006), integration maturity (see e.g., Domingues et al., 2016; Poltronieri et al., 2019; Santos et al., 2022), and integration strategy (see e.g., Karapetrovic, 2002; Wang & Liu, 2023) – in order to control for possible integration benefits and, thereby, advance IMS-related knowledge.

Thirdly, in regard to the knowledge gap of IMS components beyond QMS, EMS, and OHSMS that yield potential positive impact on current and/or upcoming sustainability challenges, this thesis provides an action plan for research about MSSs in the light of CS. This plan, derived in chapter 5 (refer to Figure 45), intends to motivate research about (niche) standards – such as, for example, ISO 26000 (social responsibility), ISO/IEC 27001 (information security), and ISO 22301 (business continuity). Moreover, the work revealed that there are also standards in place outside the ISO-family that should be considered when designing an IMS directed at fostering CS. For example, the British BS 8001:2017 or the French XP X 30-901, which support firms in internalising the principles of the circular economy. In sum, research is needed on MSSs with low research maturity and high sustainability relations, because these standards will enhance CSP and, thereby, could act as valuable differentiation tools for companies. Further, as this work stresses the importance of combining multiple MSs, this research stream should also deal with the question of how such additional (niche) standards can be successfully integrated into (existing) IMS, thereby pointing out firm- as well as industry-specific CSF and integration barriers.

Fourthly, regarding the stream concerning the possible contributions of (integrated) MSs to the adoption of economical sustainability approaches, chapter 6 provided pioneering work in the frame of the circular economy. To this end, the formulated research agenda (refer to Figure 48) sets the pathway for more detailed studies by asking 10 FRQs. However, besides more investigations on IMS and the circular economy, this fourth future research stream might be enlarged and eventually also challenge how standards and systems can contribute to the successful achievement of global sustainability goals like, exemplarily, the UN'S SDGs, *"Decade on Ecosystem Restoration"*, and the targets of the *"Biodiversity Beyond 2020"* programme.

Besides the four knowledge gaps depicted in Table 6 and the additional comments made in the previous paragraphs, future research efforts should also be directed at continuing, validating, and enhancing other authors' contributions in the field of IMS and sustainability, such as the publication by Nunhes et al. (2022) about *"Guidelines to build the Bridge between Sustainability and Integrated Management Systems"*.

Let us strive towards greater sustainability. Together, as one humankind.

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APPENDIX

Table 35. Illustration of Research Step 1 described in Section 5.3.1

ISO Standard	**Stage**	**Document Type**	**Sect. Appl.**	**Related Generic MSS**	**Manual Check by Authors**	**Selection for Bibl. 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

Table 35. (continued)

ISO Standard	Stage	Document Type	Sect. Appl.	Related Generic MSS	Manual Check by Authors	Selection for Bibl. Analysis
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	

Table 35. (continued)

ISO Standard	Stage	Document Type	Sect. Appl.	Related Generic MSS	Manual Check by Authors	Selection for Bibl. Analysis
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		
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

Table 35. (continued)

ISO Standard	Stage	Document Type	Sect. Appl.	Related Generic MSS	Manual Check by Authors	Selection for Bibl. Analysis
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		

Table 35. (continued)

ISO Standard	Stage	Document Type	Sect. Appl.	Related Generic MSS	Manual Check by Authors	Selection for Bibl. Analysis
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: The table has been downloaded from ISO (2022c) on 7 January 2023. 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: Adapted from ISO (2022c).