

**FINANCIAL IMPACTS OF ENVIRONMENTAL
MANAGEMENT SYSTEM IN PRIVATE COMPANIES -
SYSTEMATIC LITERATURE REVIEW**

**Jyväskylä University
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ABSTRACT

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Title Financial Impacts of Environmental Management Systems in Private Companies – Systematic Literature Review	
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<p>Abstract</p> <p>Environmental management systems (EMS) provide opportunity for improving corporate financial performance (CFP). There is a vast number of studies trying to identify the impact of implementing certified or non-certified EMS on CFP and profitability. The results show mixed and inconclusive findings. This systematic literature review retrieves and synthesizes from previous studies, which financial measures have been considered in research literature assessing the impact of EMS adoption to company's financial performance, has the research literature been focused on fact-based data or interviews and perceptions, what type of empirical findings have been made between the noted financial impact and EMS as well as points out what financial aspects been overlooked in current research literature.</p> <p>In accordance with prior research this study found mixed yet slightly positive correlation between EMS and corporate financial performance. One of the main challenges in current research trends was found to be the inconsistent and diverse usage of different financial measures as well as the versatile interpretations of the impact mechanisms. This in addition with the wide usage of perceptual and self-reported measures was found to lead to limited understanding of the causalities between EMS and CFP. This research provides a good understanding of the financial measures, impact mechanisms, and data collection methods utilized in current research literature as well as their limitations. It proves more research is needed especially about the detailed linkages and impact mechanisms of EMS to CFP to support corporate decision making.</p>	
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<p>Tiivistelmä</p> <p>Ympäristöjohtamisjärjestelmä tarjoaa mahdollisuuden parantaa yrityksen taloudellista suoritusta. Lukuisat tutkimukset koittavat selvittää sertifioidun tai sertifioidun ympäristöjohtamisjärjestelmän vaikutuksia yrityksen taloudelliseen suoritukseen ja kannattavuuteen. Löydökset ovat monelta osin vaihtelevia ja epäselviä. Tämä systemaattinen kirjallisuuskatsaus selvittää aiempiin tutkimuksiin pohjautuen, mitä taloudellisia mittareita on käytetty arvioitaessa ympäristöjohtamisjärjestelmän implementoinnin vaikutuksia yrityksen taloudelliseen suoritukseen, pohjautuvatko tutkimukset faktoihin vai haastatteluihin ja näkemyksiin, millaisia empirisiä löydöksiä on tehty kyseisten taloudellisten mittarien ja ympäristöjohtamisjärjestelmän välillä, sekä millaisia taloudellisia mittareita on mahdollisesti jätetty tutkimuksissa huomioimatta. Linjassa aiempien tutkimusten kanssa, tämäkin tutkimus löysi vaihtelevan, joskin hieman positiivisen korrelaation ympäristöjohtamisjärjestelmän ja taloudellisen suorituksen välillä. Löydöksen mukaan yksi suurimmista haasteista viimeaikaisessa tutkimuksessa on ollut taloudellisten mittarien epäjohdonmukainen ja vaihteleva käyttö, sekä vaikutusmekanismien moninainen tulkinta. Tämä yhdistettynä näkemyspohjaisiin ja itse raportoituihin mittareihin on johtanut rajalliseen ymmärrykseen syy-seuraussuhteista ympäristöjohtamisjärjestelmän ja yrityksen taloudellisen suorituksen välillä. Tämä tutkimus tarjoaa hyvän ymmärryksen viimeaikaisissa tutkimuksissa käytetyistä taloudellisista mittareista, vaikutusmekanismeista ja tiedonkeruumenetelmistä sekä tutkimusten rajoitteista. Tutkimus todistaa, että jatkotutkimusta tarvitaan etenkin yksityiskohtaisista linkityksistä ja vaikutusmekanismeista ympäristöjohtamisjärjestelmän ja yrityksen taloudellisen suorituksen välillä, yrityksen päätöksentekoa tukevan tiedon tuottamiseksi.</p>	
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ACRONYMS

AT	Asset Turnover
CEP	Corporate Environmental Performance
CFP	Corporate Financial Performance
DFC	Debt financing costs
EBIT(DA)	Earnings Before Interest and Taxes (and Depreciation and Amortization)
EMS	Environmental Management System
EPS	Earnings per Share
KPI	Key Performance Indicator
MVBV	Market Value to Book Value
NOIPE	Net Operating Income Per Employee
NS	Net Sales
PM	Profit Margin
PPE	Productivity per Employee
RG	Revenue growth
ROA	Return on Assets
ROC	Return on Capital
ROCE	Return on Capital employed
ROE	Return on Equity
ROI	Return on Investment
ROS	Return on Sales
SOA	Sales on Assets
TI	Total Income

1 INTRODUCTION

1.1 Background and motivation

Growing concern and awareness for sustainability together with regulations is impacting corporate decisions towards adopting sustainable strategies to enhance corporate environmental performance. At the same time generating profit remains the main target for majority of private companies. Economic aspect is considered one of the key elements in sustainable business models (Schaltegger et al. 2016).

Does it pay to be green has been asked in one shape or form in magnitude of studies during the past decades. There has been a lot of research on the benefits of corporate environmental performance (CEP). Although many find positive correlation between CEP and corporate financial performance (CFP) there are also studies indicating mixed, unclear, or even negative correlations. For example, Klassen and McLaughlin (1996) studied the connection between the environmental and financial performance of a company and found a strong correlation between the environmental image and productivity. Despite the long discussion the dispute about does it pay to be green remains. The discussion has further continued from “if” to “when” do sustainable efforts pay off.

Companies are adopting environmental management systems (EMS) as method to implement sustainable strategies, tackle environmental concerns and boost their CEP. Main motivators for EMS implementation are external pressures such as market pressure from competitors and consumers and threat of liabilities (Anton et al. 2004). According to some authors company motivation for pursuing environmental goals originates from normative consideration, ethical rationality, or economic rationality (Baumgartner & Rauter 2017). When taking one step further to certify an environmental management system, it appears economic reasons continue to be less important decision-making criteria. Link & Naveh (2006) summarize from previous studies that potential for cost reduction was not main driver for EMS certification. Yiridoe et al. (2003) also found in their survey that from reasons for certifying, improving production efficiency together with competitive advantage were at the bottom of the list. In general, there has been growing interest in research towards ISO 14001 certified EMS. Even though multiple studies have been conducted about the economic impacts of ISO 14001 EMS the financial focus is only on small portion of the studies. Analysis by Salim et al. showed that only 15% of their sample of 509 research articles between 2000 and 2016 were focusing on economic implications where the rest of the sample was covering socio-ecological and environmental aspects. They further concluded that in addition to being underrepresented, the economic focus had been mainly in general economic benefits such as productivity, cost reductions, trade, firm

value, and reputation. Fewer research is focusing specifically on EMS and variety of financial fact-based impacts.

This draws to suspect that the full scope of financial benefits from EMS adoption might not be studied or understood. Multitude of studies note companies having limited and narrow understanding of potential benefits of EMS and even recently Abisourour et al. (2021) claim that impact of ISO 14001 certification on corporate financial performance and efficiency has not yet been clearly demonstrated. According to Salim et al. (2018) limited knowledge about economic impacts of EMS hinder research applicability in industry. Mosgaard and Kristensen (2020) argue that the companies they studied did not have wide enough understanding of potential benefits of ISO 14001 certification and were not able to explore competitive advantage from strategic use of the system.

Lack of studies imply insufficient understanding of the financial impacts leading companies more sceptical about potential benefits and implementation activities (Salim et al. 2018). It is important that corporations care for environmental issues and acknowledge that they have a huge impact on the corporate image and stakeholder relations. But will companies be able to gain full commitment in their management and daily operations if they do not recognize the full financial potential for EMS implementation? Assessment by Melnyk et al. (2003) indicates, companies lack compelling quantitatively based economic reasons for pursuing ISO 14001 certification. Lebas & Euske (2002) propose, performance to only exist if outcome and results can be described or measured so that they can be communicated for someone to decide to do something. The main driving question is weather the factors influencing financial performance have been evidenced to the extent that it could be clearly utilized by business management in making operative management decision and aiming to desired results.

It is important for the commitment of the company to know all the financial benefits. Identifying opportunities which are in line and contribute to companies' main financial targets make it easier to incorporate EMS to corporate culture and way to operate. Understanding the various interdependencies can also support companies in establishing correct key performance indicators and business measures to verify and steer their environmental efforts in a comprehensive way and to manage EMS implementation to reach optimum outcomes. Especially those benefits that can be calculated from the financial statements can also affect the legitimacy of the company's efforts and the opinions of financially motivated stakeholders. In addition to the motivational and measurement factors, the implementation should also be considered in this context. Environmental management system can be implemented in multiple ways with varying outcomes. When companies have clear financial motive, they put more effort into implementation leading to higher environmental performance.

This study aims to establish an understanding of potential gaps in current research literature and gain insight on the observed financial impacts of environmental management systems. The findings can support to tackle above mentioned issues and help companies to outline the economic impacts they should measure and aim for in relation to their EMS implementation. The findings could

be further utilized to study those financial impacts that have been lacking focus in the past research.

This master's thesis will utilize systematic literature review to investigate which financial measures have been studied in relation to EMS. The purpose is to identify how current research is mapping the measurable financial benefits of environmental management systems and what are the identified reasons for the potentially improved corporate financial performance. Study of financial benefits from EMS will be reflected against the common elements for corporate financial performance and profitability in management accounting to identify if all elements have been considered or identified.

Some older systematic reviews have been conducted on similar topics. Tourais & Videira (2016) reviewed in general the results of EMAS from time span of 1993-2012. Morioka & Carvalho (2016) reviewed corporate sustainability performance in 2006-2015. Boiral et al. (2018) are closest to this study as they reviewed adoption and general outcomes of ISO 14001 from publishing years 1996-2015. However, their review is older as well and does not cover the publishing years addressed in this study, proving clear gap in current research. In addition to having a more precise focus, this study does also give continuum to the previous reviews from publishing year 2016 onwards. Other synthesizes and analyses, such as literature reviews (Molina-Azorin et al. 2009, Tari et al. 2012), integrative reviews (Heras-Saizarbitoria and Boiral 2013), meta-analytic reviews (Albertini 2013) and bibliometric analyses (Salim et al. 2018) about the impacts of corporate environmental management or ISO 14001 certification have been conducted but they as well are different in nature due to lacking the systematic approach in methodology and having different or more generic focus in their research questions. In newer research literature systematic literature reviews have been also conducted on many other topics under the umbrella of corporate sustainability and corporate environmental performance such as circular economy, green strategies, green supply chain management and sustainable construction to name a few. Malesios et al. (2021) conducted systematic review on sustainability performance analysis, which however does not address the EMS CFP linkage.

This study is unique as despite the growing number of studies around EMS CFP linkage, very few systematic literature reviews have yet been conducted specifically on financial impacts of EMS and to my knowledge no systematic review currently exists to provide a complete outlook on the current situation. This paper further differs from earlier studies by compiling a wide overview of different financial aspects considered in the linkage between EMS and financial performance and as a conclusion by trying to identify if any aspects are overlooked in current trend of research on relation between environmental management systems and financial performance.

Further justification for this research can be found from Khan & Johl (2019), who state that after the 2015 amendment to ISO 14001, sufficient investigations to the impacts have not yet been done. Abisourour et al. (2020) point out lack of

visibility financial results from implementing environmental improvement actions and missing alignment between environmental objectives and operational and financial performance as two main challenges. Boiral et al. (2018) further concludes lacking consensus on ways to measure outcomes of ISO 14001 and utilization of inconsistent and non-comparable measures. This study aims to provide valuable information for tackling these challenges and to observe their implications to the results.

1.2 Research question

The purpose of this research is to establish comprehensive view on financial impacts of EMS and gain understanding on what the current research trends are on examining that linkage as well as the potential limitations of prior research.

Utilizing systematic literature review methodology, this thesis will answer four (4) main questions:

1. Which financial measures have been considered in research literature assessing the impact of EMS adoption to company's financial performance?
2. Has the research literature been focused on fact-based data or interviews and perceptions?
3. What type of empirical findings have been made between the noted financial impact and EMS?
4. Have some financial aspects been overlooked in current research literature?

Focus on this study is specifically on financial benefits since financial results are the key decisive factor in the operations of most business enterprises. Schaltegger & Wagner (2006) divide economic performance into commercial success indicators such as growth and market share and to financial success determined by profitability. In this study financial impacts are considered to in their wider meaning covering also such commercial and market driven factors. Framework for financial performance factors will be used to assess, categorize, and classify findings from the research sample.

Research findings on "Does it pay to be green" are often influenced by inconsistent measurement of corporate environmental management (Albertini, 2013). To improve comparability and minimize inconsistencies this study focuses only on EMS. It offers a more structured and systematic starting point for assessing linkage between environmental and financial performance, as a comparison to corporate environmental management, which can originate from wide range of different types of management structures, actions, and strategies. Meta-analysis of Albertini (2013) discovered a higher positive correlation between CEP and CFP when measured with environmental management variables. Albertini (2013) further concludes that higher financial performance originates from developing complex organizational capabilities and tying environmental endeavors to

corporate strategy, of which can be achieved through EMS. In this study focus is further directed on the performance of individual companies. Studies about EMS implementation impacts on macro-economic, or country level are excluded.

1.3 Research structure

This thesis is divided to five chapters. This first chapter introduced the background and motivation for this study as well as presented the research questions. Theoretical framework and most important concepts are explained in chapter 2. First the basic concepts of corporate environmental management, environmental management systems and financial performance are described. Next, existing research about the linkage between EMS and CFP are summarized and previous systematic literature reviews around the subject are presented. Also, the main concepts of systematic literature review are explained. Third chapter gives detailed description of the methodology of this thesis. Literature search criteria and method, screening practices, exclusion criteria as well as data extraction practices are explained. After that, the sample data is introduced. Chapter four presents result and analysis of the data. Financial impacts studied in the sample are categorized and identified financial linkages are listed and analysed. Fifth chapter concludes and discusses the findings and their potential limitations. Proposals for future research are presented in this final chapter.

2 THEORETICAL FRAMEWORK

According to Klassen and McLaughlin (1996) corporate strategy and environmental management go hand in hand. They show the linkage from environmental management to environmental performance which in turn results to financial performance. Environmental management systems are one form of environmental management. This chapter will introduce the theoretical framework and most important concepts about environmental management systems, corporate financial performance, and their linkage. First the basic concepts of environmental management systems and related certifications are explained. Second the focus will be on financial indicators and performance measurement. Categorization of financial measures will be done based on the elements they are founded on. The basic elements of financial measures will be the foundation for categorizing the findings of financial impacts of EMS in the results section of this study. Thirdly the linkage between EMS and financial performance will be explained. To understand how EMS can impact financial performance will enable assessing the correlations in the research sample. Furthermore, the previous systematic literature reviews around the same subject will be synthesized to establish a starting point for discussion and sounding board for the results of this study. In the end, the theoretical background for systematic literature review methodology will be explained before moving to the practical implementation of that methodology in chapter 3.

2.1 Environmental management systems and certification

Environmental management is a wide concept covering multitude of management strategies, structures and processes aiming for improved environmental performance. Environmental management effects and result to environmental performance meaning the impacts of company's activities and products on natural environment (Klassen and Whybark, 1999). Environmental performance of a company can be impacted by rules and regulations given from outside the company or through soft policy instruments, which are based on voluntary implementation and impact through learning processes and procedural changes (Voinea et al. 2020). Environmental management systems are one example of so-called soft instruments. Environmental management systems and certifications are one form in addition to for example environmental practices, pollution prevention strategies as well as process- or product-driven initiatives (Molina-Azorin et al. 2009). Environmental management system is a more structured and defined approach to environmental management.

Feng & Wang (2016) describe EMS as a system that integrates environmental management into daily operations of a company. According to Darnall et

al. (2008) EMS is a tool for managing organization's environmental impacts and providing a structured approach to planning, assessing, and implementing improvements to environmental performance. Melnyk et al. (2003) emphasise the formality of the system and its focus on organizational evaluation and documentation of performance in comparison to life cycle analysis, which is a more product and process focused form of environmental management. It is this structured end to end process for managing companies' activities towards sustainability that separates EMS from other forms of corporate environmental activities. It is also this structure and verifiability that drives this study to focus on impacts of EMS instead of investigating the financial outcomes of CEP or other environmental activities in general.

The plan-do-check-act cycle is in the core of environmental management system. Schaltegger et al. (2003, 293) summarize planning, action, measurement, comparison between plans and actual outcomes, feedback, and revision of expectations for future periods as characteristics for systems approach to management. Similarly, the International Organization for Standardization (ISO), describes environmental management system to be part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy (Environmental Management Systems and ISO 14001 1999, 1). At least the following basic components are included in EMS (Netherwood 2001, 41, Feng & Wang 2016):

- Environmental policy: development of and commitment to an environmental policy, which states the objectives for EMS
- Environmental impact evaluation: Identification and documentation of actual and potential environmental effects of organizations activities and policy revision based on these when needed.
- Goals and targets: impact evaluation forms basis for setting clear quantifiable and measurable goals and targets for environmental performance
- Operational procedures: procedures should be reviewed to ensure compliance with environmental objectives. With noncompliance a documented action plan should be in place to achieve the objectives.
- Responsibilities and training: environmental training programme should be implemented, and responsibilities allocated to ensure sufficient skills and motivation for implementing EMS efficiently.
- Compliance review: Operations need to be controlled and audits conducted regularly to assess the implementation of targets and the effectiveness of the management program. The management system needs to be evaluated and corrective actions taken to meet the defined targets.
- Continuous improvement: in addition to the compliance audits the procedures should be continuously assessed to identify improvement potential in current processes or completely new enhanced practices.

A common procedure is also regular reports that are made internally and externally about the environmental performance.

2.1.1 EMS Certifications

To harmonize and ensure good environmental management practices different environmental management standards and certifications have emerged. As comparison to non-certified systems, a certified EMS, whether it be ISO, EMAS, BS 7750 or any other similar standard, are based on fundamental principles defined within the respective standards (Alemagi et al., 2006). The main objective of these standards is to ensure the EMS fosters continuous improvement of corporate environmental performance. Boiral (2007) suspects that the reasons for EMS certification, however, is due to social legitimacy and external pressures instead of real concerns for efficiency or environment. According to him, certification is formal structure with only loose connection to real activities. Despite the criticism a certification can be an easy way to verify if a company really has an environmental management system in place.

EMS certifications can be classified based on their institutional background of public versus private and their focus on either company or product level (Schaltegger et al., 2003, 294). In this study the focus is on the organizational EMS certifications such as the ISO14001 and EMAS, which is also reflected in the sample search words as described in the methodology section. However, although most environmental management systems in research scope are certified, certification as such was not considered an inclusion criterion for the sample of this study.

ISO 14001 is the most widely recognized environmental standard and based on the categorization from Schaltegger et al. (2003) it is a private standard issued by the industry-based ISO standardisation organisation. Figure 1 describes the number of ISO 14001 certifications globally and shows that although being stabilized the popularity of the standard seems not be declining. Dubravaska et al. (2020) and Herghiligiu et al. (2019) list environmental policy, planning, implementation, and operation, checking and corrective action, and management review to be basic steps of ISO 14001 implementation. These basic steps make the certification applicable globally with existing other management systems. Although ISO describes a systematic approach to managing environmental impacts it does not define environmental targets or require environmental reporting (Voinea et al. 2020). In addition to the motivations for implementation ISO 14001 certification has faced criticism for giving organizations considerable margin for manoeuvre resulting to superficial conformity instead of genuine improvements (Boiral, 2007). The standard was revised in 2015 to apply a risk-based approach and with a set of new requirements for the context of the organizations as well as top management support and commitment (Mosgaard, 2020). These enhancements might increase the capability of the certification itself to support organizations to generate real improvements as a result.

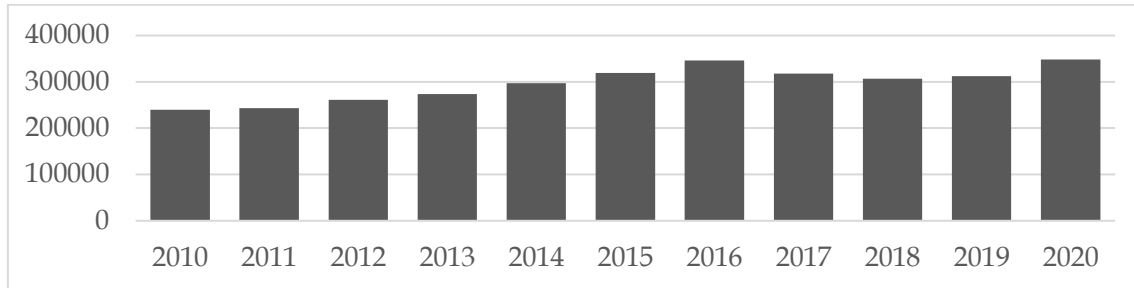


FIGURE 1 Number of ISO 14001 certifications per year

The newest EMS research has a focus on the reasons, why companies discontinue their EMS certification. Mosgaard and Kristensen (2020) summarize from statistics that the number of EMAS certified companies have steadily declined since 2013 where ISO 14001 has had a constantly growing trend. However, after 2017 also the number of ISO 14001 certified companies have decreased. Also, during the growth years there were several companies giving up the certification in addition to new applicants. Synthesizing from previous studies the main reasons for certification drop-out factors were related to lack of recognition by the market and other external stakeholders but also inability to recognize financial benefits and other added value to justify the cost of certification (Daddi et al. 2018, Merli et al. 2018, Mosgaard & Kristensen 2020). This would indicate that either the certification has not brought financial benefits to the companies, or they have not identified the linkage between the generated benefits or not have been measuring them. Also, the latest studies about certification drop-out are covered in the sample of this thesis for the portion where they shed light to the financial reasons for giving up certification.

Although similar elements are covered in both ISO 14001 and EMAS certification there are variances on their requirements and scope. The main differences are presented in Table 1, adapted, and extended from summary by Du-bravska et al. (2020). One big difference between these certifications is their institutional background where ISO 14001 is privately managed and EMAS is a public organization. EMAS is operating in European Union area only in comparison to fully global ISO standard. It can be also clearly seen that EMAS places a lot more strict requirements for the certification in comparison to ISO which relies more on recommendations and does not have as wide scope of different elements as EMAS.

TABLE 1. The main differences in the extent and requirements of ISO 14001 and the Eco-Management and Audit Scheme (EMAS).

Extent	ISO 14001	EMAS
Institutional background	Private	Public
Territorial operation	Worldwide	European Union
Validity for types of activities	All types	Mainly manufacturing industrial activities
Input analysis	Recommended	Required
Impact register	Recommended	Required
Environmental statement	Not required	Required

Competent authority	Not required	Required
Business subject registration	Not required	Required
Audit cycle	Undetermined	Maximum three years
End process management	Certification	Environmental statement verification, locality registration

In addition to ISO 14001 and EMAS also less widely used BS 8555 certification exists. As there were no papers identified in this research sample to address this specific certification, its characteristics will not be covered in this theoretical framework. The dominance of ISO certification over other types of certifications was also apparent in this study as can be later seen in the result section.

2.2 Financial performance measurement

Financial performance originates from competitive advantage and according to Porter's (1980) positioning theory its origin comes from lower costs or differentiation in comparison to competitors or industry average. In addition to Porter's positioning theory a resource-based view aims to explain corporate performance in the market. In resource-based view competitive advantage is generated by selling products or service with lower cost than competitors. Also, other company internal resources such as organizational structure or intellectual property to name a few could give the advantage.

Klassen & McLaughlin (1996) break financial performance factors simply to market, equalling the revenues, and costs. Market factors influencing revenues include higher sales volumes or higher margins from premiums based on customer preferences. Costs on the other hand are impacted by productivity, from for example process efficiency, or cost avoidance such as materials savings. Productivity in general means the ratio between inputs and outputs. Neely (2002) continues with the same fundamentals and splits business performance measurement to marketing and operational perspectives.

Regardless of the origin, financial measures are most traditional and commonly used measures to assess company performance. There are also multiple categorizations for financial measures. Some authors such as Brown & Laverick (1994) and Orlitzky et al. (2003) distinguish financial accounting-based measures of financial returns, such as profit, return on equity (ROE) and return on assets (ROA) from market-based measures of financial value including stock returns, market value, price-earnings ratio, and price per share. Accounting based measures are considered to capture companies' internal efficiency whereas market-based measures indicate external performance. Despite being criticized for being subject to manipulation through various accounting techniques and managerial considerations (Brown & Laverick 1994, Scholtens 2008) they are mostly well quantifiable and comparable as well as widely available due to legal requirements. Although not as susceptible to manipulation, market-based measures

may as well inaccurately reflect the performance expectations of investors. Market based indicators are impacted by forces outside management control and are based on a notion that the satisfaction of shareholders determines company's success (Albertini 2013). Tobin's q is another widely used indicator for company's intangible value (Dowell et al. 2000). It is calculated based on firm market value per replacement costs of tangible assets, thus including both accounting based and market-based elements.

Albertini (2013) extends the split of accounting based and market-based measures further with organizational measures. The author considers cost advantage of pollution control equipment, differentiation advantage due to green products or insurance premium rewards to be organizational measures. However, one might argue these to be already imbedded in accounting or market-based indicators. Cost advantage and insurance premiums should be directly measurable from the cost base of the company and differentiation should impact company revenues.

Continuing more on the accounting-based approach, Muda & Wahyuni (2019) consider company financial performance to be analysed and evaluated through financial statements. This could exclude some market related financial measures that cannot be found directly from firms' financial statements. They divide financial measures to three categories: 1) Earnings Measures: earning per share (EPS), return on assets, return on net assets, return on capital employment, and return on equity. 2) Cash flow Measures: free cash flow, cash flow return on gross investment, cash flow return on investment, total shareholder return and business return. 3) Value Measures (economic value added (EVA), market value added (MVA), cash value added (CVA) and shareholder value (SHV).

When considering accounting-based measures and profitability, the basic components are costs and revenues. Majority of financial profitability indicators include both components and thus it is challenging to identify the underlying factors influencing the end result. To add the complexity, Murphy et al. (1996) point out that different measures can also present logically inconsistent results. A measured variable can produce different performance outcome based on that particular measure used to assess the performance. Murphy et al. (1996) illustrate the challenge with ROE measure, which is a combination of ROA, which is considered to describe efficiency, and total assets/equity, which is considered to indicate leverage. Based on ROE alone it is impossible to conclude whether high performance originates from operating efficiency or financial leverage. This means no conclusions about performance can be made based on only measure.

The vast number of different variations of financial measures does not make the situation any easier either. Murphy et al. (1996) offer an extensive list of various financial performance measures utilized in research and categorized to efficiency, growth, profit, and size according to Table 2. In addition, measures in categories liquidity, success/failure, market share and leverage have been utilized in prior research literature.

TABLE 2 Financial performance measures used in research literature adapted from Murphy et al. (1996)

Category	Measures
Efficiency	Return on investment, Return on assets, Return on equity, Return on net worth, Gross revenues per employee, Average return on assets, Internal rate of return, Return on average equity, Relative product costs, Net sales to total capital
Growth	Change in sales, Change in employees, Market share growth, Change in CEO/owner compensation, Change in net income margin, Change in present value, Company births, Number of acquisitions, Job generation, Change in pre-tax profit, Change in labour expense to revenue, Loan growth
Profit	Return on sales, Net profit margin, Gross profit margin, Net profit from operations, Net profit level, Pretax profit, Price to earnings, Earnings per share, Average return on sales, Average net profit margin, Clients estimate of incremental profits, Market to book, Stock price appreciation
Size liquidity	Sales level, Cash flow level, Number of employees, Ability to fund growth, Current ratio, Quick ratio, Inventory turnover, Accounts receivable turnover, Case flow to total debt, Total asset turnover, Working capital to sales, Cash flow to investment, Case flow to sales

Choosing the correct and most suited financial indicators to each situation depends on performance element that is measured. Also, the timing of the measurement impacts the usability of different measures. Different indicators can lead to different results when measuring future versus past performance and depending on the time span of measurement. Even though some financial indicators might be more suitable for assessing impacts of EMS, in this study financial measures are considered in their wider meaning including a range of numeric quantifiable measures that describe the company performance. To get full picture of the research on financial impacts of EMS implementation no articles are excluded from the sample based on the type of financial measures were used in the assessment.

2.3 Mechanisms of EMS impact to financial performance

There are multiple theories to explain the mechanisms through which the environmental management system is impacting corporate financial performance. This chapter gives an overview of the different theories and categorizations. The impact mechanisms to main elements of financial performance are listed. In the end also the moderating factors are covered. Prior research trends around the topic are addressed through earlier studies conducted with different review methodologies. These items will give the starting point for discourse as well as the theoretical backbone for reviewing and analysing the research sample.

Deriving from Porter's positioning theory both cost advantage and differentiation advantage can be impacted by environmental management. According

to Porter and van der Linde (1995a) pollution is a form of economic waste resulting from incomplete, inefficient, or ineffective use of resources in a manufacturing process. Albertini (2013) synthesizes from Porter & van der Linde (1995a) and from other authors that environmental improvements generate cost advantage for example through redesigning production to be less polluting or using energy-saving appliances and manufacturing processes. Differentiation advantage can be derived from environmental management best practices focusing on product characteristics and product markets. Product focus could include producing in more environmentally friendly ways, which should also tie back to cost advantages, environmentally friendly packaging or even developing completely new environmentally friendly products. Environmental differentiation generates potential for higher sales prices that result in increased revenues or can enable first mover strategy in green product markets, which potentially leads to increased profitability.

General financial causalities investigated in relation to sustainability performance in general can be also applied to EMS implementation. Labuschagne et al. (2005) present four economical elements. Firstly, financial health includes profitability, liquidity, and solvency, which can be tied close back to accounting based financial measures. Second, economic performance considers how company value is perceived by shareholders and external stakeholders, is measured by e.g., share profitability, market share and other market-based measures. Thirdly potential financial benefits include subsidies and technology improvements. Labuschagne et al. (2005) consider these to be other than profit related financial benefits. However, these items will impact accounting-based measures through different impact mechanisms. Forth element is trading opportunities, which assess company's trade network vulnerability and related risks. These items could be tied back to market-based measures.

According to Darnall et al. (2008) EMS should be reviewed as strategic assets of a company. They claim EMSs to enable knowledge-based skill development that can be translated also to other areas of competitiveness. This would improve information sharing, joint problem solving and overall operational efficiency. This type of intangible development is also very difficult to replicate by the competitors. Albertini (2013) further highlights the development of organizational capabilities and integration of environmental management activities to company strategy and daily operational activities. This type of approach requires competence development and engagement of the employees.

Feng et al. (2016) synthesize studies from Ann et al. (2006) to further explain the intangible linkages of EMS and CFP. They note enhanced corporate image as one intangible asset to increasing sales opportunities as well as to minimize the costs of managing stakeholder relations. Although being intangible items the impacts should be tangibly visible in the financial statements through revenues and costs. They further argue that if customers satisfaction is largely influenced by corporate environmental performance, EMS adaptation could increase sales volumes, customer loyalty and price premiums leading to higher ROA and net profit

margins. Their results indicate EMSs increase customer satisfaction and customer loyalty, which results to improved financial performance.

The negative financial implications of environmental management are mainly focused on cost aspects and companies' internal capabilities. There are also uncertainties about potential outcomes due to the timing of benefits (Albertini 2013). It may take time to materialize financial benefits of environmental and organizational development. Implementing environmental management system, increasing organizational capabilities, and investing in greening company products and operations is bound to increase the costs of the company. It is also proposed that companies focusing on environmental performance draw focus and management efforts away from core business activities (Klassen & McLaughlin, 1996; Molina-Azorin et al. 2009; Albertini 2013). This trade-off between environmental responsibility and core business focus results to reduced financial performance. The resources used for environmental improvements are also steered away from alternative investment projects that might yield higher financial benefits (Molina-Azorin et al. 2009)

The measures used to investigate the correlation, whether positive or negative, as well as the classifications and categorizations of the impacts are versatile. Abisourour et al. (2020, 4) divide the economic benefits identified in previous studies to internal and external. Internal economic benefits are found to originate from improved company image, increased efficiency, reduced usage of resources, packaging, and raw materials, focus on foreign markets, improved customer satisfaction as well as improved quality in processes and products. According to them external economic benefits are derived from green incentives, reduced information asymmetries between suppliers and buyers and competitor imitation. Also pressures from customers, suppliers and investors fall to the external category. Tari et al (2012) on the other hand categorize impacts between 1) internal performance benefits, such as cost reductions, increased productivity, and procedures, 2) external marketing benefits such as improved image and increased market share and customer satisfaction, and 3) relations benefits such as improved relations with communities or authorities. Ferron and Darnall (2016) have very similar approach with internal efficiencies focusing mainly on cost reduction and productivity and goodwill benefits covering external elements around image and relations with customers, suppliers, and other external stakeholders.

Some of these benefits are more intangible by nature but many of them can be linked directly back to concrete accounting or market based financial measures. Regardless of the method of classifying or grouping the mechanisms and impacts, majority of the basic elements are the same and could be verified through simple accounting or market based financial measures. Regardless of the slight differences in the definitions between different studies and authors one thing has strongly agreed upon in the recent research literature. Financial performance is influenced by environmental performance and environmental management (Klassen & McLaughlin 1996, Hamschmidt & Dyllick 2001, Melnyk et al. 2003, Link & Naveh 2006 etc.).

As in financial performance measurement in general, the EMS CFP linkage is impacted by the measures used. According to Albertini (2013) in prior research accounting-based measures have shown stronger positive correlation with corporate environmental management than other financial performance measures, such as market-based indicators. According to her findings environmental management can generate the kind of organizational capabilities, processes and structures that enable efficient usage of organizational resources and competitive advantage. Furthermore, it seems the weak correlation for market-based indicators originates from external stakeholders' inconsistent preferences towards companies greening efforts as well as the incapability to assess organizational capabilities from outside the company. Similar findings have been made by Miroshnychenko et al. (2017). They found external green practices to be secondary drivers for financial performance whereas internal green practices such as pollution prevention and green supply chain management to be main sources of improved financial performance.

2.3.1 Revenues and growth

Higher revenues and growth can be generated by increasing sales prices by differentiation and price premiums, or by increasing absolute sales volumes through gaining more market share in existing markets with differentiation or tapping into or generating completely new markets. Some customers place high value on environmental quality and image which might lead to better position in the markets and higher revenues (Jovanovic & Janjic, 2018; Ferron and Darnall, 2016; Melnyk et al., 2003). However, environmental performance does not automatically generate improved quality towards customers, and it is argued to be difficult for external stakeholders to rank companies and products and make buying decisions based on CEP or EMS (Albertini, 2013; Miroshnychenko et al., 2017). Ambec and Lanoie (2008) note, that finding strong empirical evidence of customer behaviour has been difficult and there is also only limited empirical evidence available for higher sales prices or volumes through product differentiation.

As in most cases increasing revenues or gaining more market share rely heavily on market willingness to reward EMS, the improvement potential might come through other mechanisms. EMS might give access to highly regulated markets and in some cases, it might be a prerequisite of doing business. Melnyk et al. (2003) noted positive correlation between EMS implementation and access to international markets as one potential for improved revenues. They further identified strong positive correlation between improved lead times and EMS implementation. This is usually considered a productivity or an operational measure, but it has direct link to revenues in those cases where company growth is not limited by the demand. In those cases where the limiting factor is company's ability to produce, reducing lead time will increase the total output and thus the revenues. In many industries shorter lead time is also a clear differentiation factor that could support the company to increase its market share.

2.3.2 Cost

Cost related benefits can originate from less waste and lower consumption and from more efficient operations. Many of them can be derived directly from improved environmental performance. Welford (2001, 27) has divided pollution prevention cost reduction strategies into five basic categories: materials use, energy usage, emissions and effluent, waste management and distribution. Materials use includes reducing components and materials substitution. Product design is also mentioned as it is closely related to the first two. All these measures can result in decreased costs of materials and more efficient production processes. Increasing recycling and reducing the quantity or weight of materials both have also a direct effect on the purchase costs of materials. Waste management includes redesigning products and processes, reuse strategies and recycling and these are all fundamentally linked to materials use. Waste management costs are directly related to the amount of waste so the link between environmental performance and costs is also here easy to see. Substituting hazardous and toxic materials with safe ones has also the potential to decrease waste management costs. Also identifying markets for waste belongs to this category. Energy usage contains fuel substitution in addition to energy efficiency. Energy costs are easy to measure, and fuel substitution can reduce costs especially when oil price is high. Emissions and effluent include water usage. These can be improved by reducing inputs and redesigning processes and increasing their efficiency. End-of-pipe solutions can be costly but preventive actions lead often to cost reductions and are strongly related to all the other categories. Welford (2001, 27) also mentions the markets for emissions and effluent. Especially, because of the tightened regulations, discharge limits and emissions allowance trading companies should take the costs of emissions and effluent seriously into account. The final category is distribution. It includes the amount and materials of packaging, which can save costs related to materials use and waste management. Logistics planning, fuel efficiency of vehicles, and the reduction of transportation and optimal loading of vehicles are connected to emissions and effluent as well as to energy usage. Cost savings can be found exemplarily from fuel consumption. Melnyk et al. (2013) among others identified strong positive impact from EMS implementation when measured with reduced costs in general. It is to be noted though, that as in many other papers as well, the research was based on self-reported measures and financial performance through fact-based measures was not confirmed.

Ferron & Darnall (2016) extend the view on cost benefits through green product design. Products design can enable substitution of materials to more cost-efficient ones and production cost reductions by eliminating expensive regulated processes altogether. The benefits of product design have been shown to outweigh the costs of development (Melnyk et al. 2003). Improvements in product quality will also reduce costs from rework and customer claims in addition to improving revenues through customer satisfaction.

In addition to the cost items directly linked to the operational and product efficiency, such as before mentioned material and energy savings, Ambec &

Lanoie (2008) note cost of labour as one potential benefit. Better motivation and engagement of existing employees can reduce employee turnover and positive company image enables attracting skilled employees, both of which will reduce recruitment costs. Employee commitment and wellbeing also reduces number of sick leaves which are a high-cost item for companies. There are cost benefits to be derived also from regulatory elements and risk management. Avoidance of taxes, fines and penalties are core benefits to be gained from environmental risk management. Regulatory benefits can also originate from expedited permit approval, less frequent monitoring, or higher latitude with discrepancies (Ferron and Darnall, 2016). Lower cost of capital and easier access to funds, i.e., possibility to obtain loans with lower interest rate is another clear cost benefit (Ambec & Lanoie, 2008; Jovanovic & Janjic, 2018).

When examining EMS CFP linkage, negative cost impacts must be addressed as well. In addition to the direct costs of potential certification, there are many costs originating from EMS implementation. In addition to product and process development activities, enhancing organizational skills and management practices requires substantial time allocation. This time allocation has direct and potentially also indirect negative cost impacts.

2.3.3 Market value and other items

Companies' market value and related measures are one of the main interests of the companies' owners. It is impacted by how the company performance measured with financial and other indicators is perceived by the stock market. Klassen and McLaughlin (1996) found significant positive correlation with environmental performance when measured with share prices, equity market valuation and shares outstanding. Other common ways of measuring market value are through Tobin's q and earnings per share. EMS implementation can impact market value through corporate image and through company profitability.

Factors to consider in relation to EMS implementation are also regulatory risks, access to cash, debt financing costs, efficient asset utilization and capability to invest. There are also some linkages back from market value and risks to accounting based financial performance. Company's perceived image and market value can impact companies access to cash in form of ability to gain new capital or get other external financing and cost of capital. The cost of capital could be equally categorized to the various cost impacts. Jovanovic and Janjic (2018) summarize availability and cost of funding as one financial benefit of EMS implementation. In addition to having lower cost for funding, available cash enables investments for improving the business. It also enables expansion of business through acquisitions and limits risk for being bought. Furthermore, the improved company image and relations with other external stakeholders through EMS implementation might support companies to attract skilled and motivated labour with lower costs. EMS implementation can act also as a motivational and commitment factor for existing employees yielding improved productivity and performance.

2.3.4 Moderating factors

There are also multiple factors moderating the EMS CFP linkage. EMS has been argued to increase companies market performance through improved institutional legitimacy and corporate image (Dowell et al. 2010, Riaz & Saeed 2020). There is however evidence that this linkage is heavily dependent on the market environment and companies could encounter negative impact on market performance due to EMS certification in emerging markets (Riaz & Saeed 2020). In markets where investors are mostly concerned about profits, and where they perceive environmental management systems to be an additional cost to the company, the market is not likely to reward the companies for their EMS certification or implementation. Also, the completeness and comprehensiveness of EMS implementation seems to be in direct link with the financial performance (Darnall et al. 2008).

Another important moderator is the completeness of EMS implementation and ambitiousness of set targets. Ferron and Darnall (2016) discuss the potential that those companies not showing improved business performance might not have sufficiently embedded continual improvement routines into their overall management strategy. In addition, they argue that the goals for the continual improvement routines might not be ambitious enough to gain results. The companies might be focusing only on products and process while ignoring more complex topics impacting the company as a whole.

Factors promoting positive correlation between EMS and CFP are as an example adaptation of other management systems such a quality management system, which could indicate improvement practices are thoroughly embedded to the corporate culture (Ferron & Darnall 2016). According to Florida and Davidson (2001) innovative companies seems to gain more from EMS implementation. The EMS can support green innovations such as greener products or production technologies which can be a source of competitive advantage and cost savings. Furthermore, the size of the company can impact the profitability of EMS adoption. Larger companies are better able to absorb the costs of EMS implementation.

2.3.5 Prior research trends and findings on EMS-CFP linkage

Multiple studies have been conducted to understand and identify the linkage between corporate environmental management and corporate performance. The individual studies and research trends have also been analysed, summarized, and synthesized in various literature reviews and meta-analyses. However, the focus has rarely been purely on financial impacts of EMS. There are also some reviews about the linkages between CFP and CEP or corporate social responsibility in more general.

TABLE 3 Prior reviews

Author and publishing year	Methodology	Sample size*, time frame	Topic
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Malesios et al. 2021	S	58, 2005-2018	Sustainability performance, including economic, social, and environmental aspects
Hamdoun 2020	S	55, 1990-2018	Outcomes of CEM in general
Boiral et al. 2018	S	94, 1996-2015	Adoption and outcomes of ISO 14001
Salim et al. 2018	B	74, 2000-2016	Studied impacts of ISO 14001
Tourais & Videira 2016	S	80, 1993-2012	Why to choose EMAS
Morioka & Carvalho 2016	S	261, 2006-2015	CSP
Albertini 2013	M	52, 1978-2013	CEM CFP linkage
Heras-Saizarbitoria and Boiral 2013	I	11, 1996-2011	Trends and gaps in ISO 14001 and 9001 research
Tari et al. 2013	L	29, 1999-2009	Benefits of ISO 14001 and 9001
Molina-Azorin et al. 2009	L	32, 1995-2008	CEM CFP linkage

S = Systematic Literature review, B = Bibliometric analysis, M = Meta-analytic review, L = Literature review, I = Integrative review.

* Number of papers addressing EMS, CEM, CEP, CSP or sustainability performance

As can be seen from Table 3 only three of the prior reviews were synthesizing studies about impacts of EMS and their focus was not only on financial impacts. On the other those that focused on CFP considered CEM in general instead of EMS. Same lack of focus on EMS has been present in the research literature in general and during Albertini's (2013) sample period from 1975 to 2011, big portion of existing research literature was focusing on the financial impacts of corporate environmental management in general instead of impacts of environmental management systems specifically. Based on the research focus and time frame the outcome of this study will be unique and extend and refine on the prior research findings. It is also to be noted, that most previous reviews were not very precise in describing the review methodology. Especially the data extraction and quality appraisal processes were completely skipped in many of the papers such as Hamdoun (2020), Heras et al (2010), Molina-Azorin et al. (2009), and Tari et al. (2012). The aim is to correct this deficiency in this research. Despite some shortcomings there are multiple important findings to be noted from prior reviews.

In their bibliometric analysis study Salim et al. (2018) examined the trend of ISO 14001 environmental management system research from 2000 to 2016. Within their final sample of 509 articles only 74 (15%) studied the economic implications of ISO 14001 certified EMS. Although the study reveals that interest for economic implications has a clearly increasing trend during the latter part of their defined period, it remains under researched. In similar manner Tari et al. (2012) identified only 29 articles addressing the benefits of ISO 14001 certification in comparison to 82 articles focusing on benefits of ISO 9001 quality standard and Boiral et al. (2018) concluded that only 17% of the analysed papers had socio-economic focus instead of environmental one. On the other Malesios et al. (2021)

noted sustainability performance research being heavily focused on economic performance measurement and Morioka and Carvalho (2016) found few years earlier economic aspects to be present in about 50% of sustainability performance research. Interestingly this financial focus in sustainability performance research has seem to be lacking when turning the focus specifically to EMS research.

Most studies approach the topic from what element has been impacted in companies internal or external operational environment. Fewer approach the topic purely from financial statement perspective and divide or link the impact mechanisms to terms of profit and loss. Boiral et al. (2018) found that the studies about ISO 14001 adaptation covered socio-economic items such as manufacturing efficiency, cost savings, customer satisfaction, market position, financial performance, investors' returns and share price. However, when they divided the outcomes of ISO 14001 to 3 main themes, environmental management outcomes, environmental indicators, and environmental awareness and social aspects, they did not have any categorizations to address the financial point of views. These could be only loosely tied to the themes through e.g., company image in social aspects or resource consumption in environmental indicators.

When financial impacts have been studied, multitude of different measures have been utilized. In general studies are mainly based on market based or accounting-based measures (Albertini, 2013, 432). Salim et al. (2013) listed general economic benefits including cost related benefits, firm value and reputation, trade, innovation, and productivity. With more detailed approach Tari et al. (2012) classified in total 13 benefit categories: market share, exports, sales and sales growth, profitability, improvement in competitive position/competitive advantage, improvement in systematization (improved documentation, work procedures, clarity of work, improvement in responsibilities), efficiency (productivity, savings in costs, reduction in mistakes and rework, shorter lead time, improved management control), improved quality in product/service, improved image, improvements in employee results (motivation, satisfaction, teams, communication, knowledge), improved customer satisfaction (reduction in complaints, etc.), improved relationships with suppliers, and improved relationships with authorities and other stakeholders. The heterogeneous usage of financial performance measures can be seen also in their categorization. A common classification of financial impacts is between internal and external but individual measure have been classified to both categories depending on the study (Tari et al. 2012).

The findings on nature of financial impacts are mixed. As a conclusion Tari et al. (2012) found that according to prior research ISO 14001 implementation results improved operational results but effects on financial result are inconclusive. Despite being able to identify positive impacts on internal and external factors such as people, operational issues and stakeholders, the studies were not able to establish clear relationship between ISO 14001 and financial performance. Albertini (2013) identified various studies with both negative and positive causalities but indicate overall positive relationship between environmental and financial performance. Heras-Saizarbitoria and Boiral (2013) concluded that the

previous research was focusing on the practical implications of EMS implementation. They found results of impact to be mixed but positive in many of the studies. They identified reduction in consumption of resources and improved image for competitors and stakeholders as the main benefits and impacts on performance in existing research literature (Heras-Saizarbitoria and Boiral 2013, 54).

One explanation for the mixed results is the heterogeneity of the research papers and research subjects. Sampling size across studies, varying research methodologies, different data collection and analysis procedures, sector of activity, organizational size, and market area of studied companies as well as inconsistent usage of financial measures influence research findings (Albertini, 2013; Boiral et al. 2018). In addition to variable methodologies, many studies may be implemented for different purposes and literature reviews on impacts of ISO 14001 may be biased by focusing on specific surveys that are not necessarily reliable or represent most significant studies in this area (Boiral et al. 2018)

Another challenge seems to be the difficulty of measuring environmental management consequences on profitability. Boiral et al. (2018) found that studies are based on large variety of different variables and no consensus exists on the performance measures to be used. The measures can be based on very different and non-comparable indicators which can lead to different results based on criteria and variable used. Many studies utilize market-based or accounting-based measures of financial performance, but also perceptual measures of financial performance based on organizational capabilities are utilized (Albertini, 2013). Boiral et al. (2018) highlight the challenge with majority of ISO 14001 research being based on quantitative studies about managers' attitudes and perceptual measures regarding ISO 14001 impacts. They note that identified positive impacts could be biased by dominant rhetoric about standard rationality and efficiency. Heras-Saizarbitoria and Boiral (2013) further pointed out the problem of utilizing perceptions and self-reporting when analysing impact on performance. Majority of the reviewed studies had used perceptual measures, such as surveys and questionnaires, instead of objective or factual measures. Their proposal is to focus more on objective data and indicators such as commercial databases for economic and financial information. In addition, they identified knowledge gap in costs and benefits of the certification process and recommend further case studies on cost and benefit, longitudinal studies on impacts of certification and systematic reviews on the effectiveness of certifiable standards.

Majority of studies considered simple on-off variable for ISO 14001 without considering the level of implementation, commitment, and motivation. These variables play important role in benefit realization and only few studies considered them (Tari et al. 2012). Boiral et al. (2018) supported this view by noting that variances in the EMS adoption process can lead to very different outcomes in the studies. In their sample Tari et al. (2012) also noted that there were no studies trying to identify if financial performance was result of EMS implementation or vice versa. As a summary, the financial impacts EMS implementation as well as the proper ways of measuring and investigating the topic remain unclear.

3 DATA AND METHODOLOGY

The study was conducted as systematic literature review, a method most used in health sciences. Purpose of literature reviews is to summarize and categorize information. Systematic literature review introduces a structured way for conducting literature reviews. Systematic literature review approach will help to avoid bias and to secure comprehensive selection of research material (Booth et al. 2016, 11). Reviewing literature with this methodology should produce full picture of the studied topic rather than unilateral interpretation.

This chapter will present the different steps taken in conducting the systematic literature review as illustrated in Figure 2. In addition, the final paragraph will describe the characteristics of the final data sample that is used for the research. Systematic literature review was considered a suitable method for this study as there is a clear research question and adequate body of literature already existing as basis for the analysis. Booth et al. (2016, 14) list several purposes for literature review from which identifying coverage of previous studies and indicating way forward for future research are relevant in this case. In addition to identifying gaps in current research, systematic literature review is also a method for summarizing existing evidence (Okoli, 2015, 882) which is one of the purposes of this study.

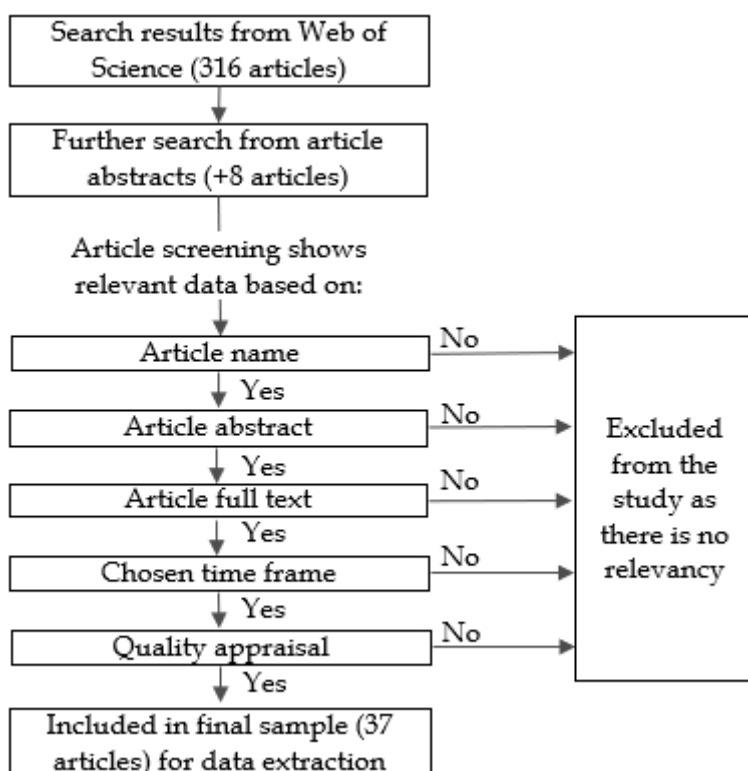


FIGURE 2 Main research steps

Chosen methodology poses some risks on the results. According to Fish and Block (2018, p 104) lacking enough understanding of the process, structure and presentation of systematic literature reviews can lead to describing and listing loosely connected research. According to them this will make the reviews unnecessary complex and difficult for the readers to follow. Another risk identified with systematic research reviews is bias in exclusion. To minimize the bias exclusion criteria will be described, and all excluded articles are listed for transparency. Further risks originate from subjectivity in interpreting and extracting the data. This risk could be eliminated by having more than one person reviewing the data. As this is not possible in this study these risks are managed with careful documentation, systematic approach, and analysing the risk and mitigative actions on each research step.

3.1 Systematic literature review methodology

There are multiple books, papers, and guides on conducting systematic literature review. Based on synthesis from other articles and guides to the research method Okoli (2015, 883-884) summarizes the steps needed for conducting successful systematic literature review. The guideline is initially intended for information systems research but is equally suited for other fields as well. Okoli's (2015, 883-884) approach consists of eight steps which were adapted for this study as described below:

1. Identify the purpose. This step is covered in the introduction of this study.
2. Draft protocol and train the team. Defining the research question is part of this step and is described in paragraph 2 in this study. The research protocol describes the method of searching for literature. The protocol for this specific study is described in more detail in sections 3.2 and 3.3. As this study was conducted with only one reviewer this second step does not require any training activities. However, the purpose of this step, securing consistency in executing the review, remains very critical in this research setup as well.
3. Search for literature. The defined search protocol, described in section 3.2 in this study, is executed in this step. Critical element is to secure the comprehensiveness of the search.
4. Apply practical screen. The purpose of this step is secure all relevant papers are considered and to reduce the number of prospective papers to manageable amount. Success in this step requires explicit list for the criteria for inclusion and exclusion. The criteria and scope must be defined in such way that the research is reproducible and that the sampling is comprehensive enough but practically manageable. The method and criteria for practical screen in this study is defined in section 3.4 of this study. The steps of literature search and practical screen will be conducted to some extent as parallel processes.

5. Extract data. Once all relevant articles have been identified, data will be extracted to answer the defined research questions. At the same time extraction can be done also for measures to establish statistical significance and documentation for characteristics of the sample. The method and data points for extractions in this research are described in subsection 3.6 of this study.
6. Appraise quality. Quality appraisal will take place as a simultaneous process with data extraction. The purpose is to identify and exclude those papers that do not meet the methodological quality requirements. Quality can be assessed by utilizing qualitative or quantitative criteria and different appraisal criteria can be utilized for assessing qualitative and quantitative studies. Typical items to assess are data-collection methodology, research sample, hypothesis, interventions and variables, analysis, results, and conclusions. Most importantly quality appraisal should establish the reliability of chosen studies.
7. Synthesize studies. This step is also known as the analysis. The purpose is to aggregate, discuss, organize, and compare data to establish a comprehensive view of the sample. The synthesis method is dependent on whether the sample consists of only quantitative studies or qualitative or multiple methodologies. Purely quantitative studies can be synthesized utilizing quantitative methods to perform meta-analysis. When synthesizing qualitative or multiple methodologies the approach requires interpretation, integration, and explanation. In this approach the subjectivity of the reviewer must be acknowledged. (Okoli 2015, 899-901). In this research the sample includes studies with varying methodologies. Categorizing of the external characteristics of final sample is described in chapter 3.8. Further categorization of the research content and combining data from the sample studies is described in the results and analysis section.
8. Write the review. This final step covers reporting the findings. Here it is important to establish both the scientific contribution but also clearly outline the rigor in methodology. This master's thesis is the outcome of the review, and its findings are covered in results and analysis as well as summarized in the conclusions of this study.

The most critical elements of systematic literature reviews are defining explicit, comprehensive, and reproducible criteria and method for executing the search for and extracting the data from reviewed literature. As preparation for the review the different categories for financial benefits to be assessed, need to be listed. Due to the rigorous nature of chosen research method, it is important to explain and document in detail the criteria and methodology used in each step of the research. Writing the review must be performed in sufficient detail to enable independent reproducibility of the study. This will be done in the next sections of this chapter.

3.2 Literature search criteria

The literature search words and criteria are part of the research protocol and step 2 in Okoli's (2015) approach to systematic literature review. Search parameters in this study were combination of environmental and financial key words. Advanced search was utilized to identify papers where search words were present in title, abstract or author key words. This enabled to narrow down the initial search result and eliminate those articles that only refer to environmental and financial performance without really investigating the topic.

The main key words utilized for environmental management systems were 1) "environmental management system", 2) "ISO14001", 3) "EMAS" and 4) "BS 8555". Key words utilized for financial performance were combinations of 1) "financial", 2) "economic", 3) "performance", 4) "benefit", 5) "impact", 6) "profit(ability)", 7) "corporate performance", 8) "economic growth" and 9) "earnings". Similar search words are utilized also in prior literature reviews such as the one conducted by Tari et al. (2012). Although covering multiple different phrases there is a risk that not all relevant literature is identified based on the search words or that the words cause biases to the results. The search words about benefit and growth are as such biased towards positive impacts instead of negative ones. However, impact and performance are neutral terms. Profit and earnings are also commonly utilized terms both in positive and negative context.

Different phrasings and combinations of chosen main words were utilized to get comprehensive coverage. For example, different formats of ISO environmental standard were "ISO14000", "ISO14001", "ISO 14000" and "ISO 14001", which are all used in the research literature. On the other hand, some environmental management acronyms were excluded based on observations of search results. EMS (Environmental management system) was not used as a search word even though it is commonly present in the article titles and abstracts. Based on the review of multiple relevant articles, even though acronym EMS was used, also the term "environmental management system" was present both in the abstract and in the author key words. It was thus concluded that excluding "EMS" from the search would not exclude relevant articles from the search results. It also enabled to significantly narrow down the search results as "EMS" has a multitude of different meanings, which returned a vast sample of articles irrelevant to this study.

Based on these criteria key words, a Boolean search formula was generated. Publishing year was not used as a limiting criterion at this stage of the literature search to secure sufficient sample of relevant research literature. Document type was limited to articles and language criteria was English. The formula, related acronyms and result filters are described in the below Table 4.

TABLE 4 Boolean search

Boolean search	((AB=("environmental management system" OR "ISO14001" OR "ISO14000" OR "ISO 14001" OR "ISO 14000" OR "BS 8555" OR EMAS) OR TI=("environmental management system" OR "ISO14001" OR "ISO14000" OR "ISO 14001" OR "ISO 14000" OR "BS 8555" OR EMAS) OR AK=("environmental management system" OR "ISO14001" OR "ISO14000" OR "ISO 14001" OR "ISO 14000" OR "BS 8555" OR EMAS)) AND (AB=("financ* performance" OR "economic* performance" OR "financ* benefit" OR "economic* benefit" OR "financ* impact" OR "economic* impact" OR "profit*" OR "corporate performance" OR "economic* growth" OR "earnings" OR "cost*") OR TI=("financ* performance" OR "economic* performance" OR "financ* benefit" OR "economic* benefit" OR "financ* impact" OR "economic* impact" OR "profit*" OR "corporate performance" OR "economic* growth" OR "earnings" OR "cost*") OR AK=("financ* performance" OR "economic* performance" OR "financ* benefit" OR "economic* benefit" OR "financ* impact" OR "economic* impact" OR "profit*" OR "corporate performance" OR "economic* growth" OR "earnings" OR "cost*"))))
TI	Title
AB	Abstract
AK	Author Keywords
Refined by	
Document types	Article
Languages	English
Timespan	All years
Databases	WOS, KJD, MEDLINE, RSCI, SCIELO

3.3 Literature search method and results

As a third step of this systematic literature review, literature search was conducted with Web of Science advanced search utilizing the formula and search words described in the previous chapter. The search returned 316 articles for further review and screening. This literature search methodology creates potential limitation for the research. The search was conducted through only one database which might limit the sample. O'Brien & Conor (2020) instruct to utilize multiple databases for comprehensive sample. Furthermore, utilizing only electronic source in comparison to physical library, could be a risk but it should be considered an insignificant limiting factor when majority of publications are online.

To mitigate the risk in data search, a complementary search was performed based on the references on the found relevant articles as recommended by Okoli (2015). The references were screened for any further previously unidentified articles matching the search criteria. In addition, the research samples of identified existing literature reviews around the same topic were carefully reviewed and cross referenced against the existing sample. Total 8 additional relevant articles were identified with this method leading to a total initial sample of

324 articles. This way further verification was achieved for having comprehensive sample according to specified criteria. When assessing reliability of this research it is to be noted though, that the review and assessment of comprehensiveness was conducted only by person. Comprehensiveness could be further improved by having more than 1 reviewer.

Before the articles were retrieved, screening was done based on article name and abstract to limit the sample. This process is described in more detail in section 3.4. in this study. Once the relevant articles were identified they were searched with google scholar. Finding the article with google scholar was considered sufficient evidence for the article being peer reviewed and reliable enough to be included in the sample. This initial sample of articles was stored for more detailed screening and analysis.

3.4 Article screening and exclusion criteria

The literature search returned 324 articles. All identified articles were listed with full reference data, including potential exclusion criteria. Initial screening was done in multiple rounds to narrow down the sample. First focusing only on article titles, then on the abstracts and finally superficial review of the full article text. 71 articles were excluded from the sample simply based on the title where one could easily identify irrelevance for this research. Majority of these articles were present in the search results due to different meanings for the acronym "EMAS".

Abstracts of remaining 253 articles were reviewed and further 132 articles were excluded by confirming the papers were not relevant for this study based on their abstracts. After initial screening 121 articles remained. Further five articles were excluded due to not being able to gain access and one due to Spanish language. The text of remaining articles was scanned and again further 20 articles were excluded due to the data content being not relevant to this research for similar reasons as described in previous paragraph. Two of the excluded 20 articles were systematic literature reviews and thus not meeting the inclusion criteria.

The screening identified multiple articles with content closely related to the research questions but not precisely addressing the EMS CFP linkage. Although being able to provide interesting insights, these articles were excluded from the final sample to stay within the boundaries of the research questions. Common reasons for exclusion were the research focus on EMS implementation practices, motivations for certification or expected outcomes of EMS implementation. The excluded articles were not studying the economic implications of implemented environmental management systems in private companies. Table 5 presents four main themes from the excluded articles from years 2016-2021.

TABLE 5 Common themes in excluded articles

Theme	Nr of Excluded articles from 2016-2021
Impact of other types of sustainable activities instead of EMS on corporate performance	15
Motivations and success factors for EMS implementation	12
Environmental impacts instead of financial impacts	6
Moderating variables and contingent factors for the motivation or outcomes of EMS implementation	6

The screening of article abstracts and content, also revealed articles about the reasons why companies have decided to discontinue certification. These articles were included in the sample to provide insight to potential negative impacts and reduce the bias towards positive impacts of EMS implementation. Inclusion and exclusion criteria are presented in Table 6. The criteria are in line with previous similar studies such as the systematic literature review from Boiral et al. (2018). As pointed out by Okoli (2015), the practical screening of articles is rather subjective part in a literature review with multiple considerations and decisions. To minimize bias of this stage of the research the full list of the articles is presented in Appendix 2 with reasons for exclusion.

TABLE 6 Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> • Article published between 2016 and 2021 	<ul style="list-style-type: none"> • Theoretical and conceptual articles, systematic reviews, bibliometric and meta-analyses
<ul style="list-style-type: none"> • Article published in peer-reviewed journals 	<ul style="list-style-type: none"> • Final reports for institutions, Books, memoirs, and unpublished theses as an article
<ul style="list-style-type: none"> • Article addressing the link between environmental management system and company financial performance 	<ul style="list-style-type: none"> • Success stories about ISO 14001 not based on a scientifically sound analysis of the impact of the standard
<ul style="list-style-type: none"> • Study focusing on private sector 	<ul style="list-style-type: none"> • Articles published in a language other than English
<ul style="list-style-type: none"> • Article based on a rigorous and clearly described methodology (qualitative, quantitative, or mixed) 	<ul style="list-style-type: none"> • Access to the article

After the screening the sample remained at 95 articles. Suitable sample in this type of study is 30-50 articles. To reach a manageable sample a further inclusion criteria of publishing year was introduced. The sample was narrowed to past five years and all articles published prior to 2016 were excluded resulting to a sample of 42 articles. Two of the included articles were from same authors and addressing the same research. One having the contents of the main study and the other presenting the data for the study. It was decided to process these as one study in the sample to avoid duplicate findings.

3.5 Quality appraisal

Quality appraisal was performed simultaneously with data extraction. If it was noted that the paper did not meet the minimum methodological or other quality requirements the data extraction was not completed. This research considered six main qualitative criteria which were mainly focusing on the methodological integrity.

1. The papers must present some type of research question or hypothesis.
2. Methodology must be described and if e.g., statistical models are used, those must be explained
3. Data collection method must be explained
4. Data sample must be described
5. The studied financial impact(s) must be defined. Majority of these type of studies were already excluded in practical screening
6. The studied EMS must be defined so that it is distinguishable from other environmental factors. Majority of these type of studies were already excluded in practical screening

There are also other more analysis and conclusions related items that could be utilized in assessing the sample quality. Tranfield et al. (2013) propose based on earlier research that sampling strategy, data quality, generalizability, primary marker, context sensitivity, and theoretical adequacy to be included in quality assessment. This research did not exclude papers that exhibited weak correlation in the results or had lower quality of conclusions or discussion excluding one exception. In addition, some papers were included despite lacking critical analysis on the limitations and potential biases in their execution. Exclusions were not done on these bases as there was only one reviewer and the risk for subjectivity and bias would have increased. Also, it was important to get a comprehensive understanding of the current research trends and the lower quality papers alike provide understanding of the research field.

In the end, further four articles were excluded based on poor quality resulting to a final sample of 37 articles. Articles excluded based on quality appraisal are listed in Table 7 with exact description of the exclusion criteria.

TABLE 7 Exclusions based on quality appraisal

Article	Reason for exclusion
Al-Kahloot, E., Al-Yaqout, A., & Khan, P. B. (2019). The impact of ISO 14001 standards certification on firms' performance in the state of Kuwait. <i>Journal of Engineering Research</i> , 7(3), 286-303.	Article was excluded based on the very narrow and indiscriminate description of the methodology and conclusions as well as missing any actual analysis of the data. It was resembling more like presentation of research data rather than the research itself.

- Castellano, R., Ferretti, M., Musella, G., & Risitano, M. (2020). Evaluating the economic and environmental efficiency of ports: Evidence from Italy. *Journal of Cleaner Production*, 271, 122560. doi:10.1016/j.jclepro.2020.122560
- Ross, J., Penesis, J., & Badrick, T. (2019). Improving laboratory economic and environmental performance by the implementation of an environmental management system. *Accreditation and Quality Assurance*, 24(5), 319-327. doi:10.1007/s00769-019-01388-6
- Yang, M. G., & Kang, M. (2020). An integrated framework of mimetic pressures, quality and environmental management, and firm performances. *Production Planning & Control*, 31(9), 709-722. doi:10.1080/09537287.2019.1681533
- Abstract claims to study EMS but it is not established that sample really has a system that can be considered as EMS. Economic efficiency not clearly explained.
- Success story description. Not fulfilling requirements for scientific research.
- Meaning and content of financial performance is not explained. Otherwise methodology well explained.

3.6 Data extraction

Data extraction was performed by reading the articles and simultaneously documenting and assessing the data on 8 items:

1. The research questions and the hypothesis about economic impacts of EMS implementation
2. Research methodology
3. Data source
4. Separation between facts and perceptions
5. Sample details:
 - a. Publishing year
 - b. Journal where published
 - c. Geographical location of studied companies
 - d. Sample size meaning the number of companies studied
 - e. Type of EMS studied
 - f. Nr of years studied
6. Financial impact in the paper with 6-point scoring for the identified correlation as described in Table 8.
 - a. 26 different financial indicators were identified as starting point for the data extraction based on items noted in the initial review of the sample as well as items picked from other literature.
 - b. The originating sources of individual financial indicators and performance were further categorized and grouped to Revenues, Costs and Market. These were coded with positive, negative, neutral, or inconclusive correlation or as being not applicable to the paper and financial indicator in question.

- c. The total number of studied financial indicators per research were documented as a side product.
- 7. Other interesting findings and notes
- 8. Assessment of quality as described in previous sector for quality appraisal. In addition, general comments about quality were written if something noteworthy was identified.

TABLE 8 Grading for financial impacts

Score	Explanation
0	Not applicable
1	Strong negative correlation
2	Low negative correlation
3	Neutral correlation
4	Low positive correlation
5	Strong positive correlation

A similar categorization grid has been used also in other similar studies such as the systematic literature review by Boiral et al. (2018). It also follows the logic suggested by Tranfield et al. (2003) to cover both the aspects of characteristics of the studies as well as their results in relation the research questions. The form of the grid and the datapoints to be collected were finetuned and finalized when reviewing the first few articles. Here as well few iteration rounds took place, and the tables and findings were elaborated with deeper content analysis on chosen topics. Other researched topics, such as environmental performance or contingent factors, were not documented as they are not a focus item in this thesis.

The sample consist of studies with variety of different research methods and types of expressing and writing the result. Ideally this type of research would have two people independently extracting and analysing the data. This study was conducted only with one person increasing the risk of not being able to identify all relevant items or making subjective interpretations of the results. Having recognized the risk for bias it should also be noted that the method and documentation of data extraction helps to minimize the risk.

3.7 Other steps

There were also few additional steps and iterations involved with the research. As already described in the previous chapter about data extraction, the categorization grid was adjusted according to the data found from the articles. In a similar manner the final selection of financial indicators and their grouping became evident only after having extracted data from the sample. Formulating and refining the research questions based on the sample as well as identifying the underlying themes based on the findings are typical characteristics of a systematic lit-

erature review. In addition, the research questions were modified based on interesting findings about the studied subject. The research question about fact-based versus perception-based research focus was formulated once identifying the importance of the topic. At the same time the order of the research questions was revised to generate a logical continuum.

3.8 Characteristics of final sample

The final sample of 37 articles was first categorized based on publishing year, journals where published, geographical distribution, and type of EMS studied. The publications were quite evenly split to the study period of 2016-2020. Figure 3 describes the number of publications per year and despite the peak in 2020 the trend is only slightly increasing. Previous literature reviews have shown an increasing interest towards the topic in terms of number of publications starting from the late 90s (Boiral et al. 2018, Tourais & Videira 2016, Morioka & Carvalho 2016). Based on the finding in this research in relation with the previous studies, it seems the increasing trend is slowing down.

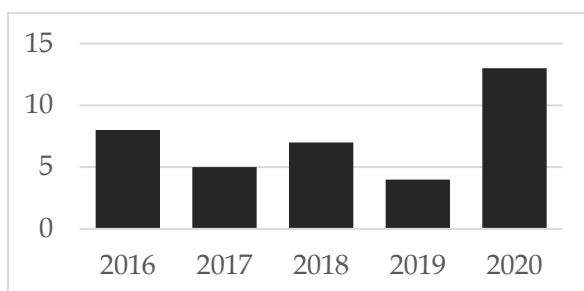


FIGURE 3 Number of publications per year

The sample was distributed to 20 different publications according to details presented in Table 9. Four journals had more than one article published in them. Majority of the articles were published in journals focusing on sustainability related topics. Minority of the studies were published in journals focusing on general management topics and even lower portion in journals with financial focus.

TABLE 9 Journal type, name, and number of publications

Name of publication	Number of publications
Journal of cleaner production	9
Sustainability	6
Corporate Social Responsibility and Environmental Management	4
Business Strategy and the Environment	2
Other 16 Journals: Aquaculture Reports, Asia Pacific Management Review, Economic Analysis and Policy, Ekonomski Horizonti, European	16

Management Journal, European Scientific Journal, Fresenius Environmental Bulletin, Institutions and economies, International Journal of Organizational Leadership, International Journal of Production Economics, Journal of Business Ethics, Journal of Enterprising Communities, Journal of Environmental Planning and Management, Journal of Sustainable Tourism, Quality - Access to Success, Sage Open

Geographical distribution of the sample is described in Figure 4. The figure shows only most presented countries, and some studies included several countries. With 54,1% the majority of the studies had been conducted either fully in Europe or included European countries. However, according to the ISO 2020 Survey (ISO 2021) results European companies account less than 25% of the certified companies. Within the European studies the focus was aimed to those countries where volume of certifications is also high. Another area over presented in the sample was North America. Both United States and Canada had been in focus of many studies despite holding a low volume of certifications.

After Europe, the second biggest geographical focus area in the studies was China with 18,9%. However, China represents over 53% of certified companies (ISO 2021). Other Asian countries represent 16,2% of the total sample. This is roughly in line with the general trend of the registrations with some exceptions. Japanese companies hold 5,4% of all ISO certifications yet there were no studies focusing purely on Japanese companies. Three studies equalling to 8,1% of the sample included multiple companies where Japan was listed as one of those resulting to a minor emphasis in comparison to the total number of certificates. In addition, India and South Korea were not represented in the research sample despite being in top 10 countries according to number of certified companies: India with 2% of the total number of certifications and Korea with 1,5%. Ghana was the only African country represented in the sample, but African countries hold a very minor portion also the certifications globally. However, these countries might have minor coverage through two studies including multiple undefined countries in their sample, but this could not be verified based on the lack of details in the studies in question.

It is to be noted that due to the limited sample size in this study, one individual research in one country is over presented in terms of percentages. Thus, implications of the research volume of individual countries are not as significant as the tendencies visible in the research between western countries, developing countries and China. Similar uneven geographical distribution in number of publications was notable between 2000 and 2016 by Salim et al. (2018). Seems there has not been significant improvement during the past five years of research as this disproportion was revealed also in literature review by Boiral et al. (2018) for period prior to 2016. The main change compared to their review in terms of geographical focus is between Europe and US. Focus on Europe has even further increased whereas United States, which was the most studied country, has significantly reduced in interest.

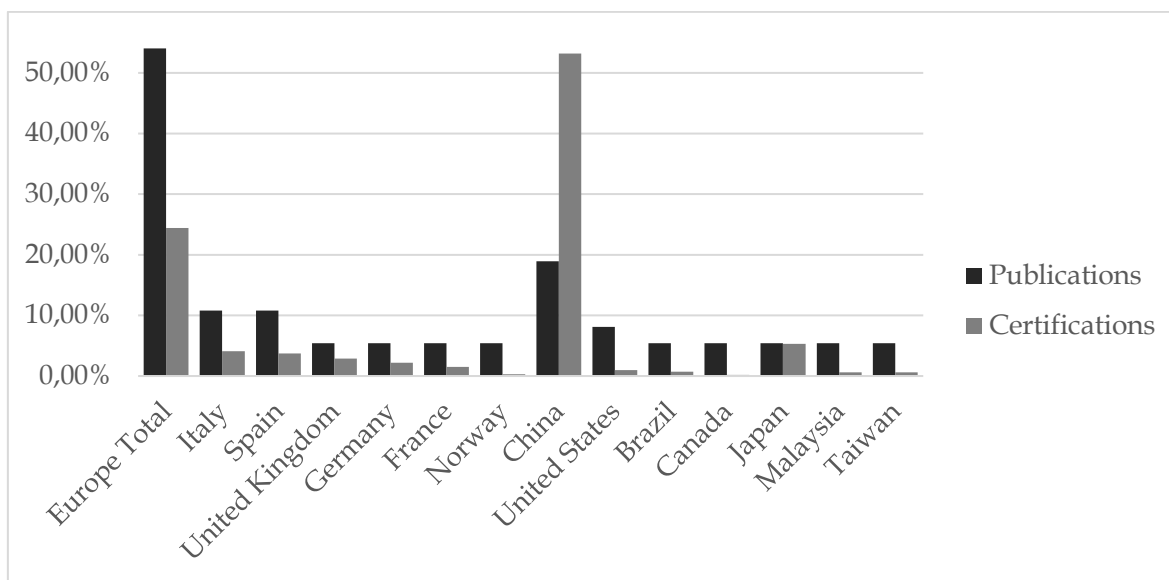


FIGURE 4 Geographical distribution (% of publications - % of certifications per country)

Majority of the sample studies focused on ISO 14001 which is understandable considering the global distribution of the certification and significantly high number of certifications compared to EMAS. There was total eight studies focusing fully or partially to EMAS and total five studies where the type of EMS was not separately specified. Those studies might include companies with ISO 14001 or EMAS certification as well as companies with uncertified environmental management systems. Details are presented in Table 10.

TABLE 10 Type of EMS studied

Type of EMS	Number of publications	% of publications
ISO 14001	24	65 %
EMAS	4	11 %
ISO 14001 and EMAS	4	11 %
Other / not defined	5	14 %

4 RESULTS AND ANALYSIS

Before deep diving on how the research sample answers the posed research questions it's important to highlight some observations about the methodological choices and tendencies within the sample. These are items more related to the content of the research and laying foundation to the results in comparison to the external characteristics which were presented at the end of previous chapter. After this each of the research questions will be answered in their own sections. In the end, the results will be summarized for a clear overview of the results.

The review showed that majority of the studies, total 57%, were conducted with different quantitative approaches as described in Table 11. The number of quantitative research papers remained stable during the research period of 2016-2020. Qualitative approaches were infrequent throughout the period with 14% of the sample papers and only one research was conducted with mixed methodology. Similar focus in quantitative research was already noted by Boiral et al. (2018). A clear difference to the earlier observed research trends (Boiral et al. 2018, Morioka & Carvalho 2016) was the increase of longitudinal focus. 27% of the sample, 10 studies in total, took a longitudinal approach to the research topic and especially when looking at the percentages of research papers, the trend towards longitudinal studies was increasing towards year 2020. It is to be noted that all the longitudinal studies were conducted with quantitative approaches.

TABLE 11 Methodology, number of publications and percentages by publication year

Methodology	Nr of publications	% of publications	2016	2017	2018	2019	2020
Longitudinal	10	27%	0%	60%	14%	50%	31%
Mixed	1	3%	0%	0%	14%	0%	0%
Qualitative	5	14%	25%	0%	14%	0%	15%
Quantitative	21	57%	75%	40%	57%	50%	54%

According to Boiral et al. (2018) qualitative studies would have more diverse group of respondents as well as more in-depth and critical analysis of the topic in relation to quantitative studies. This might also impact the findings of this study where majority of the sample is quantitative in nature and could therefore lack diversity. Fortunately, the increasing focus in longitudinal studies is improving the capability to see the relevant impacts of the certification. They also state that lack of focus in qualitative methods could be explained by the difficulty of collecting and analysing qualitative data in comparison to quantitative. Also, ideally, the difficulty of certain approach should not be steering the research trends away from important research aspects.

The longitudinal studies had a time span of 3-15 year with majority of the sample focusing on three to six years as presented in Table 12. In addition to the clearly longitudinal studies, the one mixed methodology study in the research sample had longitudinal elements in it. Nancy and Shine (2018) extended their

research about greenhouse gas emission reductions to compare two separate 3 - year periods. However, their longitudinal considerations were not focused on financial impacts.

TABLE 12 Number of years studies

Number of Years studied	3	4	5	6	8	10	15
Number of longitudinal studies	2	2	1	2	1	1	1

Table 13 indicates the number of studies by sample size divided into categories by size. The sample is distributed quite evenly between smaller and larger sample sizes. Figure 5 illustrates sample size in comparison to two dominant methodologies, quantitative and longitudinal. We can observe the higher sample sizes being focused on quantitative approaches. This is likely due to characteristics of the methodologies and the easier handling of large data amounts with quantitative methods. Taking this into consideration it is good to see that there are also longitudinal studies conducted with larger samples. The research sample covered 19166 companies in total. It is impossible to know, what portion of the sample is individual companies and on the other hand how many companies have been part of the sample in more than one study. According to ISO 2020 Survey (ISO 2021) the total number of ISO 14001 certified companies in 2020 was 417478. If ignoring potential for duplicate entries the sample would address 5% of certified companies. This would indicate reasonable coverage also in this study.

TABLE 13 Sample size

Sample size	Number of publications	% of publications
1	1	3 %
2 - 25	8	22 %
26 - 100	9	24 %
101 - 500	13	35 %
501 - 1000	2	5 %
> 1000	4	11 %

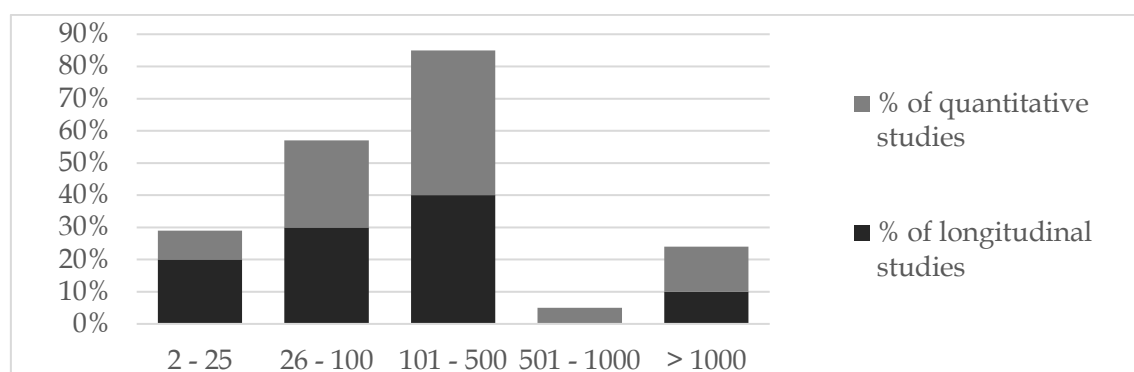


FIGURE 5 Sample size as % of quantitative and longitudinal studies

4.1 Financial focus in research sample

As discussed already in theory section of this study, there are multitude of different financial measures utilized to assess the linkage between EMS implementation and financial performance. The same trend seems to continue in the more recent studies. In the sample of this study, over 20 different types of financial measures could be identified. To add the heterogeneity, there were multiple studies utilizing different variations of self-reported perceptual measures with varying level of details in the content. The list of different financial measures studied and the number of papers they were represented in are visible in Table 14.

As many of the measures can be impacted both through revenues, costs, or other elements, the financial impact mechanisms of each measure are also described in Table 14. The categories for financial impact mechanisms chosen here are growth and revenue increase driven measures, productivity and cost related measures, assets utilization related measures and measures originating from market valuation including risk management and liquidity. The first three: revenue, cost and asset related measures can be considered as accounting-based measures. Earnings per share is the only measure combining accounting- and market-based elements. In addition, there were general perceptual measures not justifiably falling into any of the above mentioned four categories.

TABLE 14 Financial measures studied, their financial impact mechanism and their occurrence

Acronym	Description	R	C	A	M	Occurrence in nr of papers
ROA	Return on Assets	X	X	X		13
ROC/ ROCE	Return on Capital / Return on Capital employed	X	X	X		2
ROE	Return on Equity	X	X			7
ROI	Return on Investment	X	X			2
ROS	Return on Sales	X	X			6
SOA	Sales on Assets	X		X		2
AT	Asset Turnover (Revenues / Total Assets)	X		X		1
NS	Net Sales	X				3
RG	Revenue growth / Change	X				5
PRICE	Price premium	X				1
PM	Profit Margins / cost reductions	X	X			10
PPE	Productivity per Employee	X	X			1
SGAS	SGA* on Sales Revenue	X	X			1
NOIPE	Net Operating Income Per Employee	X	X			3
EBIT(DA)	Earnings Before Interest and Taxes (and Depreciation and Amortization)	X	X			2
TI	Total Income	X	X			1
DFC	Debt financing costs				X	1
EPS	Earnings per Share	X	X		X	1
TOBIN	Tobin's Q				X	4
MVBV	Market Value to Book Value				X	1

INV	Inventory Turnover	X	1
SER	Self Reported General Perceptual Measures		10

*SGA = Sales, marketing and general admin costs.

R = Growth and revenue increases, C = Productivity and cost reductions, A = Asset utilization, M = Market value, liquidity and risks.

Return on assets was the most commonly considered measure alongside perceptual measures. ROA is considered a general indicator for financial performance and firm profitability (Ali et al. 2020 Li & Wu, 2017), however Treacy et al. (2019) for one, had chosen this measure as they considered it to evidence success in cost reductions and operational efficiency. This indicates that the chosen measure and its interpretation can be impacted by the chosen theoretical background and initial assumptions of a research. ROS was a commonly used measure to indicate decreased costs (Li & Wu, 2017; Ali et al., 2020). Interestingly second most utilized measure, product margin (PM = cost of goods sold divided with sales), was chosen by many (Lee et al., 2016; Treacy et al, 2019) for the exact same reason. Noteworthy is that all these three measures are positively impacted equally by reduction in costs but also by increases in revenues. In addition, ROA is further impacted by the value of company assets. Sales on assets, net sales and growth or change in revenues were all utilized for identifying increased sales volumes.

Another often most utilized measure was return on equity. Here noteworthy is that unlike with the other common measures, none of the authors made efforts to bridge the linkage between EMS implementation and the chosen measure. Teng & Wu (2018) noted a prior recommendation of utilizing most common financial measures, ROE, ROA, and ROS, together as the basis for selection. Rehman et al. (2020) simply quote another author for ROE being the highest priority construct of a firm's profitability. Morioka and de Carvalho (2016) highlight the importance of choosing the right indicators for investigating the relation between environmental and financial performance and note that the resulting positive or negative correlation depends on the chosen indicator. Despite several studies clearly described the theoretical background for utilizing certain measures (Ali et al., 2020; Lee et al., 2017; Feng & Wang, 2016; Li & Wu, 2017), there we unfortunately many that did not justify their choices (Ong, 2016; Peiro-Signes, 2020, etc.).

Accounting based measures have prevailed over the market-based measures with only 19% of the sample articles containing one or more of the measures originating from market valuation, leaving the market point of view clearly understudied. From the market-based values Tobin's q was the only one utilized in more than one paper. MVBV and Tobin's q have been utilized e.g., by Miroshnychenko et al. (2017) and Teng and Wu (2018) to indicate future performance in comparison to the backwards looking accounting-based measures.

The challenge with multiple variables and lacking consensus of performance measures noted already by Albertini (2013) and Boiral et al. (2018) seems

to remain in recent research literature. As there are multiple correlations, contradictions, and causalities between different measures (Murphy et al. 1996), more than one measure should always be utilized to enable sufficient analysis of the phenomenon and concluding on potential impacts on performance. To tackle the problem about half of the papers in the research sample are utilizing more than one financial performance measure. The number of studied measures per research ranged from one to nine according to details in Table 15. Still almost half of the papers used only one financial measure to try to prove causality and a bit less than third of the papers utilized three measures or more.

TABLE 15 Number of studied measures

Number of measures per paper	Number of papers	% of the sample
1	18	49 %
2	7	19 %
3	6	16 %
4	2	5 %
5	2	5 %
6	1	3 %
9	1	3 %

Utilizing only single measure might be suited to some of the market-based measures to indicate performance on the market. For example, Tobin's q and share price as measures are unambiguous. However, there as well the causality and drivers can remain unclear. Riaz & Saeed (2020) among others measured EMS impact to market performance only with Tobin's q . They proposed further studies to enable identification of the reasons behind the linkage, such as investment opportunities or profitability of the firm.

Apart from pure revenue measures, the accounting-based measures are always impacted by at least two drivers or revenue, cost, or asset utilization. If the aim is to establish understanding not just on if EMS impacts financial performance but also on how or why, choosing only one measure is not enough. Making assumptions on such basis is not reasonable. Based on the sample in this study, this type of insufficient reasoning is quite common and could be related to the theoretical dispositions. In some papers financial measures such as ROA and ROE were concluded to prove causality between EMS implementation and cost reductions (Herghiligi et al. 2019; Rehman et al. 2020) and revenues as their impact mechanism were overlooked. Inconsistent interpretations can be found also from e.g., Voinea et al. (2020) as they find negative impact to financial performance when measured with revenue growth and suspect it relates to cost increases. Good utilization of different financial measures can be observed in the study by Ali et al. (2020). They applied ROA, ROS and SOA to enable distinguishing the impact origins of costs and revenues.

In addition to diverse and at times inconsistent usage of different financial measures, the linkages between operational and financial measures leave room for improvement in the research sample. As example, Nancy & Shine (2018) studied benefits of ISO 14001 by revenue growth and cost reduction measures as well

as energy consumption. Energy consumption data was fact based and longitudinal whereas the financial measures were investigated through interviews. The opportunity of examining the factual cost outcome of energy consumption and thus creating a strong causality between the operational and financial performance was not taken.

4.2 Facts versus Perceptions

Although accounting-based and market-based measures are predominant in the sample, there were still many studies relying on perceptual measures. According to the utilized data source the sample was divided to studies with fact-based statistics retrieved from different data bases and official documents, and to studies relying on perceptual data from interviews. This information was combined with the earlier categorization of accounting- or market-based measures versus the general perceptual measures, such as “lack of market recognition” or “added value” in study by Daddi et al. (2018), “business performance” by Ferron & Darnall (2016), and “financial performance” by Voinea et al. (2020)

As presented in Table 16, in total 22% or eight articles were relying solely on general perceptual measures of improved financial performance. In addition, another eight articles, 22% of the sample, utilized seemingly accounting- or market-based measures, but instead of retrieving the measurement data from fact-based statistics or financial statements, they utilized interviews to ask for the view on how the chosen financial measures had developed since EMS implementation. The information disclosed by companies to the surveys was not verified.

TABLE 16 Percentage of articles based on data collection method and measure categorization

Data collection	Accounting-based measures	Market-based measures	Accounting- & Market-based measures	General perceptual measures
Fact based, numeric statistics	46 %	8 %	3 %	0 %
Perceptions, interviews	22 %	0 %	0 %	22 %

As an example, Voinea et al. (2020) utilized revenue growth as an indicator for financial performance. The information from the survey participants was considered if they submitted the data at minimum three times during the survey period. In another study by Jovanovic et al. (2020), respondents were asked to assess on Likert scale, if they achieved cost reductions as a benefit of ISO 14001 implementation. Survey with Likert scale assessment was also utilized by Fend & Wang (2016) for assessing financial performance in ROI, ROA, ROS, PM and growth in sales, profits, and market share. In all these cases the information would be more reliably available through financial statements. Furthermore, in case of Jovanovic et al. (2020) getting reliable information would require the respondent’s ability to consistently assess the source of potential cost reductions

after ISO implementation. This in turn would require a comprehensive set of key performance indicators (KPIs) and systematic performance measurement inside the responding company.

Significant differences could also be observed in which financial measures were selected when utilizing fact-based or perceptual data. For many measures: ROE, SOA, AT, PPE, SGAs, NOIPE, EBIT and EBITDA, TI, DFC, EPS, TOBIN, MVBV, PRICE, INV, only fact-based data sources utilized. Table 17 presents the number of studies with perception-based data per financial measure. Sales focused financial measures, such as net sales and revenue growth as well as profit margins and cost reductions seemed to rely less on facts.

TABLE 17 Number of studies where financial measures studied with perceptual methods

Acronym	Description	Facts	Perceptions
ROA	Return on Assets	11	2
ROC/ROCE	Return on Capital / Return on Capital employed	1	1
ROI	Return on Investment	1	2
ROS	Return on Sales	4	2
NS	Net Sales	1	2
RG	Revenue growth / Change	1	3
PM	Profit Margins / cost reductions	4	5

In fact-based papers, multiple different data collection methods were utilized. Financial statements and annual reports were utilized among others by Rehman et al. (2020), Herghiligi et al. (2019) and Ong (2016). Also, different databases for financial information, such as Thomson Reuters dataset (Miroshnychenko et al., 2017), Osiris database (Rehman et al., 2020; Riaz & Saeed, 2020), and financial database FAME (Treacy et al., 2019), were commonly used. Third common data source were information from stock exchange, such as New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotations (NASDAQ) utilized by Lee et al. (2017). It can be concluded that factual information exists and is available to be utilized. In the reviews by Heras-Saizarbitoria and Boiral (2013) and Boiral et al. (2018) majority of the studies had used perceptual measures and management attitudes. As in this sample 21 papers, 57%, relied on facts and accounting-and market-based measures, we can see clear development towards objective measurements and away from perceptions.

4.3 Impacts of Environmental Management System to Corporate Financial Performance

In addition to reviewing the impacts of EMS to financial performance based on the different measures used, there are also some other elements and categorization that are of interest when reviewing the results. Before reviewing the details,

based on the sample in this research, the impact of EMS implementation on corporate financial performance is positive. In total 17 studies, 46%, found the correlation to be favourable (Ali et al., 2020; Frondel et al., 2018; Herghiligiu et al., 2019; Jovanovic et al., 2020, etc.) whereas negative correlation was identified only in seven studies constituting 19% of the sample (Riaz & Saeed, 2020; Daddi et al., 2018, Merli et al., 2018, etc.). Another seven studies or 19% of the sample identified the EMS CFP linkage to be neutral (Dubravaska et al., 2020; Ferron & Darnall, 2016; Teng & Wu, 2018, etc.) and remaining six papers, 16%, had inconclusive or mixed results about the impact (Mosgaard & Kristensen, 2020; Peiro-Signes et al., 2020; Voinea et al., 2020, etc.). If considering those six papers neutral as well, the total percentage of neutral papers would be 35%.

As discussed in the earlier chapters, several measures can originate from different financial impact mechanisms. Table 18 shows how the authors in this sample are explaining the correlation between EMS implementation and financial performance and what they consider to be the underlying source for the impact. Number of articles are listed based on the instances where positive, neutral, or inconclusive, or negative findings have been interpreted to originate through revenue based, cost based, or market based financial impacts. The impact mechanism was explained most often, with 42% of the cases, as cost based or originating from operational efficiency. It can be also seen that the revenue-based interpretations of the causality are more positive than the cost or market based.

TABLE 18 Financial impact of EMS implementation based on impact mechanism

Number & % of articles	Revenue based impacts	Cost based impacts	Market based impacts	Total*
Positive	10 / 48%	10 / 38%	5 / 33%	25
Neutral / Inconclusive	8 / 38%	13 / 50%	7 / 47%	28
Negative	3 / 14%	3 / 12%	3 / 20%	9
Total	21 / 34%	26 / 42%	15 / 24%	

*Total number of articles is higher than sample size as one article can be present in the table multiple times

When reviewing the results in relation to the type of EMS studied it can be seen the results are more favourable with ISO 14001 compared to EMAS certification. The four papers focusing only on EMAS were evenly split between neutral and negative impact with no positive findings at all. This is a big contradiction to the total positive results of 46% from the total sample. The two negative papers were studying the reasons for discontinuing EMAS certification. The negatively oriented research setting could explain the overrepresentation of negative results in relation to EMAS. Another reason could be the higher cost of maintaining the more demanding EMAS certification in comparison to ISO 14001. Merli et al. (2018) among others identified the high cost of EMS maintenance to be a critical factor. The costs might outweigh the benefits. In addition, the market and revenue related benefits can be lacking due to low market recognition of the certificate (Daddi et al. 2018). Critical assessment of the EMAS related findings is hindered by three out of four papers being based on perceptions instead of facts.

It must also be noted that the number of studies focusing on EMAS is too low to be able to make solid conclusions.

Variation in the financial impacts can be also observed between different geographical areas as described in Table 19. Identified results in the research sample are clearly positive or neutral both in Europe and in Asia where less than fifth of the results indicate negative correlation between EMS implementation and financial performance. In China on the other hand the results are more polarized with equally high number of identified positive and negative correlations and only a small portion of neutral or inconclusive results. When it comes to South America, United States, and Africa, there are no negative findings done. However, the sample size is not sufficient for concluding a more positive outcome of EMS implementation in these areas in general. Market environment has been shown to impact the EMS CFP linkage. Riaz & Saeed (2020) suspected a negative impact especially in the emerging markets. This view is not supported by the findings of this research as Asia, South America and Africa have high positive results. The more negative results from China on the other hand could be explained by high environmental regulation. Feng & Wang (2016) for one noted tightened environmental regulations and high environmental costs in China. In highly regulated markets EMS could be a prerequisite for doing business and thus not giving competitive advantage. Also, the expectations for EMS as well as the thoroughness of implementation could be higher than in other areas resulting to costs outweighing the potential cost reduction and efficiency improvements.

TABLE 19 Portion of financial impact across geographical areas

Geographical areas*	Positive	Neutral/mixed/inconclusive	Negative
Europe	41%	47%	12%
China	43%	14%	43%
Asia	50%	33%	17%
South America	50%	50%	0%
United States	100%	0%	0%
Africa	100%	0%	0%

* Listed in the order based on number of publications

4.3.1 Impacts from accounting-based measures

The accounting-based measures are combining elements from revenue and growth, cost and efficiency, and asset utilization as already presented in Table 14. As also presented in previous chapter Table 18, the sample studies concluded more positive outcomes originating from revenues and growth in comparison to cost reductions or efficiency improvements. When comparing the scores from the different measures, presented in Table 20, it is impossible to identify any distinctive factors to differentiate the impact origin either to revenues or costs. The only difference can be seen with those measures factoring in also asset utilization, ROA, ROC, SOA and AT. The average score for those measures is slightly negative at 2,6, where the score for revenue impacted measures is 3,1 and for cost impacted 3,2.

Very interesting finding is that the measures themselves have wide range of variation depending on the study. For example, EMS implementation has been found to have both strong negative correlation (Li & Wu, 2017) as well as strong positive correlation (Herghiligi et al., 2019; Lee et al., 2017, etc.) with financial performance measured with ROA. This could indicate inconsistent results due to other moderating factors and variables involved, such as the industry of sample companies or the level of EMS implementation, that are not explored in this study. It could also indicate inconsistent usage and interpretation of the measures.

TABLE 20 Financial impacts of EMS with accounting-based measures

Article nr*	ROA	ROC	ROE	ROI	ROS	SOA	AT	NS, RG	PRICE	PM	PPE	SGAs	NOIPE	EBIT(DA)
1	4				4	3								
2									3					
3	3							3						3
4	4													
6														3
7	3			3	3			3		3				
8	3			3	3			3		3				
11								4		4				
12	5													
13								5		?				
15										4				
16	5				5					3				
17	1				3	1								
18			2											
21			2											
25								4		4				
26	5		5											
27	2	2	2					2		2	2			4
28			4											
30	4		4											
31		3												
32	3		3		3									
33	4						3			4				5
34								3						
36												3	3	
Average score	3,5	2,5	3,1	3,0	3,5	2,0	3,0	3,4	3,0	3,4	2,0	3,0	3,0	3,7

1 = Strong negative correlation, 2 = Low negative correlation, 3= Neutral correlation, 4 = Low positive correlation, 5 = Strong positive correlation

* Article number according to Appendix 1.

Further interesting observation is that when looking at the measures and correlations from individual papers perspective, there is very limited range of variation. In majority of the papers the correlations are equal or either positively or negatively inclined regardless of the measure. For example, Ali et al. (2020)

concluded neutral or low positive correlation with all their measures, findings from Li & Wu (2017) range from neutral to strong negative correlation, and results from Treacy et al. (2019) vary from neutral to low and strong positive correlations. As the only exception, Peiro-Signes et al. (2020) found low negative correlation when measuring the performance with six different accounting-based measures and oppositely a low positive correlation when measuring with EBIT and EBITDA. This disposition towards positive, negative, or even fully neutral correlation within individual papers regardless of the utilized measures leads to further questions about the consistency of measurement. It draws to suspect strong unidentified moderating factors within the respective samples or biases in the research setups or interpretation of the measures and results. It could also be result of incomplete documentation or separation of the result data in the research papers.

The studies identified positive impact through cost reduction with multiple different mechanisms. Cost savings through waste control, process improvements and resource efficiency, as well as reduced liabilities, crises and risks were indicated by Ali et al. (2020) and Nancy & Shine (2018). There were also studies (Herghiligi et al., 2019; Ong, 2016) that simply stated cost reduction without more comprehensive explanations or causalities. Those finding a negative cost impact were explaining it through lack of resources, additional costs from maintaining the system and not being able to realize cost savings as a result of implementation (Daddi et al., 2018; Merli et al., 2018). Teng & Wu (2018) also suspect that efficiency improvements do not compensate for the increased costs in the short term.

Results seem to be also impacted depending on the timing of measurement. Both Treacy et al. (2019) and Lee et al. (2017) identified short- and long-term improvement when measured with ROA. Many studies also indicate long term improvement when measured with PM (Treacy et al., 2019) or ROS where margin increase was implicated as the source (Lee et al., 2017). Li & Wu (2017) suspected that despite their negative short-term impacts, benefits might appear in long run. Teng & Wu (2018) suspected increased costs from implementation to outweigh efficiency improvements in short term. Continuing the same line, Wang & Mao (2020) noted the importance of time as a factor and identified higher cost reductions and performance improvements in companies that had been ISO 14001 certified for longer time. Here contrary findings were presented by Herghiligi et al. (2019), who's research indicates higher cost improvement shortly after implementation.

Despite the prior criticism and missing evidence about the positive impact of EMS implementation to customer behaviour (Albertini, 2013; Amber & Lanoie, 2008; Miroshnychenko et al., 2017), the positive impact from revenues and growth was evident in this sample. Improved financial performance through increased customer loyalty and satisfaction, image and reputation and increased market share was identified in many papers (Feng & Wang, 2016; Nancy & Shine, 2018; Ong, 2016). Here again the interpretation of different measures seems loose

in some studies. Peiro-Signes et al. (2020) for one consider improved EBIT measure to result from increased sales or prices and overlook the fact that the measure is equally impacted by cost reductions.

There were very limited number of papers with negative interpretation of the EMS implementation impact to company revenues. Neutral tendency in revenue-based measures is quite logical. Even if customers would not be willing to reward EMS implementation, they are unlikely to stop buying from a company due to EMS implementation assuming it does not have an impact to product quality or pricing. For example, Teng & Wu stated that consumers do not help boost sales revenues of certified companies, resulting to neutral impact. The same way as with costs, the timing of measurement plays importance with revenues as well. According to Wang and Mao (2020) initial positive impact from revenues to reduce as corporate image improvement and better relationships with customers diminish over time. Lee et al. (2017) on the other found a significant long-term improvement when measured with sales growth. Thus, the findings from this sample remain contradictory on the impact.

4.3.2 Impacts from market-based measures

The category of market-based measures is used for measures such as Tobin's Q and MVBV that indicate intangible assets and market value of a company. These measures are also considered to be indicators for future profitability and potential in comparison to accounting-based measures that represent firms' contemporary and past performance. They originate from external perceptions and assessments posed on a company. A general positive note about the utilization of market-based measures is that without one exception all the papers utilized factual data instead of relying on perceptions.

In general, the results are slightly positive with total average scoring of 3,1 based on statistics in Table 21. Teng and Wu (2018) identified positive correlation when measured with MVBV and Tobin's Q as a sign of companies' ability to accumulate more intangible assets through EMS implementation. Some other articles also made conclusions about positive correlation for company image and reputation although not measuring it market based measures but evidencing it through revenue increases (Nancy & Shine, 2018; Ong, 2016). Another positively impacted measure was debt financing costs. In this study it was categorized to market-based measures as it originates from valuations done by company external stakeholders, although having a direct impact to company costs.

In these measures as well, the results were not unanimous. Earnings per share was not impacted by EMS implementation and Tobin's Q gave even negative results. Miroshnychenko et al. (2017) suggest that investors tend to perceive the adoption of EMS standard as an unreliable initiative for risks reduction and performance improvement. Also, Riaz & Saeed (2020) identified negative affect to market performance measured with Tobin's Q both in short and long run. Lee et al. (2017) noted that the fluctuation in stock prices due to EMS implementation announcement did not generate a long-term positive impact.

TABLE 21 Financial impacts of EMS with market-based measures

Article nr*	DFC	EPS	TOBIN	MVBV
21			2	
23		3		
29			2	
32			4	4
35			3	
37	4			
Average score	4	3	2,75	4

1 = Strong negative correlation, 2 = Low negative correlation, 3= Neutral correlation, 4 = Low positive correlation, 5 = Strong positive correlation

* Article number according to Appendix 1.

4.3.3 Impacts from general self-reported measures

The findings from self-reported general measures had an average score of 3 meaning a neutral correlation. The variation ranged from low negative to low positive correlation and no strong correlations were identified in the sample. Negative findings were often associated with lack of cost savings or additional costs of implementation (Daddi et al., 2018; Merli et al., 2018; Mosgaard & Kristensen, 2020). Also, revenues were in many cases identified to be negatively or neutrally impacted due to lack of public awareness (Daddi et al., 2018; Merli et al., 2018). In addition, Mosgaard and Kristensen (2020) observed no increase in income in relation to ISO 14001 implementation as non-certified system was already enough for the customers. There it remains unexplored whether the outcome would have been the same if comparing EMS implementation to no EMS at all instead of using certification of the EMS as basis.

On the positive side were observations of cost reductions and efficiency of operations (Jovanovic et al., 2020; Jovanovic & Janjic, 2018). Also improved competitive position (Jovanovic & Janjic, 2018), better risk management and legal compliance, and improved image and customer relations were identified (Murmura et al., 2018). According to Mosgaard and Kristensen (2020) the benefits were observed during the first few years and after that the benefits were limited but costs remained. There were also some other contingent factors identified. Ferron and Darnall (2016) found that only when combining EMS with quality management system positive results were achieved. According to Voinea et al. (2020) the correlation was heavily dependent on the comprehensiveness and industry sector. Mosgaard and Kristensen further identified small companies to be less likely to gain from EMS certification.

4.3.4 Impacts from facts versus perceptions

As noted earlier in the results and theory section, the method for data gathering is critical when assessing the reliability and relevancy of the results. Some important observations can be done about financial impacts when comparing the sample papers by fact-based data versus self-reporting and perceptions. In Table 22 the sample papers are categorized according to their general finding about the financial impact of EMS in terms of positive, neutral, or negative and data collection method between facts and perceptions. Here the papers with inconclusive or mixed result are included in the neutral category. As can be seen from the numbers the perceptions and self-reported data is generating more positive outcomes and the portion of negative findings is significantly higher when measured with facts. Boiral et al. (2018) noted the challenge of relying on perceptions and opinions of managers as although being relevant, they could be influenced by social desirability bias or self-reporting bias. The results here could be indications of the same phenomenon.

TABLE 22 Number of articles by overall financial impacts based on facts versus perceptions

Number of articles and % of total	Facts	Perceptions
Positive	9 / 43%	8 / 50%
Neutral	7 / 33%	6 / 37,5%
Negative	5 / 24%	2 / 12,5%
Total	21	16

When further breaking down the results by splitting the average impact scores from different measures according to accounting-based measures impacted by revenues, accounting-based measures impacted by costs, and market-based measures further differences emerge. The results in Table 23 indicate perceptions about market and revenues to be more positive than can be measured with factual numbers and on the other hand cost impacts seem to be underestimated. Although not significant, the differences are interesting and would be worth further examination.

TABLE 23 Impact scoring based on facts versus perceptions per measurement category

Average score	Facts	Perceptions
Accounting-based measures impacted by revenues	3,3	3,4
Accounting-based measures impacted by costs	3,4	3,25
Market-based measures	3,1	N/A
General perceptual measures	N/A	3,0

1 = Strong negative correlation, 2 = Low negative correlation, 3= Neutral correlation, 4 = Low positive correlation, 5 = Strong positive correlation

4.4 Gaps and overlooked items in research about EMS CFP linkage

Despite multitude of papers around the topic clear gaps and weaknesses remain in current research about the financial impacts of EMS CFP linkage. One clear issue is the inconsistent usage of measures which has been already discussed in this study. The lacking consensus pointed out by Boiral et al. (2018) seems to remain. In addition, causalities of and linkages between different financial measures are not properly explained (Ong et al. 2016, Rosa et al. 2019) or understood based on the interpretations done. Too many papers are also focusing only one measure. These leads to the causality and impact mechanisms to remain unclear and forces authors to rely on theory instead of empirically evidenced facts when explaining causality. There is a good variety of different measures but surprisingly no studies about share prices. Frondel et al. (2018) for did factor stock exchange as control variable in their study, but it was not utilized as measurement for financial performance. Including the EMS implementation impact to share price development to the measures would be an easy way to analyse, isolate and confirm market valuation.

The financial fact-based measures are very general in nature and in this sample relied heavily on publicly available data, which is understandable due to data access issues. However, the linkage to operational results remains weak when performance is observed through publicly available financial statements instead of having more detailed internal financial and operational KPIs available. In the sample of this study the linkage between operational indicators and financial measures remained unexplored. For example, Nancy and Shine (2018) studied energy consumption as an element of benefits of ISO 14001 but did not bridge the energy consumption to financial performance. The longitudinal factual findings of lower energy consumption could have been translated to monetary value and verified through accounting data. As another example Ali et al. (2020) explained improved financial performance through operational items such as cost savings from waste control based on theoretical background without knowledge of the true operational performance. This is consistent with the observation from Abisourour et al. (2020) about insufficient examination of the relationship of ISO 14001 implementation and operational performance. Klingenberg (2013) argues that common financial measures of profitability ratios do not indicate well the efficiency of operational innovations (such as EMS) and operational performance as they aggregate financial outcome of the entire organization instead of focusing on impact of implemented operational improvements. This too would support shifting the focus to more detailed financial measures and KPIs and their operational linkages.

The data collection methods are another area for improvement with still over 40% of the papers relying on self-reported or perceptual data. Financial facts

have been overlooked in many instances even though they could be easily available. The potential biases from self-reporting were not addressed in most of the studies, which was noted also by Boiral et al. (2018) in their prior review. Companies' performance has different meaning when observed from inside or outside the company. For external observer the operational performance remains unknown (Lebas & Euske in Neely, 2002). According to Neely (2002, 75) performance only exists when its outcome and results are measurable or can be described. It is debatable whether the perceptions of managers are sufficient measurement or description of outcome that would prove impact on performance. In addition, also the research focus seems to have been biased towards positive outcomes. Abisourour et al. (2020) pointed out lack of identification of environmental economic losses and the cost of implementing EMS 14001. Minority of the papers in this sample factored in the costs of implementation.

Research samples and methodologies also have limitations in current research. Clear geographical disposition was identified and already discussed in chapter of sample characteristics in this study. In methodology side the lower volume of longitudinal studies was observed. As highlighted in the impacts section, the timing of measurement is critical factor for results. Even those papers not having a longitudinal approach as such identified variations in impacts over time (Murmura et al., 2018; Wang & Mao, 2020). EMS implementation is a dynamic process and different impacts can materialize at different stages after the implementation. Identifying these requires a longitudinal approach. More qualitative approaches might also be required to understand and verify in more detail the impact mechanism and detailed causes for financial impacts.

Further possibilities for improved understanding are the contingent and moderating factors. Voinea et al. (2020) noted the EMS CFP correlation to be heavily dependent on the comprehensiveness of implementation and industry sector. The link between EMS adoption and business performance depends on how an organization integrates the standard requirements in its strategy and operations (Miroshnychenko et al., 2017). Ferron and Darnall (2016) on the other hand identified positive impact from EMS only when combined with a quality management system. Teng and Wu (2018) point out that their sample consists of publicly traded companies and results might not be applicable to start-ups and firms that are growing. Although present in some of the papers, the potential contributing, and moderating factors could be better evaluated when assessing the impacts and correlations. In their sample Tarí et al. (2012) also noted that in relation to ISO 14001, there were no studies trying to identify if financial performance was result of EMS implementation or vice versa. This consideration was not present in this sample either. Final gap comes from the definition of EMS in the sample articles. 87% of the sample utilize a certified EMS as their variable. Would be interesting to know the potential differences between impacts of certified and non-certified EMS.

5 DISCUSSION AND CONCLUSIONS

This research set to study the linkage between EMS implementation and financial performance of private companies with systematic literature review of prior research in a five-year sample period from 2016 to 2021. Based on the research sample four questions were answered in detail and discussed in prior section of this study: which financial measures have been studied, has the data sources been fact-based or perceptual, what kind of findings have been made, and what are the gaps in current research literature. Different financial measures and factors used in research literature to assess financial impacts of EMS adoption were summarized and categorized.

5.1 Main results, discussion, and comparison with earlier research

The research sample had a stable number of articles throughout the years proving the interest for the topic remains and there seems to be still many items left to explore. Majority of the papers were focused on ISO 14001 certified EMS, but sample was not limited by that. Geographical distribution of the sample studies contradicts with the distribution of ISO 14001 certifications. Similar issue has been observed in the previous literature reviews (Boiral et al., 2018; Salim et al., 2018) and seems no significant improvements have happened in the research literature during the past five years. Study of certifications is still focused on the western developed countries although the volume of certifications has transitioned to China and India. The other developing countries remain to be lacking in certifications and research. Shifting the focus to where the certifications are increasing and to other developing countries might give support and indication of the potential benefits and encourage EMS implementation and certification also in those areas.

Multiple accounting-based measures were identified originating from revenues, costs, and asset utilization. Return on assets and different manifestations of cost reductions were the most explored financial measures. Revenue growth, return on equity and return on sales were also commonly utilized. Market based measures were represented only in minor portion of the total sample. Reflecting to financial performance measures by Murphy et al. (1996), the efficiency and profit related items were clearly more utilized in comparison to growth and liquidity related measures. The inconsistent and diverse utilization of different measures as well as versatile interpretations of the impact mechanisms proved to be a major challenge in current research. Unfortunately, the multiple years of research have not managed to clarify the topic despite being pointed out several times in prior research (Albertini, 2013; Boiral et al., 2018). Choosing the right

measures and understanding their impact mechanisms should be in high focus in future research. Multiple measures should always be chosen to enable proper understanding of correlations and causalities. Also, the characteristics of studied companies should be factored into the selection of measures. For example, cost reduction, process efficiency and other operational measures could be most suited for manufacturing industry or other companies where consumption is material, whereas market-based measures might be more suited for intangible industries.

Many authors have pointed out the challenge of utilizing managers' attitudes and assessments as well as perceptual and self-reported measures due to risk of bias and potentially limited capabilities to give accurate description of changes in performance (Boiral, 2007; Boiral et al., 2018; Heras-Saizarbitoria & Boiral, 2013). The sample showed clear improvement compared to prior research trends towards objective data and indicators for financial information, yet more than 40% of the papers still relied on perceptual data. Based on the identified impacts in the research sample the concern for perceptual measures is justified. The results show clearly a more positive tendency in perceptual measures compared to fact based. As in many other papers before (Abisourour et al., 2020; Albertini, 2013; Heras-Saizarbitoria & Boiral, 2013; Tari et al., 2012), in general, the impacts of EMS implementation on financial performance remain mixed yet slightly positive. When considering the inconsistent usage of different measures, variances in methodologies, sample sizes, sample characteristics and data collection methods, as well as limited consideration for moderating factors and control variables, the inconclusive and mixed results are to be expected. However, it does not mean that there wouldn't be multiple interesting items to be discovered. When breaking down the results in more detail it can be concluded that the impacts are clearly more often positive than negative. Also, the fact that third of the sample exhibited neutral correlation means that any potential costs or disadvantages from implementation have been managed to compensate with benefits elsewhere. It can be further concluded that positive impacts are more likely to originate from costs than revenues. Results also indicate that the cost benefits might not be recognized by survey respondents and on the other hand positive impact to revenues might be overestimated.

The mixed results and usage of measures leads in many cases to limited or completely missing understanding of the impact mechanisms and true sources of financial implications. Managers might not have full understanding of the role of accounting and detailed financial measurement in this context (Jovanovic & Janjic, 2018) which could lead to missed opportunities. It could also be argued that if EMS implementation is done for external reasons such as image, stakeholder opinions or legitimacy, or purely for the sake of environmental improvements, the internal financial performance might not matter and would not need to be measured. However, it is to be noted, that true changes in consumption, process efficiency or product qualities would have financial impacts. If EMS implementation is not visible from any financial indicators it is questionable, whether the intended implementation activities have truly taken place in the

daily operations of a company. Another question is, what is the timing and magnitude of those financial impacts, under what circumstances they appear and are they positive or negative.

5.2 Evaluation of the research

This research has some limitations. First one is the sample size and included publishing years. Extending the sample size and combining the data with prior literature reviews would enable more comprehensive view and stronger conclusions. Another weakness comes from biases related to search words, article screening and recording and categorization of the results. Unlike review by Boiral et al. (2018), this research did not include studies covering the contingent factors influencing the successful adoption of the standard and the problems associated with its adoption. The focus only on measurable impacts of EMS implementation could lead to less comprehensive picture of the impacts. Studies about the costs of implementation might have also been missed due to the setup of search words. They might have included some information of overall financial impacts as well. In addition, control variables and moderating factors such as the context, method and completeness of EMS implementation were not extracted from the sample and utilized in the analysis. This could provide interesting additional information. Another interesting item could have been categorization of the financial theories or objectives of the research papers: what has been the underlying theory for assessing the financial implications of EMS and what do the authors want to achieve.

This study contributes to the existing literature by assessing and synthesizing the outcomes of past five years of research about the financial impacts of EMS implementation. The systematic review of a large number of empirical studies is able to provide more comprehensive understanding of the studied phenomenon in comparison to narrative reviews or single empirical study. The paper provides a good understanding of the financial measures and impact mechanisms utilized in current research literature as well as their limitations. Wide-ranging understanding of data collection methods and financial impacts is achieved. In addition, the trends and limitations of existing literature are addressed and new directions for research proposed. The research provides relevant information for managers and academics, so that they do not need to refer to a large body of empirical research.

5.3 Future research

The question remains on how to bridge the gap between operational performance and financial performance. Focus needs to shift from high level financial indicators to operational indicators to identify where the financial improvement potential really is. Most financial measures are representations of the outcome of companies' internal operations. Both revenues and costs driven measures can be broken down to smaller elements in accounting and linked back to operational key performance indicators. These linkages should be further explored in relation to EMS implementation. To study these topics would require access to and more detailed analysis of companies' internal financial and operational measures to enable identification of causalities.

In addition, more longitudinal research and case studies would also support in-depth understanding of the research phenomenon. It would also provide further understanding on the timing of different financial impacts in relation to EMS implementation. Also, more control variables and consideration for moderating factors would be required. The circumstances for positive or negative financial impacts should be better understood to enable managerial decision making. The causal relationship between EMS and CFP should also be further studied to identify which one is more likely to come first.

In the end, the question about the relevance of environmental management system for financial performance remains. How could EMS be developed to act as true indicator of performance to outside the company and how it could drive internal performance of the company? It might be easier for companies to calculate costs in comparison to assessing potential benefits. Additional information and studies are needed to support companies in pay back calculations, sound decision making and understanding and attaining the full benefits of environmental management systems. Improved understanding of correlation with internal financial performance could also improve the market valuation. Consensus and framework for financial measurement needs to be established. Further synthesis needs to be created to bring research about environmental management, financial performance measurement and operational performance measurement comprehensively together.

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APPENDICES

Appendix 1: Included articles

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9. Ferron Vilchez, V., & Darnall, N. (2016). Two are better than one: The link between management systems and business performance. *Business Strategy and the Environment*, 25(4), 221-240. doi:10.1002/bse.1864
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12. Herghiligiu, I., Pislaru, M., Vilcu, A., Asandului, A., Avasilcăi, S. & Balan, C. (2019). Sustainable Environmental Management System Integration and Business Performance: A Balance Assessment Approach Using Fuzzy Logic. *Sustainability*, 11(19), 5311. <https://doi.org/10.3390/su11195311>
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 14. Jovanovic, D. & Janjic, V. (2018). MOTIVES FOR, BENEFITS FROM AND ACCOUNTING SUPPORT TO THE ISO 14001 STANDARD IMPLEMENTATION. *Ekonomski Horizonti*, 20(1), 25-41. <https://doi.org/10.5937/ekonhor1801027J>
 15. Jovanovic, D., Todorovic, M., & Medved, I. (2020). Environmental Management Accounting Support to ISO 14001 implementation in Serbia: a case study. *Fresenius Environmental Bulletin*, 29, 2290-2299.
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Related: Rosa, F. S. D., Lunkes, R. J., & Brizzola, M. M. B. (2019). Exploring the relationship between internal pressures, greenhouse gas management and performance of Brazilian companies. *Journal of Cleaner Production*, 212, 567-575. <https://doi.org/10.1016/j.jclepro.2018.12.042>
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36. Wang, J., & Mao, Y. (2020). Pains and gains of environmental management system certification for the sustainable development of manufacturing companies: Heterogeneous effects of industry peer learning. *Business Strategy and the Environment*, 29(5), 2092-2109. doi:10.1002/bse.2489
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Appendix 2: Excluded articles by exclusion criteria from year 2016-2021

Reason for exclusion	Excluded articles
Abstract: relevance of content	<p>Alvarez-Garcia, J., & de la Cruz del Rio Rama, Maria. (2016). Sustainability and EMAS: Impact of motivations and barriers on the perceived benefits from the adoption of standards. <i>Sustainability</i>, 8(10), 1057. doi:10.3390/su8101057</p> <p>Arab, A., Ghasemian Sahebi, I., Modarresi, M., & Ajalli, M. (2017). A grey DEMATEL approach for ranking the KSFs of environmental management system implementation (ISO 14001). <i>Quality-Access to Success</i>, 18(160), 115-123.</p> <p>Baranova, P., & Paterson, F. (2017). Environmental capabilities of small and medium sized enterprises: Towards transition to a low carbon economy in the east midlands. <i>Local Economy</i>, 32(8), 835-853. doi:10.1177/0269094217744494</p> <p>Borja, L. C. A., Cesar, S. F., Cunha, R. D. A., & Kiperstok, A. (2018). A quantitative method for prediction of environmental aspects in construction sites of residential buildings. <i>Sustainability</i>, 10(6), 1870. doi:10.3390/su10061870</p> <p>Burzynska, D., Jablonska, M., & Dziuba, R. (2018). Opportunities and conditions for the development of green entrepreneurship in the polish textile sector. <i>Fibres & Textiles in Eastern Europe</i>, 26(2), 13-19. doi:10.5604/01.3001.0011.5733</p> <p>Capece, G., Di Pillo, F., Gastaldi, M., Levialdi, N., & Miliacca, M. (2017). Examining the effect of managing GHG emissions on business performance. <i>Business Strategy and the Environment</i>, 26(8), 1041-1060. doi:10.1002/bse.1956</p> <p>Chang, W. (2019). A data envelopment analysis on the performance of using artificial intelligence-based environmental management systems in the convention and exhibition industry. <i>Ekoloji</i>, 28(107), 3515-3521.</p>

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