Annebeth Roor-Wubs

A Handshake Away

How institutional investors manage the social and environmental impact of their investment portfolios

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Elkaar de hand reiken

Hoe institutionele beleggers de sociale en milieu impact
van hun beleggingsportefeuilles managen

Thesis

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Anna Elizabeth Roor

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Erasmus University Rotterdam

Doctoral Committee:

Promotors:	Prof.dr. D. Schoenmaker Prof.dr. K.E.H. Maas
Assessment committee:	Prof.dr. B.E. Baarsma Prof.dr. M.A. van Dijk Dr. E.S. Marti

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Acknowledgments

About the illustration and title of this dissertation: at the start of my PhD, I made several sketches to analyse my topic of interest. I drew impact value chains, impact measurement methods, transition pathways, investment chains. One sketch stayed with me throughout my research: two people standing eye to eye, shaking hands. One person is an average Dutch woman (or man) with a pension or insurance contract, the other person someone working in companies that the pension/insurance company is invested in. The front page illustration shows a Dutch doctor with a pension contract, as for Chapter 4 research was conducted at PGGM, which invests on behalf of Dutch healthcare professionals. Although these two people don't meet in reality, they are connected through the pension contract. And they may be connected in other ways too, as the Dutch doctor is not only contract holder, but also consumer, citizen, employee, daughter, maybe parent. In these roles, she is also affected by the investments' impacts which directly matter to her. And apart from her own interest, maybe she cares for the environment and finds it important that people working in supply chains are treated fairly and receive adequate wages. Although not a doctor yet, I am an average Dutch person, whose motivation for this research lies in the care for people and the environment, affected through investments. To me, each human being has the right to be cared for and to have its human rights respected. My love for nature motivates me to see how it can be restored and protected.

In the sketch I described, two people shake hands, standing stand eye to eye. In reality, there are long supply chains between them in which a lot of impact information is lost. The company and investment value chains consist of a multitude of handshakes, contracts, relationships, ingredients and parts of products being sold. It is intriguing to imagine the information contained in all those value chains, and to consider what part of that information is deemed relevant to investors. How these impacts are measured and managed fascinates me, and is the key topic of my dissertation. I keep wondering upon questions like: If they would meet eye to eye, how would a pension beneficiary care for workers in the invested companies, for the way that our economies lead to environmental degradation? What information of these value chains is recorded and reported? What can investors do with this? And how do they do this?

I feel fortunate for the people that joined me in these questions throughout my PhD trajectory. First of all, I want to thank my supervisors Dirk Schoenmaker and Karen Maas, who supported me throughout my PhD, always ready for a thorough discussion and challenging me to deliver good academic research. I am especially grateful for their trust in me to finish the work in the final stages, when I moved to Nepal and became

mother of little David. I am thankful for all the comments and suggestions given by those participating in round table discussions, case study interviews and one on one meetings. Thanks for the reviews given by fellow academics, journal editors and reviewers. I was fortunate with quite some industry interest in my research, leading to presentations at several Dutch institutional investors, where I received further comments and suggestions. I am thankful for EY and in particular the Climate Change and Sustainability Services team, who supported me financially, time-wise and by showing interest in my research. The combination of consulting financial institutions on sustainability and sustainable investing and PhD research worked out well; I enjoyed the interplay between learning in practice and research. Thanks to the members of the doctoral committee for their assessment and review in the final stage.

I am thankful for my parents and sisters, who believe in me and were always there for me. For my dad, whose parttime PhD journey and defence in Theology inspired me. A special thanks to my husband Eric Wubs. Since our paths joined, he supported me and gave me full confidence I was able to pursue this PhD. Especially in the last phase when we did everything at the same time – moving to Nepal, transitioning jobs, expecting and taking care of our son David – he supported me and gave me space to finish this endeavour.

And last, but definitely not least, thanks be to God. He created all, and through the gift of life and knowledge, we are able to set up these structures of economy, investments and connections that are so interesting to research. In this acknowledgement lies my research motivation: He knows every human being, every bird, every tree, and He cares. Let's care too.

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1. Introduction

1.1 The why of managing investments' impacts

1.1.1 Sustainable investing

For a long time sustainable investing has been the subject of societal and academic debate. In 1758, the Quakers movement prohibited their members to participate or invest in the slave trade. John Wesley, founder of the Methodist movement, delivered a sermon in 1760 on social investing in which he said that we, "ought not to gain money at the expense of life or by losing our souls." (Heaps, 2021). In the 1980s, the concepts corporate social responsibility, corporate sustainability and sustainable development emerged, and whether these concepts matter to investors was part of a growing academic debate (Pazienza et al., 2022). Extensive research has been done on which measure is 'right' and whether sustainability measures matter to e.g. firm performance, firm risk or investor returns. Sustainable investing refers to investment approaches that explicitly incorporate environmental, social, and governance (ESG) criteria into the selection and management of investment portfolios, to ensure the balance of ecological, economic, and social consequences into capital allocation decisions (based on Friede et al. (2015) and Koenigsmarck & Geissdoerfer (2023). In the past decades, sustainable investing has been presented as a range of investment approaches: from exclusionary screening, to ESG investing, thematic investing and impact investing.

The institutional investors in the Netherlands – investment funds, insurance corporations and pension funds – jointly invest 2,273 billion EUR on behalf of Dutch beneficiaries (DNB, 2025). The majority of these investment institutes employ one or more sustainable investment approaches. As investments are done on behalf of beneficiaries, the question arises whether the realized social and environmental impact of investments matter to them. Both Bauer et al. (2021) and Delsen & Lehr (2019) found in surveys among Dutch pension fund members, that they prefer more sustainable investments based on their social preferences. More importantly, it can be considered in the beneficiaries' interest that 'their'

investments contribute to a liveable world in their retirement age, rather than contributing to social and environmental degradation.

This latter point is in fact central to the discussion: average Dutch workers are connected – through their pension agreement and/or insurance contracts – with average people working at invested companies and projects for their food, products and services. While I describe Dutch workers as pension or insurance contract holders, they are also an employee, consumer and citizen. In these roles, they are also affected by the impact of the investment. In reality, between pension and insurance contract holders and those affected through investments, there is a long investment supply chain in which a lot of impact information is lost. Typically, the chain consists of beneficiaries investing their money, pension fund or insurance company boards appointing internal and external asset managers, that execute investment portfolios with actual investments in companies and projects. In each step, there is a principal-agent relationship with implications for allocation and performance (Schoenmaker & Schramade, 2019). Considering these relations, long-term investments are often managed on the basis of quarterly results, which complicates issues when considering longer term developments such as acting on climate change and other transitions.

In typical investment analyses, it is assumed that raw materials are infinite and that emissions to soil, water and air do not have limitations. Yet, resources are limited and ecosystems are deteriorating, as currently six out of nine planetary boundaries are trespassed (Richardson et al., 2023). Recent data shows that with current policies, global warming will not be limited to the goal of a 1.5°C temperature increase. So far, global emissions have not yet peaked but continue to rise. The Jevons paradox shows that an increase in energy efficiency often leads to more emissions, rather than less (Alcott, 2005). On social impacts, prices on today's products do not reflect the negative effects occurring in value chains, e.g. forced labour or wages below living wage leading to poverty. While these social issues are known, companies so far have made limited progress in solving these. There is therefore a need for companies to report on their positive and negative social and environmental impacts, so that investors can understand and act on these impacts.

Over the past decades, ESG ratings are most often used in sustainable investing to measure environmental, social and governance (ESG) matters of companies. There is extensive research on whether ESG ratings matter to returns, with conflicting results, relating to different sample compositions and ESG ratings.

In an overview study, Friede et al. (2015) show that the majority of studies in this field finds a positive relation and roughly 90% a nonnegative relation (positive or insignificant). Alves et al. (2025) examine the ESG-return relation in a large global sample with several ESG ratings and find no significant relation. ESG ratings are criticized for their relative measurement and validity problems (Berg et al., 2022; Chatterji et al., 2016; Kotsantonis & Serafeim, 2019). Rather than the outputs and impact of firms, ESG ratings focus on the business operations, on how a company does business. In light of increasing climate change concerns, an emerging research strand focused on measuring carbon emissions and climate change considerations and whether these matter to investors (Bolton & Kacperczyk, 2023; Pastor et al., 2022). This research strand focused on climate change first, but started to broaden to topics such as biodiversity and water risk. In the past years, increased sustainability regulation by the European Union has directed a significant part of companies and investors resources to gather the required data as per the Sustainable Finance Disclosure Regulation and Corporate Sustainability Reporting Directive (European Commission, 2024). On a global scale, the International Sustainability Standards Board (ISSB) put into effect the IFRS Sustainability Disclosure Standards (IFRS Foundation, 2024). But more recently, the European Union has announced it will lower reporting requirements in the number of companies needing to adhere, as well as the disclosure requirements itself (European Union, 2025).

1.1.2 Impact measurement

In response to increasing critiques on ESG ratings, an emerging research strand focuses on measuring a company's impact (Busch et al., 2024). Busch et al. (2021) state that a "substantial re-orientation toward impacts in financial markets" is needed. In this emerging academic debate, it is important to distinguish between company impact and investor impact (Brest & Born, 2013; Kölbel et al., 2020), as visualised in Figure 1.1. Company impacts are the result of a company's activities on individual stakeholders, society, and the environment. This includes intended and unintended, positive and negative, and short-term and long-term effects (see Chapter 2). By measuring impacts, the focus shifts from business operations (the focus in ESG ratings) towards the effects of a company's products and services on people and the environment. This includes a range of impacts, and it is interesting to examine whether these impacts improve over time, and how investors can influence these improvements. The latter is what is meant by investor impact: the contribution that investor's activities make to company and project impacts (based on Kölbel et al., 2020). Investors can have investor impact through three main

mechanisms: capital allocation, stewardship (voting and engaging with companies) and system-level influence (e.g. stigmatisation, endorsement, voluntary standards, benchmarking) (Kölbel et al., 2020; Marti et al., 2023). Confusion between company impact and investor impact leads to misunderstandings and over- or understatements of investors' actions, both in investment practice and research. Investors can achieve investor impact, when they act on an accurate understanding of what companies' impacts look like.

The other direction in Figure 1.1 visualises how the world influences companies and investors the so-called dependencies. Dependencies refer to the environmental, social and economic systems that an organisation relies on to function; when changes occur these can create risks and opportunities for companies and investors. For example, companies are dependent on their employees doing their job well, on the availability of natural resources and functioning governments to run their business well. Investors can assess emerging risks flowing from dependencies by understanding ongoing transitions. Transitions are transformational system changes taking place through a process of the building-up of new regimes and the breakdown of old regimes over time to achieve a sustainable economy (Figure 1.2, Hebinck et al., 2022). Transformational changes are disruptive and nonlinear, for example, new regimes may take a long period to develop but can accelerate in a relatively short period (Hebinck et al., 2022). Transitions pose transition risks to investors because investments in old regimes are at risk of destabilisation and breakdown when they insufficiently transition (breakdown pattern, Schoenmaker and Schramade, 2022). Transitions also create opportunities, as new business models experiment, accelerate and emerge into the new regime (build-up pattern).

Figure 1.1 – Visualisation of investments' impacts

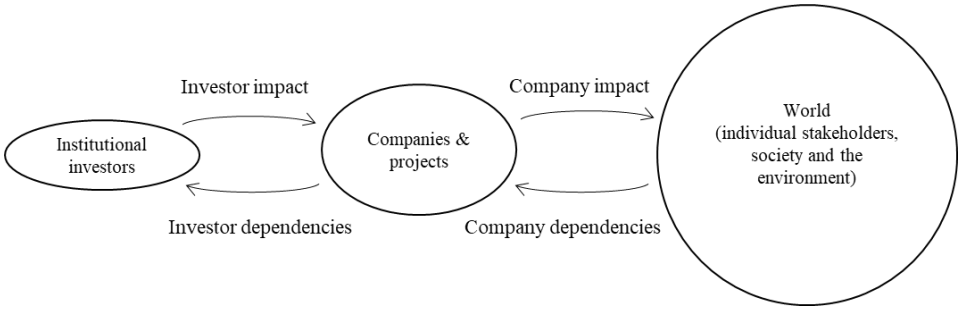
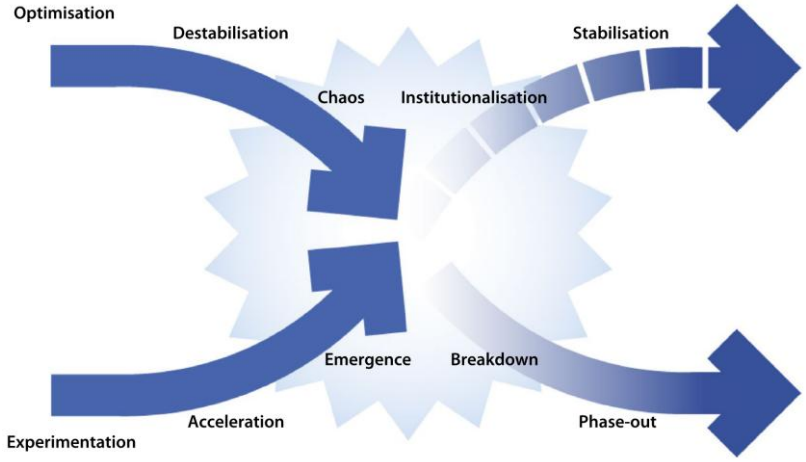


Figure 1.2 – Transition X-curve portraying build-up and breakdown patterns (Hebinck et al., 2022)



Measuring impact has been made most explicit in the area of impact investments. The goal of impact investments is to have a measurable positive impact on many of the world's social and environmental problems, and therefore measurement is central to this investment approach (GIIN, 2019; Graham & Anderson, 2015; Höchstädter & Scheck, 2014). Over 700 impact metrics in 17 impact categories are gathered in the IRIS+ System by the Global Impact Investment Network (GIIN), an organisation central to the promotion and development of impact investing. Impact investors have been reporting the realised impact of companies and projects in impact reports over the past years. One approach is to indicate how impacts contribute to the Sustainable Development Goals (SDGs) by the United Nations.

But in this impact reporting, it remains challenging to understand whether a reported impact is significant or not. As firms are influenced by many actors, understanding causality is even more a challenge. And on a more general note, the limited success of the significant volume of sustainable investing to achieve real-world improvements in the past decades provides a strong argument to relate sustainability measurement more directly to the goal of achieving a sustainable economy (Busch et al., 2016). To understand how impacts relate to this end goal, impacts can be compared against absolute thresholds, such as the Paris agreement on climate change mitigation or the planetary boundaries framework. This also provides insights into how companies are positioned towards ongoing transitions (Bjorn et al., 2020; Ryberg et al., 2020). While a challenge, several initiatives started to compare company's impacts against environmental thresholds based on academic research and social thresholds based on commonly accepted social norms. Setting these thresholds improves the informativeness of companies' impact information for investors.

1.1.3 Impact management

By measuring impact, it becomes clear that companies have a wide range of impacts. But reporting these impacts does not equal improving impacts over time. If impact investments do not provide better environmental or social impact than 'mainstream' investing, it is essentially impact washing (Busch et al., 2021; Findlay & Moran, 2019). This brings us to the topic of impact management: investors managing their investments' impact, taking action to allocate capital, executing stewardship and engaging in field building. While impact measurement is an increased topic of study, the managing of impact in investment practice is understudied (O'Flynn & Barnett, 2017; Schlütter et al., 2023).

In the literature to date, some authors examine through ethnographic or survey studies the motivations for sustainable investing and/or sustainable investing (e.g. Hehenberger et al., 2019; Hellman, 2020). Other authors examine the emergence of a sustainable investment or impact investment market (e.g. Crifo et al., 2019; Phillips & Johnson, 2021). But the way that an investment process takes place, the 'how,' is less studied. Bourgeron (2020) examines through a three- month ethnographic study how social impact is integrated into the investment process of an impact investment fund. He finds that social impact is being defined in the process itself and that social impact is advocated throughout the fundraising process with institutional investors. The finding that impact is defined in the process

emphasizes the importance of the need to research the 'how' of impact management in investment practice.

In the context of institutional investment, strategic asset allocation (SAA) is a process of particular research interest. In this process, important investment decisions are taken, while there is limited research on how investors integrate transitions and impact in doing so. Several authors point out that research in this area is thus needed (Brandstetter & Lehner, 2015; Van Dam et al., 2022). In the process of strategic asset allocation, institutional investors allocate investment to different asset classes, based on macroeconomic expectations and the calculation of expected risk and return per asset classes (Brinson et al., 1991). There is emerging academic work on how sustainability can be integrated in SAA. This is mostly done by adding ESG ratings as a third pillar next to risk and return (e.g. Gasser et al., 2017; Steuer & Utz, 2023) or by adding climate risk assessments (e.g. Bender et al., 2019; Fang et al., 2019; Rubtsov & Shen, 2022), carbon footprint or SDG contribution score (Blitz et al., 2024). The investment practice of the SAA process as a whole however, has been studied to a limited extent.

1.1.4 Dissertation methodology

This dissertation examines the following overarching question: *How can institutional investors measure and manage the impacts of their investments?* In the following four chapters, four different research methods are used to construct an answer: a systematic literature review, a conceptual model, qualitative and quantitative empirical research. Through these different methodologies, the four chapters together aim to provide a broad base of answers to the main research question. This section describes the methodologies used and the underlying philosophical standpoint. Through this, the aim is to explain the methodologies used in this dissertation, as well as to show the importance of employing a broad range of research methods in finance to gain knowledge.

The difference between the chapters does not only lay in the research methods, but also in the underlying philosophical standpoints on whether we can know reality (ontology) and if so, how we can gain knowledge (epistemology). Quantitative research generally builds on the standpoint that the reality is objective and tangible (realism) and that we can gain objective knowledge through examining relations and causes (positivism). In that sense, it allows for in depth insights on

known constructs[1], such as expected returns, betas, cost of capital and so on. It allows for extensive academic debates on these relations in theory and practice. But the dominance of quantitative research – along with its realistic and positivistic standpoints – also has limitations. First, research into known constructs can only provide insights into these constructs. To quote Gioia, Corley & Hamilton (2013): 'Advances in knowledge that are also strongly rooted in what we already know, limit what we can know.' (2013, p.16). Second, the dominance of quantitative research led to a divide between literature and the real-world practice of institutional investors (Cochrane, 2022). While academics debate on certain specific relationships, investors in practice deal with many more real-world considerations. Quantitative research does not provide insight into how organisations and people within those organisations use and apply these constructs (Crifo et al., 2019; Schoenmaker & Schramade, 2019).

This dissertation employs a range of methods and standpoints to answer the main research question, summarized in Table 1.1. Chapter 2 is a systematic literature review, where the results provide insights based on both interpretivist and positivistic standpoints. This method allows to examine what the current stand in literature is on the topic of impact measurement of investments.

Chapter 3 presents a conceptual study, which aims to apply academic knowledge on transitions and impact to the real-world process of Strategic Asset Allocation (SAA). The chapter takes an interpretive rather than positivistic stance, acknowledging that reality is socially constructed by peoples' own interpretations and experiences. The conventional SAA framework is a socially constructed process, which investment professionals execute based on their education, experience and organisational expectations. The article employs a conventional SAA framework as described in the literature, and integrates the insights from the literature on systemic risks, transitions and sustainability. In essence, the insights in this paper emerge from synthesizing research done in different research fields. The result is the integrated SAA framework, which can guide investment professionals on the next steps. Based on its findings, it also provides propositions and an asset pricing formula for future quantitative research. This chapter meets the first limitation of quantitative research: it provides novel insights that precede quantitative research in this area. Moreover, the round table discussions where both

[1] Constructs are abstract theoretical formulations about phenomena of interest, which are often formulated so that they can be measured (Gioia et al., 2013).

academia and investment professionals took part shows the interpretivist nature of this research (see 1.3 Declaration of Contribution).

Chapter 4 is Grounded Theory research applied in a single case study at a large Dutch pension provider. Grounded theory is the discovery of theory from data, systematically obtained (Glaser & Strauss, 2017). The Gioia methodology (Gioia et al., 2013) is a common approach for conducting grounded theory research. This type of research is based on an interpretivist approach: theory is discovered through understanding how investment professionals interpret sustainability integration. By giving respondents voice in the research, opportunities for discovery of new concepts is created. The heart of data collection is therefore the semi-structured interview, where respondents can easily express their thoughts and views. A case study is characterized as research in practice, without controlling the context but studying phenomena in real-life settings through several data collection methods (Gibbert & Ruigrok, 2010). Case studies at a single organisation have shown to be powerful in providing new paradigms and insights (Dyer & Wilkins, 1991). The findings on cognitive frames emerged during the systematic data analysis and provide insights into the observed practices. This chapter thus addresses the second limitation of quantitative research: it provides novel insights into people in investment practice use and application constructs. An anecdote in this regard is that several investment professionals in this organisation were unfamiliar with grounded theory research. They expected me to bring novel insights from academic research, while I was collecting their views and ways of working in order to reach novel insights. When presenting the findings a year later, several people commented that now they understood what the research was about, and that it provided valuable insights for their investment practice.

Table 1.1 – Dissertation overview methodology and epistemology standpoints

	Methodology	Epistemology	
		Interpretivism	Positivism
Chapter 2 Do investors live up to their promise? A systematic literature review on (im)proving investments' impacts	Systematic literature review	Insights into a range of purposes to measure in literature, categorized to 'prove' or 'improve' impact.	Statistics on the literature sample, e.g. how the literature considers stages of a standard investment cycle
Chapter 3 Integrating transitions and impact measurement in strategic asset allocation	Conceptual study	Integrated SAA framework which integrates transitions and impact into the socially constructed SAA framework	Propositions and an asset pricing formula for future research purposes
Chapter 4 What do you bring to the table? Cognitive frames in investment practice	Grounded theory research	Insights in cognitive frame interaction in investment practice	-
Chapter 5 Do SDG contributions matter to asset prices? First evidence	Empirical asset pricing study	-	Statistical results on the return-SDG relation, building on propositions Ch. 3

Lastly, chapter 5 presents an empirical asset pricing study. It takes a positivistic approach by examining whether the value channel or risk channel exists in the relation between SDG contributions and excess returns. In this study, the concept 'impact' is measured through the construct 'SDG contributions'. Both timeseries regressions and panel regressions are used to answer the research question. The timeseries regressions provide an initial analysis on how SDG contributions relate to the Fama-French 5 factors and Momentum factors. Panel regressions with stock characteristics are suitable to provide a comprehensive picture of the cross-sectional variation and variation over time in stock-level returns. These models test for the ordinal SDG score (a company score ranging from -3 to

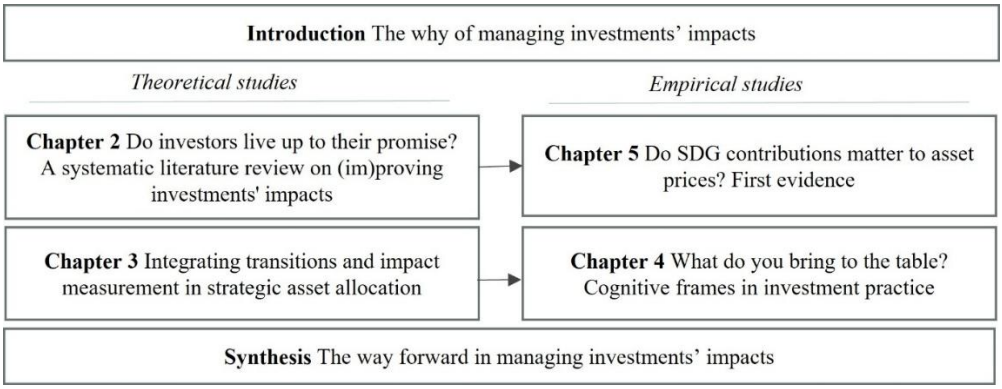
3), making the results intuitive to interpret. The results are differentiated towards regions and sectors, and robustness tests control for including a ESG rating.

In conclusion, this dissertation not only provides novel insights into the research question, it also shows the relevance and practice of employing a range of research methods and standpoints to bring forth novel insights.

1.2 Outline and research questions

This dissertation focuses on managing environmental and social impact in investment portfolios. While the previous section describes 'why' this topic is important, this dissertation examines the 'how' through four studies each with a different research method (see Figure 1.3). The overarching question to answer is: *How can institutional investors measure and manage the impacts of their investments?* Each chapter provides part of the answer through employing four different research methods. This dissertation shows that through multidisciplinary research, novel insights can be gained which benefits the academic finance debate.

Figure 1.3 – Overview of the studies in this dissertation



The second chapter provides a systematic literature review. The main aim of this chapter is to review the literature related to impact measurement of impact investments. The chapter is guided by the following research question: *What insights does the academic literature provide on measuring the impact of impact investments?* This chapter shows that measuring impact to prove and to improve are distinct practices. Measuring to prove mainly relates to show accountability to stakeholders and relates to legitimacy, stakeholder and agency theory. Measuring to improve relates to investors understanding impact, acting on envisioned impact in

decision-making, and relates to decision-making, performance measurement and organisational theory. The chapter outlines an integrated investment process, and analyses which phases are considered in the literature sample. Although several authors mention improving impact, they provide limited guidance on this. The study shows the need for future research on operationalising impact throughout the investment process, as a practice to improve investments' impact.

The third chapter provides conceptual research on operationalising impact, in particular for strategic asset allocation. The question central to this study is: *How can insights on transitions and impact measurement be integrated into strategic asset allocation?* This chapter introduces the integrated SAA framework, which enables investors to strategically allocate assets based on risk–return-impact expectations. The novel insight in this chapter is that investments' impacts are endogenous to investor decisions because the impact indicates how investments can accelerate (or slow down) transitions. Building on the framework, we provide propositions that serve as the basis for future empirical research.

The fourth chapter builds on the third chapter as it provides empirical research on how transitions and impact measurement are integrated in investment practice. It includes a large body of empirical data gathered at PGGM, the second largest institutional investor in the Netherlands. The research question guiding the research is: *How do cognitive frames interactions influence collaborations for sustainability integration in investment practice?* The study develops grounded theory on the three cognitive frames that respondents use (the business case frame, the paradoxical frame and sustainability case frame) and presents a theoretical framework for cognitive frame interactions. The findings show that each frame has a particular way of considering sustainability, and that each of these are needed to advance investment practice.

The fifth chapter builds on the second chapter by testing the propositions and model given at the end of chapter 2. The chapter is guided by the following question: *Do SDG contributions affect asset prices through the value or the risk channel?* It is the first empirical study examining SDG contributions covering a global sample, employing the Robeco SDG contributions data. The empirical results provide early evidence for the risk channel: the results show that higher negative SDG contributions are associated with higher excess returns, and higher positive SDG contributions with lower excess returns. This relation is stronger for negative SDG contributions than for positive SDG contributions. The chapter closes with a

reflection on the findings in light of the academic debate on the risk and value channel of corporate sustainability.

This dissertation closes with a synthesis. Based on the findings of previous chapters, I sketch a way forward in measuring and managing investments' impacts and give my final reflections.

1.3 Declaration of Contribution

For all chapters in this dissertation I am the lead author and responsible for the majority of the analysis and writing. Prof. Dirk Schoenmaker and Prof. Karen Maas provided valuable guidance, feedback and suggestions throughout the PhD journey, which benefited all chapters as well as my academic and personal development.

For the literature review (chapter 2), prof. Karen Maas was co-author. Together we discussed the research topic and criteria, after which I collected the data and set specific criteria. To agree on the criteria, we each independently assessed a set of articles and discussed differences in judgment. After this, I independently assessed the rest of the sample, did the analysis and wrote an initial draft of the paper. We discussed draft versions of the paper together, after which I worked further on the paper. The paper has been published in *Business, Strategy and the Environment.*

For the conceptual paper (chapter 3), the research idea came from prof. Dirk Schoenmaker, who read the paper by Van Dam et al. (2022) and thought this topic needed further academic research. Dirk Schoenmaker challenged me to critically think from an academic standpoint how sustainability could be integrated in strategic asset allocation (SAA). I considered a few strands of literature most relevant (systemic risks, transitions and impact measurement) and analysed how to incorporate these in the SAA process. The article further developed in discussions with Dirk Schoenmaker and Karen Maas and during two roundtable sessions in which several engaged people from practice and academia joined. Useful comments and suggestions were given in these roundtable sessions as well as in discussions by among others Mathijs Cosemans, Pieter Dalderop, Jaap van Dam, Mathijs van Dijk, Marcel Jeucken, Kees Koedijk, Paul de Ruijter, Willem Schramade, Onno Steenbeek, Willemijn Verdegaal, Jan Anton van Zanten, and participants at the ALM Conference 2023 of the CFA Society Netherlands. The paper has been published in *Journal of Portfolio Management.*

For the empirical paper on cognitive frames (chapter 4), the research idea was part of initial discussions for chapter 3, but evolved as a separate paper. For this paper, I worked independently in the setup, execution and analysis of the empirical data. I transcribed the interviews, coded the documents, and grouped the codes to analyse my data. I am thankful for the opportunity given by PGGM to conduct the case study and gather valuable empirical data. Harrie Dielen and Piet Klop supported me throughout this research period, providing research access to working group meetings, setting up interviews and sharing with me their journey in this topic. I discussed my analysis with Karen Maas, who suggested to look for potential typologies in my results, which led me to identify the literature on cognitive frames. Once I had a full version of the paper, Karen Maas and Dirk Schoenmaker provided comments and suggestions.

For the empirical paper on SDG contributions (chapter 5), again the research idea was part of the initial discussions for chapter 3, but evolved as a separate paper. For this paper, I worked independently on the theoretical expectations, data selection, data structuring and analysis of the empirical data. Dirk Schoenmaker challenged me to first think through theoretically what relations I expect, and how they relate to the ongoing academic debate on corporate sustainability. Karen Maas provided feedback on how to build the narrative and think through the academic contributions. I am grateful for the data access given by SDI AOP and Robeco for this study, and their guidance on how to gather and interpret the data. A full version of the paper was reviewed by Mathijs Cosemans, Bram van der Kroft, Xander Hut and Marloes Hagens. From Robeco, useful comments and suggestions were given by Paul Ruijs and Lucian Peppelenbos. From PGGM, several people provided comments and suggestions, among which Gert-Jan Sikking and Dirk van den Boer; Rongxin Zhang provided support in merging the datasets.

2. Do investors live up to their promise? A systematic literature review on (im)proving investments' impacts[2]

2.1 Introduction

It is widely acknowledged that investors have an important role to play in addressing the world's most pressing challenges (Bugg-Levine & Emerson, 2011; Clarkin & Cangioni, 2016; Gillan et al., 2021). The promise of impact investing is encouraging while the goal is to have a measurable positive impact on many of the world's social and environmental problems (GIIN, 2019; Graham & Anderson, 2015; Höchstädter & Scheck, 2014). The inherent logic followed is: when investing in impact investments, investors report companies' impacts and then conclude they have a positive impact on social and environmental problems. This logic ignores the crucial point as to whether these impact investments in fact generate the positive impact they intend; a topic surprisingly understudied (O'Flynn & Barnett, 2017; Schlütter et al., 2023). Incorporating environmental and social impact when investing is a growing topic of debate (Busch et al., 2021; Scholtens, 2006). A recent development is that impact investments are differentiated between impact aligned investments (‘buying impact’) and impact generating investments (‘creating impact’) (Busch et al., 2022; EMSA, 2023). Impact-aligned investments are investments where companies' impacts are aligned with impact objectives (Busch et al., 2022). With impact-generating investments, investors proactively aim to create investor impact through active engagement, capital allocation and other indirect mechanisms (Kölbel et al., 2020). Investors can achieve investor impact, when they act on an accurate understanding of how companies' real-world impacts look like. After all, if impact investments do not provide better environmental or social impact than ‘mainstream’ investing, it is essentially impactwashing (Busch et al., 2021; Findlay & Moran, 2019). This systematic literature review therefore addresses the following

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research question: What insights does the academic literature provide on measuring the impact of impact investments?

Academic literature distinguishes between measuring to prove and measuring to improve impacts (Lall, 2017), where proving impact focuses on transparency and legitimacy while improving impact focuses on strategic purposes and decision-making (Busch et al., 2021; Elkington, 2018; Maas et al., 2016). Lall (2017) finds that social enterprises are more driven to 'improving' impact than to 'prove' impact to stakeholders, unlike previous research. So far, scholars argue that impact investing research has mainly focussed on proving impact, rather than on how to improve it, although there is an increasing number of methods available to assess impact (Andrikopoulos, 2020; Castellas et al., 2018). Furthermore, scholars point out that for improvements of impacts, investors need to integrate impact in each step of the investment process (Bandini et al., 2022; Busch et al., 2021; Loorbach et al., 2020). Impact measurement as an integrated part of the investment process is what sets impact investors aside from, for example, venture capitalists and angel investors (Busch et al., 2021; Roundy, Holzhauer & Dai, 2017). Bandini et al. (2022) analysed practices of impact investors and conclude that to achieve impact, impact measurement should be integrated throughout an investor's business model: from value proposition, investment strategy and management of impacts once invested. Improvements in impacts are difficult to achieve without actual measurement of impact results as well as without integration in the process, but this does not mean that integration automatically leads to improvements. Cetindamar and Ozkazanc-Pan (2017) do point out that integration can avoid mission drift, in which means (investment processes and outcomes) get decoupled from the ends (having a positive impact). An integrated investment process consists of five phases (adapted from GIIN, 2020): (1) strategy setting, (2) integrated risk and return assessment, (3) integrated investment decision, (4) investment management and (5) exit investments.

We conduct a systematic literature review (Hiebl, 2023) to answer the research question. We identify relevant articles in the Web of Science core collection, in business, environmental sciences and social sciences. The sample of 141 academic articles (see Appendix A2.3) is the result of initial analysis on 570 articles, where articles addressing measuring impact of investments are included, and articles on measuring impact on countries, initiatives, education are excluded, as well as articles on how sustainability performance affects financial performance We analyse the sample on the purposes for impact measurement (categorised as

prove or improve) and which of the phases of an integrated investment process are addressed. We define impact as the result of the activities of an organisation on individual stakeholders, society and the environment, including both intended and unintended effects, positive and negative effects, and short-term and long-term effects (adapted from Maas, 2009). We aim to advance theory through this review in two ways, as suggested by Post et al. (2020), by clarifying constructs - in particular the purposes of impact measurement - and by exposing emerging perspectives that emerge from the review sample.

The results show that both measuring to prove and to improve impact are mentioned in slightly less than half of the sample, respectively, in 67 articles (48%) and 66 articles (47%). Measuring to prove concerns proving towards internal and external stakeholders. The review shows that proving can increase or decrease information asymmetry. Measuring to improve relates to investors acting on their envisioned and achieved impact throughout the investment process. Improving impact is addressed by quite some authors, but only a limited number of articles operationalise how this can be done by investors.

With regards to an integrated investment process, the integrated risk and return assessment and the integrated investment decision phase are addressed in almost half of the subsample. The other three phases of the integrated investment process – strategy setting, investment management and exit investments – are only addressed in a small number of articles. Based on the results, we sketch future research avenues. We contribute to the literature by providing construct clarity on impact measurement and by identifying emerging perspectives and related future research avenues, which can guide the investment practice to more rigorous and meaningful impact measurement and management.

The rest of this paper is structured as follows. The next section provides the theoretical background and develops the review criteria. The third section elaborates on the method used. The fourth section describes the results. In the discussion and conclusion, we describe future research directions, theoretical contributions and practical implications of this paper.

2.2 Theoretical background

2.2.1 Proving and improving impact

Previous reviews on (social) impact measurement of investments show that this can be done to prove impact to internal and external stakeholders or to strategically improve impact (Hertel et al., 2020; Kah & Akenroye, 2020; Lall, 2017; Maas et al., 2016). Lall (2017) most explicitly builds his article on the distinction between measuring to prove and improve. Hertel et al. (2020) provide a range of reasons for measurement but summarise them as 'accountability towards funders' (prove) and the 'possibility to learn and improve' (improve) (2020, p.12). Maas et al. (2016) describe measuring for transparency (prove) or performance improvement (improve). Kah and Akenroye (2020) review impact measurement from legitimacy theory, so to prove impact. Proving and improving serve different purposes and stakeholders (Figure 2.1): proving impact serves the accountability needs of internal and external stakeholders (left side), while improving impact focuses on the companies and projects invested in, and their realised impacts (right side).

Figure 2.1 – Investor measuring to prove and to improve impacts (by authors, including a logic model by Weiss, 1972)

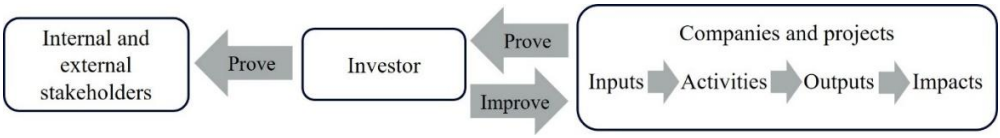
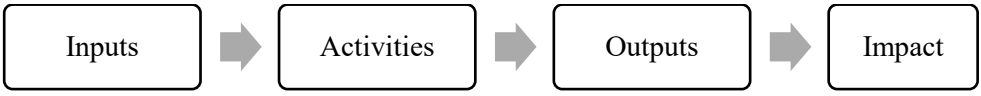


Figure 2.2 – Logic model or impact value chain (Weiss, 1972)



We first define impact for a proper understanding of (im)proving impact, as use in different research fields lead to a diffuse use and operationalisation of impact (Barman, 2020). Although the term impact investing is well debated (Brest & Born, 2013; GIIN, 2019; Höchstädter & Scheck, 2014), impact itself is often left implicit. The widely cited definition by GIIN (2019) of impact investments as an investment approach to 'generate positive, measurable social and environmental impact alongside a financial return' (GIIN, 2019, p.1), lacks a definition of impact. Many empirical studies do not assess whether their proxies for impact are in fact good proxies (Barnett et al., 2020).

In defining impact, we adopt key definition elements as provided in the literature. The definition of impact often implies causality between the organisation's activities and their effects (Clark et al., 2004; Ebrahim, 2019; Kolodinsky et al., 2006); it includes those to whom the effects apply (Ebrahim, 2019; Kolodinsky et al., 2006) and it ensures a broad perspective, which is a necessity as intended short-terms and positive effects are often more apparent than those unintended, long-term and/or negative effects (Wainwright, 2002). Therefore, largely in line with Maas (2009), we define impact as the result of an organisation's activities on individual stakeholders, society, and the environment, including intended and unintended, positive and negative, and short-term and long-term effects. A logic model or impact value chain (Figure 2.2) is often used to show how an organisation uses inputs in their business activities resulting in outputs, which have effects on individual stakeholders, society, and the environment (impacts) (Weiss, 1972). Measuring impacts is broader conceptualised by many different terms, including (corporate) social performance (Husted & De Jesus Salazar, 2006; Wood, 2010), social return (Bugg-Levine & Emerson, 2011), sustainability or ESG (environmental, social and governance) performance (Barman, 2018), and social return on investment (SROI) (Hall et al., 2015). While we focus on impact, we acknowledge there is a fragmented use of terms for similar concepts.

2.2.2 Stakeholders and investor–investee relation

In research on impact measurement of investments, several authors emphasise that different stakeholders co-determine and may have different purposes of measurement (Hertel et al., 2020; Silva et al., 2019; So & Staskevicius, 2015). Companies can differentiate between upward accountability towards funders, inward accountability towards employees, and downward accountability towards beneficiaries and public opinion (Costa & Pesci, 2016; Frølich, 2011). The dynamics with stakeholders can cause the purposes for measuring impact to change over time (Lall, 2019) or, in case of misalignment, spark conflict (Agrawal & Hockerts, 2019).

More specifically, the dynamics between investors and investees is deemed important in measuring impact. Some authors specifically describe the dynamics between investees and investors, they emphasize the importance of alignment between them with regards to the investment strategy and process (e.g. Chen & Harrison, 2020; Ebrahim, 2019; Epstein & Yuthas, 2017). Chen and Harrison (2020) differentiate in the investor–investee dynamics between transactional and relational

practices. Lall (2019) describes that measurement for legitimacy can develop into a collaborative learning relation. In case of an increasing trust relation between the investor and the investee, the investee will, for example, be more open to sharing dilemmas, while the investor will be more receptive to the investee's needs. Through this process, the measurement information becomes more strategic and therefore of higher value to both the investor and investee (Lall, 2019), including facilitating innovation and creativity (Chen & Harrison, 2020).

2.2.3 Measuring impact in the investment process

There is extant literature on measuring companies' effects on the world. These effects are most often measured through an ESG rating, but increasing critiques show that these do not capture companies' actual impacts (Chatterji et al., 2016; Kotsantonis & Serafeim, 2019; Windolph, 2011). To realise the impact promise, impact indicators need to better capture companies' impact so that investors can steer towards improving impact (Barnett et al., 2020; Brown & Kaufmann, 2022). Remarkably, the link between indicators and strategic improvements is only made by a few authors, such as Barnett et al., 2020; Halme et al., 2020; Maas et al., 2016; Thornley & Locascio, 2018.

Several authors point out that strategic improvements can be achieved when social and environmental impact are integrated in the investment process phases, where investors understand and use impact information (Bandini et al., 2022; Busch et al., 2021; Loorbach et al., 2020; Schoenmaker & Schramade, 2019). Managing impact 'involves intentionally weighing both impact and financial considerations at each step of the investment process' (Thornley & Locascio, 2018, p. 2). Ironically, in that regard, impact investing is '"metrics-rich" but "data-poor" due to the limited uptake of these metrics amongst social impact investors (Watts & Scales, 2020, p. 6). Bandini et al. (2022) put forward the managing of impact objectives throughout the investment process as a best practice and find that this is the case in only half of the case studies. Loorbach et al. (2020) argue that investors need to assess integrated value by integrating this into investment processes, information systems and performance evaluation. The term integration is often used as 'ESG integration', but whether this leads to true impact management is highly questionable (Amir et al., 2018; Van Duuren et al., 2016). Although improvements in impacts are difficult to obtain without an integrated investment process, this does not imply that integration automatically leads to improvements.

To specify an integrated investment process, the regular investment phases of the GIIN Compass (GIIN, 2020)—strategy setting, screening and due diligence, investment management and exit—are used as a basis. Institutional investors start with a strategic asset allocation process, where they allocate investments to different asset classes (Bose et al., 2019). The screening and due diligence phase involves mainly risk and return considerations in case of investments in public markets (Hsiao & Kelly, 2018; Impact Frontiers Collaboration, 2020). These steps are in line with academic literature on private social sector investments such as Ebrahim (2019), Lam and Tan (2021), Mungai (2018) and Spiess-Knafl and Scheck (2017) (Appendix A2.1). We add the investment decision as a separate phase, as the predictions or expectations of impact are important to consider in this stage. This results in a five-phase integrated investment process (Figure 2.3).

Furthermore, we integrated recent impact measurement frameworks in the integrated investment process (Appendix A2.2). The Compass for impact measurement by GIIN (2021) starts strategically with the required decision information, collecting and analysing this impact information to apply it in investment decision-making. The frameworks by Hehenberger et al. (2015) and So and Staskevicius (2015) outline (almost) all investment phases, from setting objectives to analysing ex-post what impact is realised. The Impact Frontiers Collaboration (an initiative by Impact Management Project) takes an integrated approach with managing impact and financial performance (Berkley et al., 2020). Other frameworks, such as the Framework for Impact Statements (Impact Institute, 2019), the Impact Weighted Accounting Framework (Serafeim & Trinh, 2020) and the impact multiple of money by Bridgespan Group (2019), mostly focus on defining and measuring impact. By incorporating these frameworks into the integrated investment process, we present a process that integrates financial, environmental, and social impacts and allows for managing these components across the investment cycle (Table 2.1). We distinguish between considerations on an aggregate and individual investment level (Amel-Zadeh, 2018; Impact Frontiers Collaboration, 2020).

Figure 2.3 – Visualisation integrated investment process (adapted from GIIN, 2020)

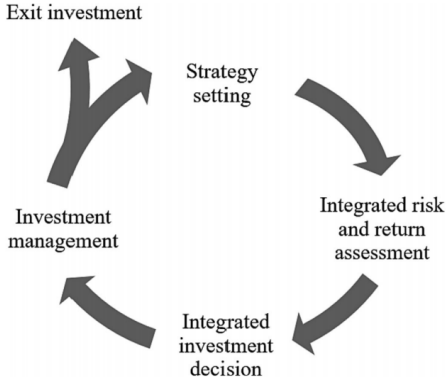


Table 2.1 – Specification of the integrated investment process

Phase	**Elements on fund or portfolio level**	**Elements on individual investment level**
Strategy setting	● Strategic asset allocation ● Investment strategy including logic model and intended impact ● Sector allocation	
Integrated return and risk assessment	● Implications of individual investments on fund/portfolio characteristics	● Assess integrated (financial and impact) risk and return ● Screening and due diligence
Integrated investment decision	● Implications of individual investments on fund/portfolio characteristics	● Investment allocated by f.e. portfolio manager or investment committee ● Decide on frequency and content of impact and financial return monitoring
Management of investments	● Increase or decrease positions ● Maintain sector allocation ● Reporting and external verification	● Active ownership (engagement and/or voting) ● Monitor integrated (financial and impact) risk and return to understand and improve performance
Exit investment	● Exit positions due to (financial and impact) fund/portfolio considerations	● Exit positions due to individual investment considerations ● Evaluate integrated (financial and impact) return and risk

2.2.4 Review criteria

This review considers the following research question: what insights does the academic literature provide on measuring the impact of impact investments? Proving and improving impact appear from the literature as different purposes of impact measurement. This section furthermore shows that investors can improve impacts when they measure to improve impact, and when they integrate impact throughout the investment process. We analyse the sample on the following criteria: (1) proving impact and/or improving impact, and (2) five phases of an integrated investment process.

2.3 Methods

We conduct a systematic literature review and follow the sample selection process by Hiebl (2023): identification, screening and disclosure of the review sample.

2.3.1 Identification

Relevant articles are identified through the Web of Science core collection on the fields title, abstract and author keywords. The Web of Science core collection is commonly used for systematic literature reviews (Hiebl, 2023). A minimum level of quality is ensured by only considering published articles in peer-reviewed scholarly journals. A range of Web of Science categories is selected to include a broad range of research fields: business, environmental sciences and social sciences (Table 2.2). Kubátová and Krocil (2020) find in their review that most impact investing articles are found in these research fields.

We use three types of search terms (Table 2.3) to identify a relevant body of literature in a structured manner. First, articles on investment and one of the several terms used for impact measurement are included (Section 2.1), consistent with earlier reviews on impact measurement (Kah & Akenroye, 2020; Rawhouser et al., 2019). Second, all articles on the topic of impact investments, SROI and social finance are included. Third, as impact measurement can be done in the context of the UN Sustainable Development Goals (SDGs), articles related to the measurement of SDG contribution of investments are included too. Literature specifically on impact of (social) enterprises is not included; for this topic, we refer to reviews by Kah and Akenroye (2020) and Rawhouser et al. (2019). Using these criteria, we identified 570 unique articles (search conducted in May 2021) (Table 2.4).

Table 2.2 – Relevant Web of Science categories

Research field	Web of Science categories
Business	Business, Management, Economics, Business Finance
Environmental sciences	Environmental Sciences, Environmental Studies
Social sciences	Social sciences interdisciplinary, Social sciences mathematical methods, Social issues, Ethics

Table 2.3 – Types of search terms

Type of search term	Search terms
On impact measurement of investments	Investment AND ("impact measurement" OR "impact framework" OR "impact management" OR "sustainability performance" OR "ESG performance" OR "evaluation framework" OR "nonfinancial performance")
1. Impact investments, SROI and social finance	"impact invest*" OR "social return on investment" OR "social finance"
2. Measurement of investments in SDGs	"sustainable development goals" AND "investment" AND (measurement OR performance OR framework)

Table 2.4 – Process steps of systematic literature review

Process step	Number of articles
Total sample including duplicates	641
Duplicates	- 71
Total sample excluding duplicates	**570**
Excluded as part of screening process	- 429
Review sample	**141**

2.3.2 Screening

Relevant articles are selected for the review sample through a process of screening on the title and abstract of the article, and where relevant the full text of the paper. The authors assessed an initial set of articles separately, compared the selection and identified inclusion and exclusion criteria for the review sample. The criteria to exclude were (1) articles without a reference to impact measurement of investments, (2) articles examining impact on, for example, countries, initiatives or education, and (3) articles on how ESG, sustainability, or impact ratings affect financial performance. For analysis on the latter, we refer to reviews by Friede et al. (2015),

Gillan et al. (2021), and Khan et al. (2016). The authors applied the exclusion criteria to the rest of the identified articles and discussed articles which needed additional judgment. The screening resulted in a final sample of 141 articles (Table 2.4).

The sample is coded in Mendeley on the criteria (measure to prove and/or improve impact and the five integrated investment process phases) as well as the summary statistics characteristics (Section 4.1). A code for measuring to 'prove' was given when the purpose related to showing or evidencing the impact to others, such as internal and external stakeholders or related to reporting requirements. A code for measuring to 'improve' was given when the purpose of measurement is to understand and act on the measured impact, in the investment process and of the company's impact itself. Each of the five investment phases were coded separately, in line with elements mentioned in Table 2.1. Appendix A2.3 provides the review sample (141 articles) by authors, year published and title. Full references are available upon request to the authors.

2.3.3 Analysis of review sample

This systematic literature review analyses the literature on predefined criteria to examine the research question, leading to both quantitative results and further qualitative analysis. We analysed the review sample in depth through a process of analysis and synthesis, by rereading articles with similar codes, for example, all articles addressing the strategy setting phase, and by rereading the articles with novel and interesting insights. In doing so, we aim to expose emerging perspectives on how investments' impacts are measured and used. To provide more clarity on why impact measurement is conducted, we listed the purposes that are mentioned in the articles relating to the codes 'prove' and 'improve'. We analysed these purposes and synthesised them into categories of purposes of impact measurement (see Appendices D and E). These categories provide the basis for Section 4.2. Through this analysis, we aim to contribute theoretically by providing construct clarity and exposing emerging perspectives (Post et al., 2020). Appendix A2.3 provides the review sample (141 articles) by author, year published.

2.4 Results

2.4.1 Summary statistics

Table 2.5 lists the sample's main characteristics. First articles are published in 2003, between 2007 and 2012 no articles are identified, and research attention increased steeply from 2013 onwards (Table 2.5a). This is in line with impact investing arising in the 2000s, and the fact that initially practitioners mostly discussed the topic (Calderini et al., 2018).

When specified towards type of study—theoretical, conceptual or empirical (qualitative or quantitative) (Phillips et al., 2015)—the majority of the articles are empirical (104), with 63 qualitative articles and 41 quantitative articles (Table 2.5b). Many qualitative articles use case studies, but other methods such as ethnography are also used. Quantitative articles mainly assess the use of impact information, for example, the effects of responsible investment on environmental and/or social indicators. Some of the quantitative articles (eight articles) use experimental methods, most of these testing investor preferences. Theoretical articles mainly consider how concepts are defined or used in impact measurement. Many conceptual articles introduce a framework to measure impact or to illustrate the impact investment playing field.

Finally, we assess the research field of the articles depending on the content of the articles. The largest research fields in the sample are impact investments (35 articles), business research (24 articles), responsible investment (22 articles) and SROI (19 articles) (Table 2.5c). A smaller number of articles focus on social enterprises (10 articles), non-governmental organisations and public-private partnerships (9 articles), social finance and social impact bonds (9 articles), (policy) evaluation (6 articles), development financial institutions (4 articles), and philanthropy (3 articles). Impact is discussed in a wide range of journals; in total 75 different journals are included in the sample. The journals Sustainability (n = 19), Journal of Social Entrepreneurship (n = 6) and Evaluation and Program Planning (n = 6) published most articles in the sample. Several authors contributed to more than one article in the sample: Apostolakis et al. (2016, 2018) Barman (Barman, 2018, 2020; Barman et al., 2021; Hall et al., 2015), Crifo (Crifo et al., 2015; Crifo & Mottis, 2016), Ormiston (Castellas et al., 2018; Ormiston, 2019; Ormiston et al., 2015), and Cubas-Díaz and Sedano (2018a, 2018b).

Table 2.5 – Summary statistics (*n*=141)

5a. Period published		**5b. Type of study**		**5c. Type of research field**	
Period	**Number of articles**	**Type of study**	**Number of articles**	**Research field**	**Number of articles**
2003	1	Theoretical	19	Impact investments	35
2004	1			Business	24
2005	1	Conceptual	37	Responsible investment	22
2006	1	Empirical: Qualitative	63	Social Return on Investment (SROI)	19
2007-2012	0	Empirical: Quantitative	41	Social Enterprises	10
2013	2	**Total (more than one category possible)**	**160**	NGOs and PPPs[3]	9
2014	4			Social finance and social impact bonds	9
2015	9				
2016	15			(Policy) Evaluation	6
2017	17			Development financial institutions	4
2018	17			Philanthropy	3
2019	26			**Total**	**141**
2020	29				
Jan-May 2021	18				
Total	**141**				

The construct is the main term used in the article to measure or define impact. The sample shows many different constructs: 63 different constructs are used in 141 articles. Certain constructs are used frequently, such as impact investment (n = 19) and SROI (n = 17). These two topics form research fields in which the construct is defined fairly consistently, and authors build upon each other's work. The constructs social impact (n = 17) and impact (n = 10) are also used frequently but are defined in different ways. There are many variations on (social) impact, such as social impact assessment, social impact bond and impact rate metric. Some constructs are only used once, for example, blended value and socio-

[3] Non-governmental organisations and public-private partnerships

economic impact. These articles refer to a range of other articles but introduce their own understanding and framework of impact, which shows there is not yet a consistent understanding of impact. Future academic literature can contribute to build a more consistent understanding of impact.

2.4.2 Measuring to prove impact

The majority of the sample articles (87 articles, 62%) address at least one measurement purpose (Figure 2.4). We provide an illustrative overview of how authors address purposes to prove or to improve impact in Tables 2.6 and 2.7. In 54 articles (38%), no specific purpose to measure impact is specified, some of which address investor preferences for impact investment characteristics or general impact investment field developments.

Table 2.6 – Categories impact measurement purposes related to 'Prove impact'

Category purpose impact measurement	Summary of purposes
1.Communicate impact	General aim of communication, legitimacy, evidencing etc.
2. Prove to internal stakeholders	Reinforcing mission; reinforcing organisational structure; communication to internal stakeholders, e.g. employees
3. Prove to external stakeholders	Communicate and convince external stakeholders; transparency and accountability; conceal poor performance; signal quality; fulfil regulatory requirements
4. Attract / Prove to investors	Attract funding; demonstrate results to investors; accountable to investors

A list of the purposes per category is described in Appendix A2.4.

Measuring to prove impact is mentioned in almost half of the articles (67 articles, 48%). The purposes can be summarised to four categories: (1) communicate impact, (2) prove to internal stakeholders, (3) prove to external stakeholders and (4) attract/prove to investors (Table 2.6 and Appendix A2.4). In short, purposes relate to accountability towards stakeholders, either upwards to funders, internal towards employees or downwards to clients.

Many articles describe a general purpose of communicating impact (category 1): to report, celebrate achievements, provide legitimacy, social license to operate and grow. Several of these describe a measurement approach, and then mention one of these generic purposes for measurement. This notion generally ignores the fact that stakeholders who receive the information, often have particular views on why, which and how impact is measured (Costa & Pesci, 2016; Hertel et

al., 2020; Lall, 2019; Silva et al., 2019; So & Staskevicius, 2015) (see also Section 2.2).

With regards to internal stakeholders (category 2), scholars address for example the reinforcement of the mission (Alijani & Karyotis, 2019), reinforcement of organisational structures (Stockdale & Standing, 2006) and motivating employees (Ormiston, 2019). Proving impact is a useful tool to evidence realised impact to employees motivated by the promise of impact investing. These purposes therefore relate to employee engagement theory and legitimacy theory.

Several authors bring forth purposes relating to external stakeholders (category 3). Some general purposes mentioned are accountability, external legitimacy and managing stakeholder expectations, which relate to several theoretical fields, such as stakeholder theory (e.g. convince stakeholders, communicate value to stakeholders) and legitimacy theory (e.g. externally increase organisational legitimacy).

Purposes, such as signal quality and impact to key stakeholders, conceal poor performance, exert control over environment and convince stakeholders, show that proving of impact is used to act on a principal agent problem (agency theory) (Akerlof, 1970; Bengo et al., 2021). This principal agent problem results from information asymmetry, which is the 'fact that different people know different things' (Stiglitz, 2002, p. 469). Companies know different things compared to their external stakeholders, related to both their impact intentions as well as to the realised impact of their products and services (Stiglitz, 2000). Information asymmetry is even more explicit in purposes raised to attract and/or prove impact to investors (category 4): attracting investors, be accountable do donors and demonstrating results. An interesting result of this review is that there is divergence in the sample on this point: certain authors argue that information asymmetry between investors and investees decreases through impact reporting, whereas others argue it increases, which we describe in detail next.

Diouf and Boiral (2017) and Lim et al. (2020) describe that impact reporting decreases investor–investee information asymmetry as impact information serves as a signal to investors and other stakeholders. Although introduced in the job market, signalling theory can also apply on the investor–investee relation (Connelly et al., 2011; Desjardine et al., 2020). Investors can use companies' signals in decision-making (Desjardine et al., 2020; Stiglitz, 2000). Second, Fatica and Panzica (2021) and Reimsbach et al. (2018) argue that external assurance on impact information

can serve as a signal of the reliability of information, also leading to lower information asymmetry.

On the other hand, impact reporting can also increase information asymmetry. First, there can be friction between the intentions (or purposes) of companies measuring impact and investors and other stakeholders using that impact information (Agrawal & Hockerts, 2019; Glänzel & Scheuerle, 2016; Tirado-Beltrán et al., 2020). Lim et al. (2020, p. 635) describe this as follows: 'Information asymmetry occurs when one party does not know all the characteristics of another party and when one party is concerned about another party's intent.' Aligning purposes is specifically addressed in the context of social impact bonds, as they require a group of stakeholders to align their impact goals and contract agreements (Care et al., 2020; Del Giudice & Migliavacca, 2019; Rania et al., 2020). Aligning purposes is a clear reference to agency theory, which explains relations between principals and agents. Second, companies might report to prove their positive image to investors, while investors want to use different information to improve impact (Barman, 2020). When companies conceal poor performance with impact reporting, it is in fact impression management rather than communicating actual performance (Diouf & Boiral, 2017).

Other relevant theories that relate to proving impact areresource dependency theory and institutional logics. Research on resource dependence theory examines how external factors, such as investors' capital, affects company's behaviour (Hillman et al., 2009). Lastly, there are several authors that describe the emerging market for impact investing as a marketplace, on a global scale or in a particular region (sub-Saharan Africa, India, France). Describing this emerging market in terms of beliefs systems and actors' behaviour relates to the theory of institutional logics, a theoretical lens that Glänzel and Scheuerle (2016) and Hehenberger et al. (2019) use in their article.

Figure 2.4 – Purposes of measurement as specified in sample articles (n = 141)

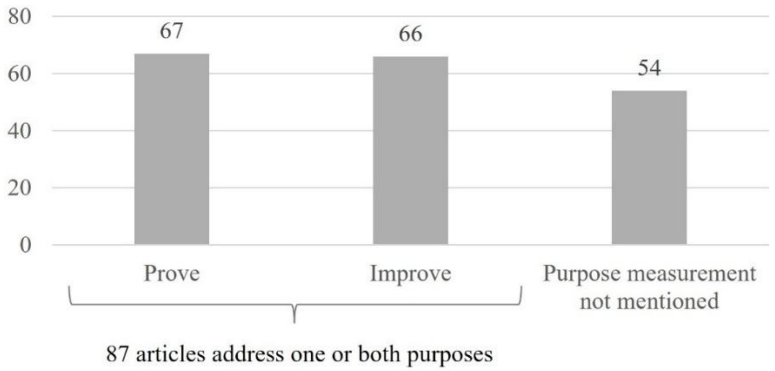


Table 2.7 – Categories impact measurement purposes related to 'Improve impact'

Category purpose impact measurement	Summary of purposes
1.Strengthen strategic decision-making	Guide management decisions; support investment decision; steering instrument; inform decision-making
2.Understand / Learn about impact	Organisational learning; understand impact; enable stakeholders to understand; adapt based on information
3.Improve performance and scale impact	Improve operational effectiveness, performance; scale or optimise impacts; improvement program
4. Allocate resources	Guide resource allocation decision; make funding decisions
5. Incentives to achieve social and environmental impact	Reward mechanism in (social) impact bonds and social return on investment

A list of the purposes per category is described in Appendix A2.5.

2.4.3 Measuring to improve impact

Improving impact is mentioned in 66 articles in the sample (47%). The purposes can be summarised to five categories: (1) strengthen strategic decision-making, (2) understanding/learn about impact, (3) improve performance and scale impact, (4) allocate resources and (5) incentives to achieve social and environmental impact (Table 2.7 and Appendix A2.5).

First, in quite some articles, measurement to improve relates to decision-making, for example, guiding material decisions (Costa & Pesci, 2016) or improving, informing or managing decision-making (Nielsen et al., 2021; Ormiston

et al., 2015; Ou, 2016). Authors make use of decision-making theory, including sometimes rational choice or bounded rationality notions. Although quite some authors mention improving impact, there are only a few articles that describe how investors can do so (further elaboration on this in Section 4.3).

Second, measuring can increase the understanding and knowledge on impact, either for the organisation itself or for stakeholders. This contributes to the idea of organisations as continuous learning entities (Lall, 2019). Sample articles refer to (organisational) learning (Maier et al., 2015; Ormiston, 2019; Tirado-Beltrán et al., 2020), understanding impact (Beer & Micheli, 2018; Burton, 2020; Castellas et al., 2018) or monitoring performance (Barman, 2018; Perrini et al., 2020). This sometimes relate to the investor–investee dynamic and growing understanding of impact. For example, an SROI process 'results in closer collaboration between investors and investees leading to more co-learning and co-creation' (Alijani & Karyotis, 2019, p. 12). Furthermore, measuring impact allows stakeholders to understand impact (Akingbola et al., 2015; Diouf & Boiral, 2017) and can increase alignment on the investment strategy and execution between investor and investees (Agrawal & Hockerts, 2019). So besides a direct signal from investor to investee, the process of impact measurement can lead to understanding and better alignment between investors and investees.

Third, purposes are raised that relate to improving performance and scaling impact, such as improving operational effectiveness, business value or working practices. These purposes relate mostly to organisational theory, decision-making theory and performance measurement theory. Authors describe measurement practices as a rational process to come to optimal choices. An interesting emerging theory in the review sample is scaling impact, as put forth by Aschari-Lincoln and Jacobs (2018) and Han and Shah (2020). The latter describe scaling social impact as 'the effectiveness of addressing a social issue, transforming the way people perceive a problem, and changing the status quo' (Han & Shah, 2020, p. 216). Aschari-Lincoln and Jacobs (2018) show three success enhancers for investors who are keen to scale (i.e. improve) the impact of the investee: (1) investor pre- and post-alignment on scaling approach and goals, (2) understanding and acting upon mutual dependency of capacity/up/deep scaling, and (3) impact reporting alignment between target group and investee/investor. Authors show that the limited uptake of impact measurement by investors is related to a lack of alignment between investor–investee and the presence of 'greenwashed' financial products (Barman, 2020; Phillips & Johnson, 2021).

Fourth, measurement to get better insight in allocating resources or investments efficiently and effectively is also a means to improve impact, as described by Burton (2020), Consolandi et al. (2020), Maier et al. (2015) and Nielsen et al. (2021). Burton (2020) describes that understanding ex-ante potential impact of companies is a practice that allows for optimising capital allocation for impact. Maier et al. (2015) shows that SROI calculations can be used by investors to allocate resources efficiently and effectively. As with financial performance calculations, impact measurement can provide useful input in resource allocation, to allocate for (expected) impact.

Fifth, authors put forward the use of measurement to develop and assess performance in relation to an incentive structure to achieve social and environmental impact, for example, in relation to social impact bonds and SROIs. This incentive structure is one of the central elements in social impact bonds: only when intended impacts are achieved, payments are paid out (Care et al., 2020). Improving impact is made explicit and integrated, but the complex collaborations for social impact bonds limit the private capital invested in these bonds (Del Giudice & Migliavacca, 2019).

2.4.4 Improving impact throughout the integrated investment process

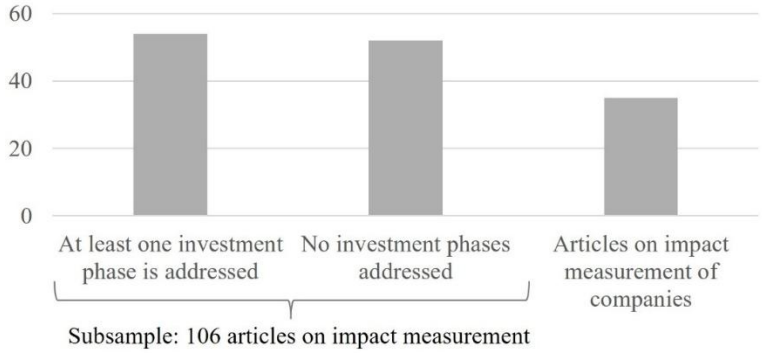
Investors can improve impact when they integrate impact throughout the five phases of the integrated investment process (Section 2.3 and Figure 2.5). In the review sample, 35 articles do not mention the investment process at all but focus on companies' impact measurement rather than investments. Most of the articles relate to impact measurement of investments (subsample 106 articles), of which 54 articles (51%) address at least one investment phase (Figure 2.5). The integrated risk and return assessment (47 articles) and the integrated investment decision (43 articles) are mentioned most often, while the other three phases are addressed much less—strategy setting (15 articles), investment management (19 articles) and exit investments (11 articles) (Figure 2.6). Agrawal and Hockerts (2019)—one of the two articles in the sample that addresses all five phases—point out that investors 'structure, coordinate and manage risk through different stages of the impact investing lifecycle' (2019, p.12).

2.4.5 Improving impact in strategy setting

Only 15 articles address the strategy setting phase, which indicates that impact measurement is not an integral part of strategy setting in current literature. Bengo et

al. (2021) conclude that impact investors often fail to adopt a specialised strategy to integrate social impact in their investment process, hampering the growth of impact investments. Emerging perspectives from the paper that do address strategy setting are on intended impact and on how to manage the tension of having two objectives.

Figure 2.5 – Investment phases mentioned in the sample (n = 141).



First, improving impact starts by outlining the intended impact in the strategy setting phase. Decision-makers can strategise pre-investment on the impact aim of the investment(s), which develops over time, just as the societal challenges do. Building a strategy around available data is not a proof of a strategic approach aimed at improving impact but demonstrates a focus on proving impact (Polonsky et al., 2016). Rather, intending to influence systemic issues and giving voice to stakeholders provides the necessary focus to improve impact (Casasnovas & Jones, 2022). The logic model as depicted in Figure 2.2 is a useful starting point to strategise on the intended impact. Ebrahim (2019) describes that based on the intended impact, investors can measure and manage different metrics: outputs, impact or interim impact. Often, measuring impact is not the first-best option given the cause-and-effect relation and the limited control that investors have over the intended impact (Ebrahim, 2019). The impact strategy can guide pre-investment discussions on what is possible and most useful to measure, given the intended impact (Mansell et al., 2020). Future research can examine how impact objectives are operationalised and tracked throughout the investment process, providing further understanding of this process. It is anticipated that the available impact data improve over the years, given the development of global standards per January 2024 (IFRS Foundation, 2023) and European legislation (European Commission, 2024). Impact measurement can be the means to strategically implement these regulations

in investment practice (Bengo et al., 2022), forming an interesting research avenue in the upcoming years.

Second, several authors address the tension of having two objectives (financial and impact), which can be dealt with by integrating the impact ambition in the investment strategy. Investors can decide if their main focus is achieving impact (impact-first), achieving financial return (finance-first), or something in between (Bocken, 2015; Glänzel & Scheuerle, 2016; Lyons & Kickul, 2013). Making a deliberate choice also then guides optimising the expected financial return and expected impact, a process often part of taking asset allocation decisions (Bengo et al., 2022; Biasin et al., 2019; Burton, 2020). Whether or not these two objectives represent a trade-off depends on the viewpoint of the investor and investments made (Daggers, 2022). So far, sustainable investing is often operationalised as optimising financial return and including sustainability aspects for that financial aim, but Revelli (2016) emphasises that investment decisions can be focused on real world impact and embedded in relationships. This may imply including impact performance in investors' remuneration, which is an area for future research (Barman, 2020; Moody et al., 2015).

2.4.6 Improving impact in integrated risk and return assessment

The sample articles most often address the integrated risk and return assessment phase (47 articles, 44% of subsample, see Figure 2.5). Several authors describe in detail how to assess and measure impact, while some authors (e.g. McCallum and Viviers, 2020, Moody et al., 2015), Ormiston et al., 2015) emphasise the importance and especially the difficulties of impact measurement, for example, due to lack of (consistency of) data, among others.

There is quite a consistent understanding of impact measurement in the SROI and social impact bond research fields. Five out of the seven articles on social impact bonds provide a comparable figure on how the actors involved interact to measure impact (Care et al., 2020; Del Giudice & Migliavacca, 2019; Kabli et al., 2021; Rania et al., 2020; Rizzello & Kabli, 2020). The articles on SROI provide valuable insights by describing the advantages and limitations of calculating SROI. SROI calculations can provide rationalisation and comparability and aim to objectify impact measurement (Cooney, 2017; Maier et al., 2015). Klemela (2016) emphasises that this should be accompanied by a qualitative description of how the measured social impact relates to the impact objective. Barman et al. (2021) and Mook et al. (2015) raise the concern that a single-ratio calculation might in the end

not serve the intended impact nor serve strategic decision-making. In the context of social impact bonds, Guter-Sandu (2021) emphasises that performance targets pose the risk of achieving targets rather than truly assessing whether the intended aim is achieved. By providing both quantitative and qualitative information, attention is put on the purpose of improving impact. This relates to the point that what gets measured and valued is constituted by people and markets themselves; what holds value is in the eye of the beholder (Kish & Fairbairn, 2018; Lehner et al., 2022; Mook et al., 2015).

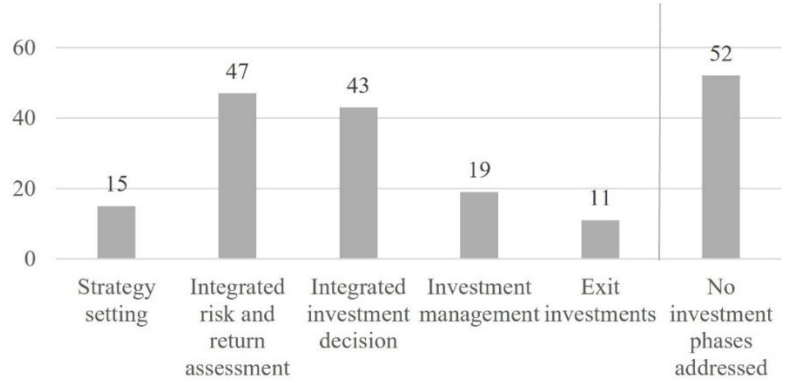
Outside of the SROI and social impact bond field, several authors take caution with using a single impact metric. Two reasons are that a single metric assumes that different impacts can be measured in just one indicator (King, 2017) and the risk of settling for the lowest common dominator of what is feasible to measure at that moment (Polonsky et al., 2016). Hall et al. (2015) argue that stakeholder demands should be operationalised into performance indicators and included into management accounting. In line with this, Minguzzi et al. (2019) emphasise that the complexity of reality can be translated into simple and clear indicators, which provide meaningful and reliable impact data. Barman (2020) finds, in his ethnographic study of a French impact investment fund, that the targeted impact for a particular investment is the number of students having access to certain education. The fund in that study showed a development from qualitative information to more quantitative and comparable information over time. Summarising, measuring indicators that clearly relate to the intended impact and impacted stakeholders can improve measurement practices, incorporating both qualitative and quantitative information.

2.4.7 Improving impact in the integrated investment decision

The integrated investment decision phase is mentioned in over 40% of the articles (43 articles, 41% of total sample). Certain authors explain that for integration of impact information, a decision-making model or process is needed, for example, a multi-criteria decision-making (MCDM) process (Kumar et al., 2020; Rania et al., 2020), a hybrid decision-making model (Ou, 2016) or a decision support system (Calvo et al., 2015). Decision-making models can make the impact risk and return assessment more explicit, which supports integrated investment decisions (Calvo et al., 2015). These articles, however, lack an understanding of how these decision-making models are operationalised and used in investment practice.

A few authors already pave the way in this regard. Hsiao and Kelly (2018) find that Taiwanese investors in the investment decision phase are mainly interested in timely information that directly link sustainability information with financial value creation. Joliet and Titova (2018) find that ESG performance information plays a role in the investment decision, both at the start (pre-investment) and exit (liquidation) of an investment, but of smaller importance than financial considerations. Lee et al. (2020) show that impact investors may be prone to behavioural biases in decision-making, limiting the ability to improve the impact of investments. Heeb et al. (2023) show that investors in an experiment setting show impact size indifference.

Figure 2.6 – Investment phases addressed in articles on impact measurement of investments (n = 106)



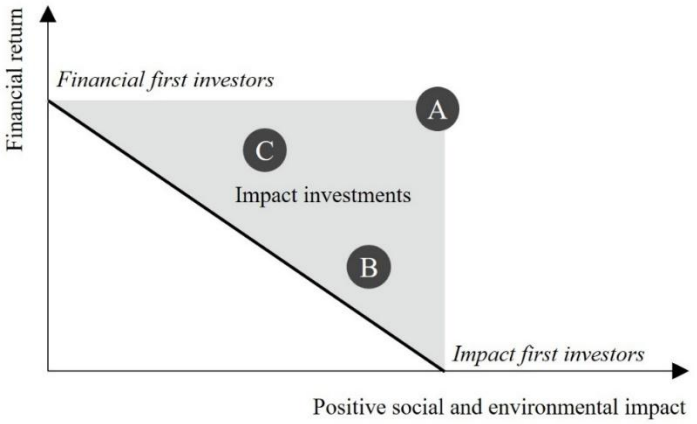
2.4.8 Improving impact in investment management

In the investment management phase, investors can monitor to what degree investments reach their intended impact, for example, by mapping the investment portfolio against social, environmental and financial impact performance. Through monitoring, impact is managed throughout the holding period, providing a basis for further decision-making in this phase (Aggarwala & Frasch, 2017; Lim et al., 2020). Scholars in the sample have a mixed view on how impact should be measured. While some authors provide complex decision-making models consolidating several indicators into a single impact score, other authors emphasise choosing a limited number of indicators closely related to the intended impact aim. Although complex models resulting in a single score provide a comparable and complete score, it might also lead to a difficult understanding of what this single score exactly explains (King, 2017). On the other hand, reporting on a few indicators may lead to

an incomplete picture of material social and environmental impact of investments. In this debate, it is important to retain space for discussion with stakeholders and prioritise the realisation of the intended impact (Lehner et al., 2022). Impact management can only take place when decision makers understand and use impact data to understand progress against the intended impact aim and steer their investment portfolio.

An example for investment management is given by Aggarwala and Frasch (2017) and Lee et al. (2020); both provide a graph of investment options or positions in a portfolio that can be used for investment management monitoring. Based on these authors, Figure 2.7 depicts how investments have different levels of financial and social and environmental return, depending on their different business models (Maas, 2019). Obviously, option A is most efficient, optimising both financial and social and environmental return. However, when only option B and C are available, investors determine based on their strategy to what degree they optimise profit as well as social and environmental impact. 'Impact-first' investors choose option B, while 'financial-first' investors choose C. This portfolio view, accompanied with qualitative information, might form a basis for integrated investment management. If two or three impact aims are defined, separate figures on each provide useful insights to decision-makers. For example, Bender et al. (2019) optimise the portfolio based on five climate indicators. Investors can also consider using a 3D-model as visualised by, for example, Gasser et al. (2017) and UN PRI (2018), in which risk, return and real-world impact form the three axes. While Figure 2.7 provides a static view, recent models such as Schramade et al. (2022) introduce a more dynamic view, allowing for decision-making based on integrated value. This underscores that financial return and impact are intrinsically connected through the value-creating potential of the business model.

Figure 2.7 – Portfolio view investment management



2.4.9 Improving impact in exiting investments

Lastly, the sample shows limited insights into the exit investment phase, mostly mentioned in the context of venture capital (Agrawal & Hockerts, 2019; Block et al., 2021). In this phase, the integrated (financial, social and environmental impact) return and risk can be evaluated. This shows to what degree the investment contributed to the intended impact. Learnings from these evaluations inform the investment strategy going forward.

2.5 Discussion and conclusion

This systematic literature review analyses the growing body of literature on impact measurement of investments. It analyses the purposes of measuring impact and how impact is integrated throughout the integrated investment process. Impact investing is an emerging field of research; a lot has been written about why impact measurement is important for impact investing. Nevertheless, there is limited research available describing how impact investors can use impact measurement and integrate it into the different phases of the investment process. Scholars and practitioners could use this review article as a reference to understand the current status of the field of impact measurement and how to use it to improve the impact of impact investing. The results show proving and improving as two distinct logics in impact measurement: proving impact focusses on internal and external stakeholder communication, while improving impact draws attention to acting in

and throughout the investment process on the impact information. Table 2.8 provides a summary of these two distinct practices: the key logic, the categories of purpose measurement, relevant theories, key insights relating to emerging theories and future research areas.

Based on our results, we sketch future research avenues that can be used by academics and practitioners. The review shows that many authors refer only generally to the use of impact measurement by stakeholders, which contradicts the importance of involving stakeholders in the why and how of impact measurement (Silva et al., 2019). Future research therefore can be done on the operationalisation of impact measurement and stakeholders' involvement therein. The review shows a divergence as to whether impact reporting decreases or increases information asymmetry between investors and investees. Future research can examine the dynamics of impact measurement as a practice of information asymmetry, and how this increases or decreases between investors and investees. The practice of investor–investee communication can also be examined using a resource dependence theory lens.

With regards to improving impact, it shows that although many articles mention improving impact as a measurement purpose, there are only a limited number of authors providing insights into how investors can actually do so. Literature in this regard is in an early stage, both conceptually as well as empirically. At the same time, the risk of impact washing and occurrence of investor biases when it comes to managing impact (Heeb et al., 2023; Lee et al., 2020) show the importance of this topic going forward. Future research could focus on the operationalisation of improving impacts throughout the investment process. More specifically, related to strategy setting, future research could examine how impact objectives are operationalised and tracked throughout the investment process, providing further understanding of this process. The tension of having dual objectives (financial and impact) is discussed by several authors. In this regard, novel governance structures, such as embedding impact performance in investors' remuneration, are an interesting area for future research (Dordi et al., 2023). Finally, impact scaling is an interesting emerging perspective and deserves further research, as it conceptualises improving impact as not only enlarging the investee (capacity scaling) but also the quality and depth of impact (up and deep scaling).

This review has two important limitations. First, it does not include research on CSR and the effect of ESG ratings on financial performance; for these topics, we

refer to reviews by Friede et al. (2015), Gillan et al. (2021) and Khan et al. (2016). Second, by focusing the analysis specifically on the purposes of measurement and the integrated investment process, other insights that might be captured by the sample have received less attention.

This study contributes to theory in several ways. First, it analyses the purposes of impact measurement and distinguishes two different logics, proving and improving impact. Through this analysis, we provide construct clarity on impact measurement and its use (Post et al., 2020). Second, we identified emerging perspectives for future research avenues. The integrated investment process, which merges and extends existing frameworks, can be used to further conduct empirical research. Third, this review shows the importance to move beyond the arguments of legitimacy and stakeholder theory if we want to capitalise the promise of impact investing to make the world a better place. Impact measurement is an essential practice for both impact-aligned and impact-generating investments (Busch et al., 2022; Dordi et al., 2023). A combination of conceptual and empirical (both qualitative and quantitative) research is needed to capture how impact is measured and managed within the investment process.

This research also provides interesting results for the investment community, as it is of great importance to guide the investment practice to rigorous and meaningful impact measurement and management. Practitioners can use the integrated investment process to take the next steps in impact management. More broadly, this research contributes to society and the environment at large as they benefit when investors improve their investments' social and environmental impact.

Table 2.8 – Proving and improving impact as two distinct logics in impact measurement

Key logic	Category purpose impact measurement	Relevant theory	Emerging perspectives from review sample	Future research areas
		Prove impact		
Measure companies' impacts to prove → investors prove impacts to internal and external stakeholders	1. Communicate impact 2. Prove to internal stakeholders 3. Prove to external stakeholders 4. Attract / Prove to investors	Employee engagement Legitimacy theory Stakeholder theory Agency theory (information asymmetry, signalling) Resource dependence theory Institutional logics	1. Stakeholders important to why and how of impact measurement, but often only generally referred to 2. Impact measurement as signal to in- or decrease information asymmetry	1. Operationalisation of impact measurement and stakeholders' involvement therein 2. Dynamics impact measurement as practice of information asymmetry
		Improve impact		
Measure companies' impacts to improve → investors act throughout investment process on impacts (executes investor impact) → increase investor impact	1. Strengthen strategic decision-making 2. Understand / Learn about impact 3. Improve performance and scale impact 4. Allocate resources 5. Incentives to achieve social and environmental impact	Organisational theory Decision-making theory (including rational choice and bounded rationality) Performance measurement theory Behavioural economics	1. Improving impact as purpose mentioned, but operationalisation is lacking 2. Dual objective (financial and impact) as a challenge 3. Impact scaling as emerging view on improving impact	1. Operationalisation of improving impacts throughout investment process 2. Operationalisation of impact objectives; novel governance structures to achieve these objectives 3. Examining impact scaling (capacity, up and deep scaling) as concept for improving impact

Appendices chapter 2

Appendix A2.1 – Overview phases investment process

Author	Type of investments	Pre-investment phases	Post-investment phases
Ebrahim, 2019	Social sector impact investments	● Search (Identify opportunities) ● Diligence (Assess performance potential)	● Improvement (Improve performance) ● Evaluation (Assess performance)
Lam & Tan, 2021	Private impact investments	● Deal flow generation ● Deal filtering ● Due diligence ● Deal structuring	● Value creation ● Performance reporting and evaluation ● Deal exiting
Mungai, 2018	Private impact investments	● Deal origination ● Investment appraisal	● Active management ● Realise value
Spiess-Knafl & Scheck, 2017	Impact investments	● Screening and due diligence	● Capacity building ● Reporting ● Exit
GIIN, 2020	Public and private impact investments	● Strategy setting ● Screening and due diligence	● Investment management ● Exit
International Finance Corporation, 2019	Public and private investments	● Strategic intent ● Origination and structuring	● Portfolio management ● Impact at exit ● Independent verification

Appendix A2.2 – Impact measurement frameworks mapped to integrated investment process

Author	Strategy Setting	Integrated Risk and Return Assessment	Integrated Investment decision	Investment Management	Exit Investment
GIIN, 2020	● Define decision needed	● Collect standardized impact information ● Conduct analysis	● Apply insights in investment processes		
Berkley et al., 2020		● Create an impact rating ● Select a financial valuation metric	Implications for future investments (Integrated decision-making)	Measure, manage, and communicate integrated impact and financial performance	
Impact Institute, 2019	● Get started/ Scope ● Define objective ● Scope assessment ● Define the impact and impact pathway	● Measure impact ● Value impact ● Attribute and aggregate impact ● Interpret and test the results		● Report ● Steer impact	
Bridgespan Group, 2019	● Assess relevance and scale ● Identify target social-environmental outcomes	● Estimate economic value of outcomes to society ● Adjust for risks ● Estimate terminal value ● Calculate SROI			
Hehenberger et al., 2015	● Setting objectives	● Analysing Stakeholders ● Measuring results ● Verifying and valuing impact	● Decide key indicators for measurement ● Decide monitoring content and frequency	● Verifying and valuing impact ● Monitoring and reporting	● Analyse impact results against objectives
So & Staskevicius, 2015		● Estimating impact: conducting due diligence pre-investment	● Planning impact: Deriving metrics and data collection methods to monitor impact	● Monitoring impact: Measuring and analysing impact to ensure alignment and performance	● Evaluating impact: Understanding post-investment social impact of an investment

Appendix A2.3 – Overview review sample

Authors	Year Published	Title
Addy, C., Chorengel, M., Collins, M., Etzel, M.	2019	Calculating the value of impact investing An evidence-based way to estimate social and environmental returns
Aggarwala, R. T., & Frasch, C. A.	2017	Philanthropy As One Big Impact Investment: A Framework For Evaluating A Foundation's Blended Performance
Agrawal, A., & Hockerts, K.	2019	Impact investing strategy: Managing conflicts between impact investor and investee social enterprise
Akingbola, K., Phaetthayanan, S., & Brown, J.	2015	A-Way Express Courier
Alijani, S., Karyotis C.	2019	Coping with impact investing antagonistic objectives: A multistakeholder approach
Andrikopoulos, A.	2020	Delineating social finance
Apostolakis, G., Van Dijk, G., Blomme, R. J., Kraanen, F., & Papadopoulos, A. P.	2018	Predicting pension beneficiaries' behaviour when offered a socially responsible and impact investment portfolio
Apostolakis, G., Kraanen, F., & van Dijk, G.	2016	Pension beneficiaries' and fund managers' perceptions of responsible investment: a focus group study
Aschari-Lincoln, J., & Jacobs, C. D.	2018	Enabling Effective Social Impact: Towards a Model for Impact Scaling Agreements
Barber, B., Morse A., Yasuda A.	2021	Impact investing
Barman, E.	2020	Many a Slip: The Challenge of Impact as Boundary Object In Social Finance
Barman, E.	2018	Doing Well by Doing Good: A Comparative Analysis of ESG Standards for Responsible Investment
Barman, E., Hall, M., & Millo, Y.	2021	Demonstrating Value: How Entrepreneurs Design New Accounting Methods to Justify Innovations
Beer, H. A., & Micheli, P.	2018	Advancing Performance Measurement Theory by Focusing on Subjects: Lessons from the Measurement of Social Value
Bender, J., Bridges, T. A., & Shah, K.	2019	Reinventing climate investing: building equity portfolios for climate risk mitigation and adaptation
Bengo, I., Borrello, A., & Chiodo, V.	2021	Preserving the Integrity of Social Impact Investing: Towards a Distinctive Implementation Strategy
Berg, F., Kölbel, J. & Rigobon R.	2019	Aggregate Confusion: The Divergence of ESG Ratings
Berning, S.	2019	The Role of Multinational Enterprises in Achieving Sustainable Development - The Case of Huawei
Biasin, M., Cerqueti, R. Giacomini E., Marinelli, N., Quaranta, A.G., Riccetti, L.	2019	Macro Asset Allocation with Social Impact Investments
Blagov, Y., Petrova-Savchenko, A.	2021	The transformation of corporate sustainability model in the context of achieving the UN SDGs: evidence from the leading Russian companies
Block, J. H., Hirschmann, M., & Fisch, C.	2021	Which criteria matter when impact investors screen social enterprises?
Bocken, N. M.P. P	2015	Sustainable venture capital - catalyst for sustainable start-up success?

Bosch-Badia, M., Montllor-Serrats J. & Tarrazon-Rodon, M.A.	2018	Sustainability and ethics in the process of price determination in financial markets: A conceptual analysis
Bourgeron, T.	2020	Constructing the Double Circulation of Capital and ``Social Impact.'' An Ethnographic Study of a French Impact Investment Fund
Brounen, D., Marcato G. & Op 't Veld, H.	2021	Pricing ESG Equity Ratings and Underlying Data in Listed Real Estate Securities
Buonocore, J., Choma E. Villavicencio A., Spengler, J.D., Koehler, D.A., Evans, J. S., Lelieveld, J., Klop, P., Sanchez-Pina, R.	2019	Metrics for the sustainable development goals: renewable energy and transportation
Burton, J.	2020	Supporting entrepreneurs when it matters: optimising capital allocation for impact
Calderini, M., Chiodo, V., & Michelucci, F. V.	2018	The social impact investment race: toward an interpretative framework
Calvo, C., Ivorra, C. & Liern, V.	2015	Finding socially responsible portfolios close to conventional ones
Care, R., Rania, F., De Lisa, R., Carè, R., Rania, F., & De Lisa, R.	2020	Critical Success Factors, Motivations, and Risks in Social Impact Bonds
Caseau, C. & Grolleau, G.	2020	Impact Investing: Killing Two Birds with One Stone?
Castellas, E. I.-P., Ormiston, J., & Findlay, S.	2018	Financing social entrepreneurship
Cetindamar, D. & Ozkazanc-Pan, B.	2017	Assessing mission drift at venture capital impact investors
Cezarino, L.O., Queiroz Murad, M. de, Resende, P.V., Falco Sales, W.	2020	Being green makes me greener? An evaluation of sustainability rebound effects
Chowdhry, B., Davies, S.W., Waters, B.	2019	Investing for Impact
Clark, R., Reed, J. & Sunderland, T.	2018	Bridging funding gaps for climate and sustainable development: Pitfalls, progress and potential of private finance
Consolandi, C., Phadke, H., Hawley, J., Eccles, R.G.	2020	Material ESG Outcomes and SDG Externalities: Evaluating the Health Care Sector’s Contribution to the SDGs
Cooney, K.	2017	Legitimation dynamics: How SROI could mobilize resources for new constituencies
Cordes, J. J.	2017	Using cost-benefit analysis and social return on investment to evaluate the impact of social enterprise: Promises, implementation, and limitations
Costa, E., & Pesci, C.	2016	Social impact measurement: why do stakeholders matter?
Courtney, P.	2018	Conceptualising Social Value for the Third Sector and Developing Methods for Its Assessment
Crifo, P., Forget, V. D. & Teyssier, S.	2015	The price of environmental, social and governance practice disclosure: An experiment with professional private equity investors

Crifo, P., & Mottis, N.	2016	Socially Responsible Investment in France
Cubas-Díaz, M. & Sedano, M. Á. M.	2018	Measures for Sustainable Investment Decisions and Business Strategy – A Triple Bottom Line Approach
Cubas-Díaz, M. & Sedano, M. Á. M.	2018	Do credit ratings take into account the sustainability performance of companies?
Daems, R., Maes, E.. Mehra, M., Carroll, B., Thomas, A.	2014	Pharmaceutical portfolio management: Global disease burden and corporate performance metrics
De Amicis, L., Binenti, S., Maciel Cardoso, F., Gracia-Lázaro, C., Sánchez, Á., Moreno, Y.	2020	Understanding drivers when investing for impact: an experimental study
Del Giudice, A., & Migliavacca, M.	2019	Social Impact Bonds and Institutional Investors: An Empirical Analysis of a Complicated Relationship
DeLisle, J.R., Never, B., Grissom, T.V.	2020	The big data regime shift in real estate
Diouf, D., & Boiral, O.	2017	The quality of sustainability reports and impression management
Diouf, D. & Boiral, O.	2019	Social impact measurement: What can impact investment practices and the policy evaluation paradigm learn from each other?
Dushenko, M., Bjorbaek, C.T. & Steger-Jensen, K.	2018	Application of a sustainability model for assessing the relocation of a container terminal: A case study of Kristiansand port
Ebrahim, A. & Rangan, V.K.	2014	What Impact? A Framework for Measuring the Scale and Scope of Social Performance
Endsor, C., Debney, A. & Withers, O.	2020	Could impact investing catalyse an ecosystem wide recovery for native oysters and native oyster beds? Lessons learned from the Zoological Society of London's Rhino Impact Investment Bond that could shape the future of oyster restoration
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Leborgne-Bonassié, M., Coletti, M., Sansone, G.	2019	What do venture philanthropy organisations seek in social enterprises?
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Lyons, T. S., & Kickul, J. R.	2013	The Social Enterprise Financing Landscape: The Lay of the Land and New Research on the Horizon
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Meyer, J. & Krauss, A.	2021	The social performance of microfinance investment vehicles
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Mook, L., Maiorano, J., Ryan, S., Armstrong, A., & Quarter, J.	2015	Turning Social Return on Investment on Its Head
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Rania, F., Trotta, A., Carè, R., Migliazza, M. C., & Kabli, A.	2020	Social Uncertainty Evaluation of Social Impact Bonds: A Model and Practical Application
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Yates, B. T. & Marra, M.	2017	Social Return On Investment (SROI): Problems, solutions … and is SROI a good investment?

Appendix A2.4 – Purposes of impact measurement related to 'Prove impact'

1. Communicate impact		
Generate better approximation of the real impact	Assess effectiveness to enable growth social enterprise	Legitimacy
Communicate value	Provide legitimacy	Social legitimacy
Provide evidence regarding value	Audit social impact of project	Showcase impact
Prove programme objectives	Improve transparency, comparability, and trust	Evaluate performance
Appraise delivered value	Evaluate their own results and performance	Highlight impacts
Report performance	Transparency and accountability	Legitimate organisations or projects
Celebrate achievements	Reporting legitimisation strategy to improve reputation	Social license to operate and grow
Give a yes or no verdict	Show different features of project	Prove and verify
Show its materiality to value company		
2. Prove to internal stakeholders		
Reinforce existing organisational structures	Assess staff performance	Communicate to internal stakeholders
Reinforce mission within organisation	Employee motivation	
3. Prove to external stakeholders		
Accountability	Communicate value to stakeholders	Guide decision-making by stakeholder groups
Manage stakeholder expectations	Measure impact on stakeholders	Test and convince others
Convince stakeholders, clients	Communicate to external stakeholders	Measure and report value created for stakeholders
Accountability towards stakeholders	Conceal poor performance	Externally increase organisational legitimacy
Transparency and accountability	Compare organisations	Fulfil regulatory requirements
Exert control over environment	Signal quality and impact to key stakeholders	Hoop jumping exercise
External legitimacy	Communicate results to stakeholders	Comply with legal reporting requirements
4. Attract / Prove to investors		

Demonstrating results, driven by funders Attracting investors Attract funding Assist in project funding	Fundraising purposes Attract support from, or to appease powerful actors Need to attract investors Reporting to funders	Measurement of incremental change does not support funding for scaling up Be accountable to donors

Appendix A2.5 – Purposes of impact measurement related to 'Improve impact'

1. Integrate in strategic decision-making		
Reference in strategy setting Management / improving / informing decision-making Optimise execution strategy Identify financing opportunities for achieving mission Informs and improves decision-making Guide managerial decisions Manage project by outcomes-driven work program Guiding decision makers Improved investment decisions Investors include in decision-making	Informing decision-making Incorporates social and environmental issues in decision-making process Strategic decision making and evaluation Support investment decision Consider environmental and social concerns in decision-making Improve decisions Decision framework how results can be improved or optimized	Investors do not steer target firms towards higher levels of ESG Investors include in decision-making Make investment decisions Guide decision-making by investors and companies themselves Utilize results as steering instrument ESG integration into financial decision-making Reference in investment strategy
2. Understand / Learn about impact		
Organisational learning Continuous learning Internal learning Learn and self-correct behaviour Co-learning and co-creation	Benchmark results to understand investment needs Benchmark results to understand investment needs Measure success to derive improvements Improve the intervention Develop awareness of staff and volunteers	Gain understanding of impacts Develop understanding of company or project Understand goals/targets and related evidence Know if achieved what intended Manage alignment investor and investee

Modify organisational behaviour to maximize impact To evaluate outcomes, target resources and gain understanding Understand impact (three times) Appraise of value leading to understanding Strengthen knowledge Assess future opportunities Predict impacts	Understanding and acting upon different types of impact scaling Analyse effectiveness Learn from information, adapt and self-correct behaviour Review program design and implementation Identify required actions to improve sustainability performance	Enabling employees and volunteers to analyse impact Understand deeper impact to all stakeholders in each stage of project cycle Understand stakeholder impact Allow stakeholders to understand impact Enable stakeholders to understand impact Understand deeper impact to all stakeholders Understand value to employees
3. Improve performance and scale impact		
Improve operational effectiveness Improve the intervention Improving performance Enable improvements to programmes and services Discover opportunities to improve services Monitor performance Engage company to improve performance	Investors do not steer target firms towards higher levels of ESG Scaling impact - creating transformative social change or system change Engage company to improve performance Adapt interventions Scale impact Optimise impacts	Determine what programs to implement Improvement program design and implementation Improve working practices Track impacts to improve organisation Improve ESG performance through investor engagement Improve working practices
4. Allocate resources		
Performance measurement for resource allocation Guide resource allocation decisions Allocate resources efficiently and effectively	Informed decisions ongoing use of resources Identify financing opportunities for achieving mission Effectively allocate capital	Improve the efficiency and accuracy of selection Track impacts to inform how resources are allocated Set funding priorities
5. Incentives to achieve social and environmental impact		
Signal to steer investments to most efficiently improve impact / Impact bond tied to outcome target	Enhance social outcomes through social impact bond Define targets based on measurement SROI	Deliver improved outcomes through social impact bond/ Reward mechanism

3. Integrating transitions and impact measurement in strategic asset allocation[4]

3.1 Introduction

Current environmental and societal challenges are not addressed in strategic asset allocation (SAA). Institutional investors therefore cannot steer on the contribution of their investments to transitions towards a sustainable economy. Strategic asset allocation is a process in which institutional investors, based on macroeconomic expectations, calculate expected risk and return and allocate investments to different asset classes (Brinson et al., 1991). Most common asset classes are equities, corporate and sovereign bonds, real estate, infrastructure, and private equity. In the end, institutional investors aim to achieve financial return for their beneficiaries, while managing risks (Koedijk et al., 2018). Investors take important decisions in SAA, yet there is limited research on how investors integrate sustainability in this process.

This article introduces an integrated SAA framework which integrates transitions and impact. This enables investors to strategically allocate assets based on risk-return-impact expectations. The design for integrated SAA entails four steps: 1. Integrated investment policy 2. Form macro-economic expectations 3. Form risk-return-impact expectations 4. Construct the portfolio. The proposed integrated SAA framework contributes to the literature by providing a fundamental rethinking of SAA based on the latest academic insights on transitions and impact. More specifically, we make three academic contributions. First, we provide the novel insight that investments' impacts are endogenous to investor decisions, as impact indicates how investments guide transitions. This implies that investors can act to mitigate transition risk and accelerate their contribution to transitions through their investment portfolio. Second, we propose to measure impact alignment, where companies' impacts are compared to system thresholds of a sustainable economy. This is a fundamental different measurement than ESG ratings, which measure incremental or relative performance, and receive increasing academic critiques (Berg et al., 2022; Chatterji et al., 2016; Kotsantonis & Serafeim, 2019). Third, the proposed integrated SAA framework serves as an overarching framework for investment professionals and as a theoretical embedding of recent empirical evidence (Bolton & Kacperczyk, 2021, 2023; Huij et al., 2023; Pastor et al., 2022).

Therefore, this article is highly relevant for investment professionals. When investors operationalise integrated SAA, they can manage the degree to which their investments facilitate or hamper transitions to a sustainable economy. Furthermore, recent empirical evidence shows that investors do not yet optimise expected impact, as they show insensitivity to the size of the realised impact (Heeb et al., 2023; Lee et al., 2020) and see impact as a category rather than as a criterium to optimise (Heeb et al., 2023; Lee et al., 2020). It is therefore important that investors adopt adequate processes to understand and manage the impact alignment, alongside the risk and return dimensions, of their investment portfolio.

The rest of the paper is structured as follows. In section 2, we summarize the relevant literature on systemic risks, transitions, and the integration of sustainability in SAA. In section 3, we develop the integrated strategic asset allocation framework and elaborate on the four phases. In section 4, we provide propositions that provide a basis for future empirical research. In discussion section 5, we reflect on how investors can alter asset allocation decisions based on this framework. Section 6 closes with a conclusion.

[4] This chapter is published as: Roor, A., Schoenmaker, D. & Maas, K. (2025). Integrating Transitions and Impact Measurement in Strategic Asset Allocation. *Journal of Portfolio Management*, 51, 9 , p.116-141.

3.2 Systemic risks, transitions, and sustainability in SAA

For integrated SAA, the most relevant strands of literature are on systemic risks and transitions, and on integrating sustainability in SAA. Systemic risks flow from changing environmental, social and financial systems, which can damage investments and the economy at large (Lukomnik & Hawley, 2021; Zigrand, 2014). Systemic risks often create non-diversifiable systematic risk (Lukomnik & Hawley, 2021). While systemic risks were previously considered outside investors' control, recent insights show that investors can address systemic risks when they broaden their view on the sources of these risks (Zigrand, 2014). Increasingly, systemic risks originate from environmental and social global challenges (Bolton et al., 2021), as shown in the increasing dominance of these challenges in the Global Risks Reports by the (World Economic Forum, 2023)[5].

Systemic risks stemming from environmental and social challenges can be assessed by analysing transitions. We define transitions as transformational system changes taking place through a process of build-up of new regimes and breakdown of old regimes over time to achieve a sustainable economy (Hebinck et al., 2022). Transformational means that changes are disruptive and non-linear, e.g. new regimes may take a long period to develop, but can accelerate in a relative short period (Hebinck et al., 2022). Transitions pose transition risks to investors, as investments in old regimes are at risk of breakdown when they insufficiently transition (Schoenmaker & Schramade, 2022). At the time of writing, the four largest transitions are the energy transition, the transition to a circular economy, the food transition (towards healthy food production with respect for land and water) and the social transition (ensuring decent labour practices and respecting human rights) (Schoenmaker & Schramade, 2023). These four transitions are changes towards a sustainable economy, whereas there are also other transitions, e.g. digitalisation and an ageing population. Until now, strategic asset allocation has mostly considered changes within economic systems (e.g. growth, inflation and interest rates). Transitions are not explicitly considered by investors, whereas they can have a significant effect on expected risk and return. By actively considering these, investors can anticipate risks and opportunities that are overlooked in current asset allocation models.

Besides anticipating the effects of transitions on the portfolio, investors can also affect transitions themselves; the financial crisis that started in 2007 shows that individual risk-taking of investors can lead in aggregate to significant systemic risks (Zigrand, 2014). Certain institutional investors invest such large amounts that they at times can be price makers (Lukomnik & Hawley, 2021). Institutional investors such as APG adopted objectives on contributing to transitions (APG, 2022). For these reasons, it is important to understand transitions and investors' contribution therein, which is a research gap we address in this paper.

There is some recent academic work on how sustainability can be integrated in SAA. This is mostly done by adding ESG (environmental, social and governance) ratings as a third pillar next to risk and return (e.g. Gasser et al., 2017; Steuer & Utz, 2023) or by adding climate risk assessments (e.g. Bender et al., 2019; Fang et al., 2019; Rubtsov & Shen, 2022). Blitz et al. (2024) adopt as third pillar also the carbon footprint and scores on how companies contribute to the Sustainable Development Goals (SDG). ESG ratings compare performance often against peers or measure the degree of risk mitigation, rather than providing information on whether a company's sustainability performance fits within a sustainable economy (Barnett et al., 2020; Elkington, 2018; Larcker et al., 2022). Recent critiques show that ESG ratings have limited correlation and are subject to validity problems (Berg et al., 2022; Gyönyörová et al., 2021; Kotsantonis & Serafeim, 2019). ESG ratings look by nature at incremental and relative performance (Baue & Thurm, 2020), while academic literature emphasizes the importance of absolute measurement in order to compare it to an end state (e.g. a sustainable economy) (Barnett et al., 2020; Elkington, 2018; Bjorn et al., 2020; Ryberg et al., 2020). Climate risk assessments provide an initial step, but are limited to climate change related effects.

[5] In the 2023 report, the top 10 global risks by likely impact (severity) consists of six environmental risks and two societal risks, one geopolitical risk and one technological risk. Although they identify several economic risks, these were considered less severe than the top 10.

On a more general note, the limited success of the significant volume of 'sustainable' investing to achieve real-world improvements in the past decades provides a strong argument to relate sustainability measurement more directly to the goal of achieving a sustainable economy (Busch et al., 2016).

Increasingly, measuring impact of companies is seen as the next step (Busch et al., 2021). We define impact as the result of the activities of an organisation on individual stakeholders, society and the environment, including both intended and unintended effects, positive and negative effects, short-term and long-term effects (Chapter 2). Busch et al. (2021) state that a "substantial re-orientation toward impacts in financial markets" (Busch et al., 2021) is needed. Furthermore, comparing impacts to system thresholds is suitable, as it provides insights on how companies are positioned towards ongoing transitions ((Bjorn et al., 2020; Ryberg et al., 2020). In the context of SAA, several authors point out that integration of impact in SAA is a necessity (Brandstetter & Lehner, 2015; Van Dam et al., 2022). Through this article, we aim to address this research gap as to how to integrate impact in SAA.

3.3 The integrated strategic asset allocation framework

We address the identified research gap by introducing an integrated strategic asset allocation framework (Figure 3.1 and Table 3.1). In essence, integrated SAA leads to achieving an integrated investment objective: Achieve financial return and impact while managing risk. For a pension fund, this objective relates to its mission of providing a good pension to the pension participants. Table 3.1 compares the conventional strategic asset allocation, in line with (Koedijk et al., 2018; Van Dam et al., 2022; Vermeulen & Boeijen, 2018)), to the integrated SAA framework. In essence, integrated SAA fundamentally rethinks conventional SAA and forms a novel approach enabling investors to strategically allocate assets based on risk-return-impact expectations. We elaborate on each of the four steps of integrated SAA in the next paragraphs.

Figure 3.1 – Integrated strategic asset allocation framework

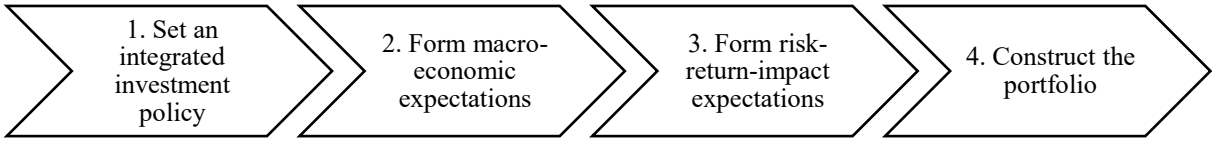


Table 3.1 – Conventional strategic asset allocation (SAA) and integrated SAA (by authors)

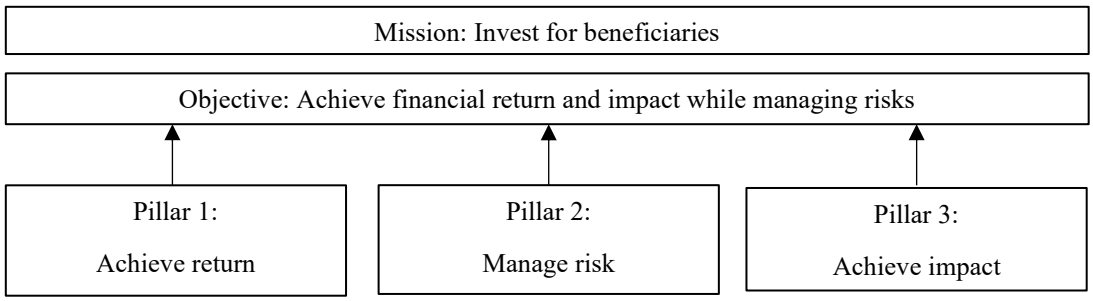
	Conventional SAA	Integrated SAA
1. Set an integrated investment policy	• Formulate mission and investment objectives (return, risk) • Adopt investment beliefs • Determine risk appetite	• Formulate mission and investment objectives (return, risk, **impact**) • Adopt investment beliefs**, including impact beliefs** • Determine risk appetite
2. Form macro-economic expectations	• On growth, interest rate, inflation	• On growth, interest rate, inflation **and transitions** • Transitions requires a sector view
3. Form risk-return-impact expectations	• Set risk-return expectations on all asset classes	• Integrate impact alignment as a separate dimension • Extend to risk-return-**impact** expectations on all asset classes, informed by sector views
4. Construct the portfolio	• Stochastic modelling and scenario analyses using macroeconomic factors • Results in different asset mixes with different risk-return characteristics • Construct a portfolio by optimising expected risk-return	• Stochastic modelling and scenario analyses using macroeconomic and **transition** factors • Results in different asset mixes with different risk-return-**impact** characteristics • Construct a portfolio by optimising expected risk-return-**impact**, informed by sector views

3.3.1 Set an integrated investment policy

The first step in integrated SAA entails setting an integrated investment policy: formulating the mission and investment objectives, adopting investment beliefs and determining the risk appetite.

Institutional investors start by formulating a mission and investment objectives. In their mission, institutional investors often stay close to their identity as an institutional investor: to invest on behalf of beneficiaries, e.g. providing a good pension (Koedijk et al., 2018). Within integrated SAA, the ultimate investment objective is to achieve financial return and impact while managing risks (Figure 3.2). This objective includes three integrated objectives: to achieve return, to manage risks and to achieve impact. Conventional SAA includes two objectives – risk and return – although these are often not explicitly formulated as separate objectives. Achieving impact starts by understanding impact; investors obtain information on their investments' impacts – whether in companies, real estate or infrastructure – and act on it. Specific objectives in achieving impact can relate to certain transitions. For example, the Dutch pension fund PMT wants to generate impact contributing to the energy transition as their beneficiaries work in the carbon-intensive metalworking and mechanical engineering sector (PMT, 2019). Recently, many institutional investors adopted a net-zero strategy, consisting of a net-zero emission objective and associated actions to decarbonize the investment portfolio and accelerate the energy transition through impact investments (Babcock et al., 2022).

Figure 3.2 – General mission and investment objectives in integrated SAA



Next, investors adopt investment beliefs, including beliefs on transitions and impact. For example, investors establish that transitions are relevant in two ways: they affect the investor in terms of expected risk-return-impact (outside-in) and the investor has an ongoing effect on transitions through its investment portfolio

(inside-out). This double materiality principle (outside-in and inside-out, or financial and impact materiality) forms the foundation for looking at transitions and impact throughout the integrated SAA process. Investment beliefs support rational decision-making in SAA (Campbell & Viceira, 2001). So far, pension fund boards have limited discussions on certain investment beliefs, which may hinder investors in taking a role in financing transitions (Koedijk & Slager, 2023). Table 3.2 provides examples of investment beliefs.

Table 3.2 – Illustrative investment beliefs (by authors)

1.	We care for the world our beneficiaries retire into. Therefore, we do not want our investments to do significantly harm to the environment or people.
2.	We seek for investment opportunities within our risk-return-impact objectives that improve living conditions of our beneficiaries and the society they live in.
3.	The current negative environmental and social impact of the economy poses a systemic risk on the future economy, and thus transition risks are relevant to consider.
4.	Impact investments in developing markets are needed to accelerate transitions to a sustainable economy worldwide.
5.	Companies that provide solutions to accelerate transitions have a competitive advantage.

Finally, investors determine their risk appetite, including the risk appetite for transition effects in the portfolio. Several illustrative investment beliefs of Table 3.2 can lead to certain risk appetites: belief 1 can lead to a minimum level of certain impacts to avoid significant harm, belief 3 can lead to an assessment of and threshold on transition risks.

3.3.2 Form macro-economic expectations

Conventional SAA assesses the future 'economy' on three macro-economic factors: economic growth, inflation, and the interest rate (Van Dam et al., 2022). With these factors, investors anticipate changes within the current economic systems, but fail to anticipate relevant transitions that affect one or more sectors. In line with (Geels & Schot, 2007), the stage of a transition (denoted by T) is driven by developments on different levels, summarized as public policies (P), technology and science (TS), consumer preferences (C), niche innovations emerging to the economy (I) and the positioning of companies towards the transition, which we denote as impact alignment, IA (see next section), so

$$T = f(P, TS, C, I, IA) \quad (1)$$

Developments on these levels are long and interconnected processes; they can be accelerated through 'windows of opportunities', e.g. extreme weather events may accelerate public policies (Geels & Schot, 2007). By assessing the future 'economy' also on transitions, investors can better anticipate system changes. Transitions pose transitions risks to investors (outside-in) and investors affect transition through their investment portfolio (inside-out). So far, transitions are mostly researched as a source of transition risk, e.g. affecting expected risk-return (Daumas, 2023). Risks relating to the energy transition are most comprehensively researched, more specifically the physical and transition climate change effects[6] (e.g. (Cosemans et al., 2022; Fang et al., 2019; Reinders et al., 2023). Cosemans et al. (2022) show that physical climate change effects cause investors to believe this negatively affects economic growth, leading to higher expected risks which are not fully compensated by higher equity premiums as of today. Therefore, this can translate into lower exposure to equities in asset allocation decisions (Cosemans et al., 2022). Besides outside-in effects, Eq. 1 shows that companies themselves affect transitions, as their impact alignment drives the pace of the transition. The impact alignment of companies is endogenous to the stage of a transition. Therefore, investors' investments in these companies are also endogenous to the stage of transition, as their investments and related decisions affect the pace of transitions taking place. As

[6] Physical effects capture the effects of climate change, while transition effects capture structural changes in the economy due to climate change adaptation and mitigation measures.

Busch, Bauer and Orlitzky (2016) put it: "Whatever form sustainable development takes, banks and investors can be seen as key drivers – or obstacles to it." (2016, p.320). Using a 15-year time horizon, as conventional SAA often does, can limit the extent to which certain transition effects become apparent. But given that the investment horizon of most institutional investors is longer, in particular of pension funds and life insurance companies, transition effects for different sectors can also be assessed on this longer time horizon.

3.3.3 Form risk-return-impact expectations

To form risk-return-impact expectations, we need an adequate way of measuring impact. As elaborated on in the Introduction, several authors call for an absolute measurement of impact, where companies' impacts are compared against an end state, e.g. a sustainable economy. This measurement is relevant as conventional risk-return calculations assume that companies can use raw materials and emit to soil, water and air without any limitation. Yet, resources are limited and ecosystems are deteriorating, as currently six out of nine planetary boundaries are trespassed (Richardson et al., 2023). Recent data shows that with current policies global warming will not be limited to the goal of a 1.5°C temperature increase. So far, global emissions have not yet peaked but continue to rise. The Jevons paradox shows that an increase in energy efficiency often leads to more emissions, rather than less (Alcott, 2005). Therefore, thresholds are needed to achieve global climate – and broader environmental – targets (Pineda et al., 2020). On social impacts, prices on today's products do not reflect the negative effects occurring in value chains, e.g. forced labour or wages below living wage leading to poverty. Sustainability due diligence is increasing in importance to identify and mitigate these negative social impacts (Saloranta & Hurmerinta-Haanpää, 2023). Thresholds on key social impacts improve the informativeness of companies' disclosures in this regard.

For this type of measurement we need to derive a company's impacts and a threshold to compare it with. We define impacts (I_i) as results of a company's activities on individual stakeholders, society, and the environment, including both intended and unintended effects, positive and negative effects, short-term and long-term effects (Chapter 2). We call the threshold a system threshold S_i (which can be allocated to geographies and sectors; see Appendix A3.1)[7]. By setting thresholds at company-level for environmental and social impacts of a company (operating in a certain geography and sector), we can ensure that the end state of a sustainable economy is realised. We employ the sustainability quotient of McElroy et al. (2008) and define impact alignment (IA) for impact *i* as follows:

$$IA_i = \frac{(-)\,(I_i - S_i)}{S_i} \qquad (2)$$

, where I_i is compared to S_i results in negative impact alignment ($IA_i < 0$), aligned ($IA_i = 0$) or positive impact alignment ($IA_i > 0$). These three interpretations are visualised in Figure 3.3. Impact alignment requires considering several relevant impacts, just as risk-return expectations can be characterised by more than one indicator (Aouni et al., 2018). We can now make the link from impact alignment to transition. Negative impact alignment reflects the business-as-usual scenario, slowing down the transition. Impact aligned means that the company is on track of the envisaged transition pathway. Positive impact alignment implies that the company is ahead, accelerating the transition.

We illustrate the use of our indicator IA_i by means of examples in Table 3.3: Company A emits more GHG emissions than the system threshold (resulting in a negative impact alignment), while Company B emits in line with the system threshold (thus avoiding negative impact). By lowering emissions, company A can lower negative impact and company B can make a positive contribution to climate change mitigation. Furthermore, as described by Yi et al. (2022) the living wage gap is the gap between "actual wages and benefits paid to a worker

[7] The literature on absolute (environmental) sustainability assessments uses the term carrying capacity for system thresholds. Carrying capacity is defined as 'the maximum persistent anthropogenic pressure that the environment can tolerate without suffering impairment of the functional integrity of its ecosystems' (Bjørn et al., 2020, p.842). As we cascade the system threshold to company level, we use this term as it more explicitly a threshold that relates to the system level.

and a normative living wage" (Yi et al., 2022, p.34). This living wage per country is developed over several years by NGOs and serves as a system threshold (see also Table A3.1). When put in percentages, company A pays out to all its employees at minimum a living wage (100%), and therefore avoids a negative impact on its employees. On the same impact, company B has negative impact while it provides less than the living wage (on average 80%) to its employees. Hence, falling short of the minimum obtains a negative score. Determining system thresholds on a company level is quite a challenge (Ryberg et al., 2020), but there are initiatives such as the Transition Pathway Initiative (2024) and Science-Based Targets Network (SBTN, 2023), which take system thresholds as a basis and thus provide valuable insights.

Institutional investors face the traditional buy-or-make decision. Investors can 'buy' impact (and thus contribute to transitions) by selecting companies that are non-negatively impact aligned. Alternatively, investors can 'make' impact (and thus contribute to transitions) by buying companies with a negative impact alignment and engaging with these companies to improve their impact by moving away from their business-as-usual strategy.

Figure 3.3 – Visualisation impact alignment

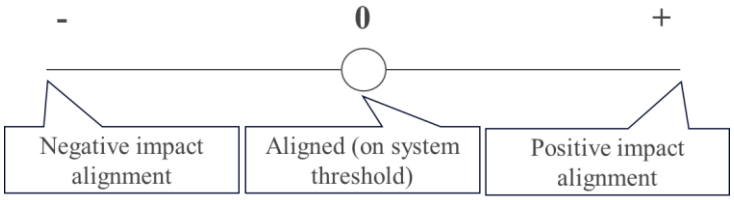


Table 3.3 – Examples impact alignment

Company & impact	I_i	S_i	Impact alignment	Interpretation
Company A – GHG emissions	300 Mt CO_2eq	250 Mt CO_2eq	$\frac{-(300-250)}{250} = -0.2$	The company emits more GHG emissions than S_i and thus needs to reduce in order to fit within a sustainable economy.
Company B – GHG emissions	250 Mt CO_2eq	250 Mt CO_2eq	$\frac{-(250-250)}{250} = 0$	The company emits in line with S_i, thus avoiding significant harm. By lowering emissions, it contributes to climate change mitigation.
Company A – Living wage	100% living wage	100% living wage	$\frac{(100-100)}{100} = 0.0$	The company pays all employees at minimum a living wage so reaches the S_i and avoids a negative impact.
Company B – Living wage	80% living wage	100% living wage	$\frac{(50-100)}{100} = -0.5$	The company pays 50% of employees at minimum a living wage so falls short of the S_i and has a negative impact.

I_i is impact i of a company, S_i is a system threshold cascaded to company-level to indicate whether the impact fits within a sustainable economy. For negative impacts, the minus sign is used. For positive impacts, the minus sign is left out.

When comparing actual impacts against system thresholds for several impacts, we can calculate an aggregated impact alignment score for a company as

$$Company\ IA\ = \sum_{i}^{n} \frac{(-)\ (I_i - S_i)}{S_i} \qquad (3)$$

, which aggregates the IA calculated in eq. 2. In the example of Table 3.3, company A has IA of -0.2 ($Company\ IA_A = -0.2 + 0 = -0.2$) and company A -0.5 ($Company\ IA_B = 0 - 0.5 = -0.5$). For an investment portfolio, we can calculate the aggregated impact alignment score as

$$Portfolio\ aggregated\ IA\ = \sum_{i}^{n} Company\ IA_i * w_i \qquad (4)$$

, where for each company i the impact alignment score is multiplied by the weight (w_i) in the portfolio. An investment portfolio with 60% invested in company A and 40% in company B thus obtains a portfolio aggregated IA of -0.32 ($Portfolio\ aggregated\ IA\ = -0.2 * 0.6 + \ -0.5 * 0.4 = -0.32$). As with each aggregation, the score now provides a more general assessment rather than a detailed understanding of each particular impact. While company impacts are non-substitutable (Schoenmaker & Schramade, 2023), a summation does presume so. Investors can therefore choose to separately assess positive and negative impacts, to assign higher weights to more important impacts or to penalise extreme negative values (e.g. impacts < –0.5). These decisions can be based on the investment objective and investment beliefs, and the importance of certain transitions to the investor. We provide a simple summation to establish the measurement of impact alignment against system thresholds, providing a basis which can be further applied and developed.

The challenge lays in setting appropriate system thresholds at company level. We elaborate on this in Appendix A3.1. Several impacts are already reported by many companies, e.g. greenhouse gas emissions, water usage, material usage, gender wage gap, CEO-to-worker pay ratio, customer satisfaction. However, a data availability challenge remains, as current corporate reporting still provides insufficient insights into companies' actual impacts (Bjørn et al., 2023). All large European companies are required to report on these impacts as part of the Corporate Sustainability Reporting Directive (European Commission, 2024). On a global scale, the International Sustainability Standards Board (ISSB) put in effect the IFRS Sustainability Disclosure Standards (IFRS Foundation, 2024). European investors that make sustainable investments are asked by the European Supervisory Authorities to set system thresholds on negative impacts (EBA EIOPA & ESMA, 2022), but so far only a few investors did so. Impact alignment at a sectoral level can also be assessed by employing reliable sector research. This paper conceptualises IA for companies, but IA can also be applied to corporate and sovereign bonds, real estate, infrastructure, and private equity.

3.3.4 Construct the portfolio

In the fourth step, investors in conventional SAA use expectations per asset class and expected correlations between asset classes to perform stochastic modelling and scenario analyses. Expected correlations can be estimated by historical correlations and prospective correlations. Investors construct the portfolio based on these insights and real-world restrictions: they determine what asset mix fits their objectives best. Integrated SAA is characterized by integrating transitions in the set of macro-economic variables and then forming integrated risk-return-impact expectations for asset classes. Transitions may influence the underlying factors determining the correlation between asset classes, and hence may inform the (certainty of) correlations used in portfolio construction.

Furthermore, integrated SAA moves beyond an asset class view towards a sector-level and geographical portfolio view. A sector-level analysis makes sense, as transitions generally affect certain sectors significantly, while other sectors may be affected far less. Through a sector level view, investors get a better understanding of how their investments relate to the real economy. Research shows that the carbon intensity of broad market indices (e.g. MSCI Europe index, Russell 1000) are overweighted in carbon intensive sectors, compared to the total economy (Cosemans & Schoenmaker, 2022). A geographical portfolio view makes sense, as for example climate change effects affect regions with different effects and severity (Tokat-Acikel et al., 2021). From these portfolio insights, sectors and geographies may emerge that offer investment opportunities to improve impact alignment or that may be key to accelerate required transitions.

Conventional SAA results in the choosing of a certain asset mix with allocations to asset classes, with certain conditions and expectations per asset class, sometimes referred to as 'investment buckets'. An important advantage of integrated SAA is that it provides the opportunity to already in this stage identify where positive impact alignment can best be achieved. The impact potential of asset classes, sectors and geographies provides

valuable insights lacking in conventional SAA. For example, the equities and bonds of companies that meet (or are willing to improve to meet) the threshold S in certain (impactful) sectors can be selected. This can also be done on the geographical dimension, to improve the risk-return-impact potential. Notably, only a limited proportion of institutional investment is currently done in geographies with the largest positive impact potential, e.g. countries that face a financing gap for addressing e.g. high poverty rates and environmental challenges. Research by the United Nations (2024) shows that to achieve the SDGs, the least developed and low-income countries face financing gaps of 15 to 30 percent of their GDP (United Nations, 2024). Financing gaps increased over the past few years, as countries saw resources and tax income decrease due to the COVID-19 pandemic and subsequent events.

'Investment buckets' often limit the ability to invest in positive impact alignment opportunities, as they may have slightly different characteristics than conditions set for that 'bucket'. Institutional investors can adopt objectives to invest in positive impact aligned investments, providing guidance for decision-making. At the same time, investors can support companies in improving their impact alignment. Investors may be interested in the delta of impact alignment as the potential change that companies can make. Impact alignment provides a solid ground for investor engagement, for capital allocation decisions and other forms of investor impact (Kölbel et al., 2020).

Let's examine, by means of a simplified example, how an investor can construct its portfolio based on risk-return-impact characteristics. We limit the example to an equity portfolio with six sectors. We draw on work by (Gasser et al., 2017) and outline a basic mean-variance portfolio optimization as:

$$\max \alpha\mu + \gamma\theta - \beta\sigma^2 \tag{5}$$

, where an investor maximizes return μ of the investment portfolio by means of factor α, and minimise risk (measured as variance σ^2) by means of factor β. The portfolio aggregated IA (formula 4) is denoted as θ, and optimized by means of factor γ, which is missing in conventional SAA. The optimization for the investment portfolio has three underlying objectives, which are made explicit in equation 6-8:

$$\max \mu_{PF} = \sum_{i=1}^{n} \mu_i w_i \tag{6}$$

$$\min \sigma_{PF} = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} \sigma_i \sigma_j w_i w_j \rho_{ij}} \tag{7}$$

$$\max \theta_{PF} = \sum_{i=1}^{n} \theta_i w_i \tag{8}$$

, with i and w_i denote a risky security ($i = 1 \dots n$) and the portfolio weight of a risky security, respectively. ρ represents the correlation between securities. The investor selects the most important transitions and analyses whether the expected correlation between sectors should be updated. The portfolio has a constraint of the total weight of 1 ($w_i = 1$). We can maximise the Lagrange function to derive the first order conditions (Gasser et al., 2017). This leads to:

$$\vec{w} = C^{-1}\vec{\alpha} + C^{-1}\vec{\gamma} \tag{9}$$

, whereby $\vec{w}$ is the vector matrix for w_i, $\vec{\alpha}$ is the vector matrix for $\alpha\mu$, and $\vec{\gamma}$ is the vector matrix for $\gamma\theta$. C^{-1} is the inverted covariance matrix. Using the investor's preferences (α, γ, β), a range of portfolios can be simulated to assess how a higher preference for one of the three objectives (risk, return, impact) affects the other two. The investor can consider these portfolios and actively consider the three objectives holistically. This differs from conventional SAA, where impact is considered only after the portfolio is already allocated based on expected risk and return. Table 3.4 outlines an illustrative portfolio of the investor, with a sector distribution *w*, following the MSCI World Index distribution at the time of writing (MSCI, 2024). While there is a range of return and risk metrics discussed in literature, for illustration purposes we use annual return on equity (μ), and annualized

standard deviation of stock prices (σ), using historical data. Table 3.4 includes impact alignment (θ, see eq. 2-4) as well as the impact alignment difference (or trend) over the last three years, based on hypothetical values for illustration purposes.

Table 3.4 – Illustrative average expected risk-return-impact for investment portfolio

Industry sector	w **(%)**	μ **(%)**	σ **(%)**	θ	**3y difference** θ
Information technology	24	15.32	35.53	-0.1	-0.05
Consumer goods	17	14.18	31.76	-0.4	+0.07
Financial sector	15	11.74	23.83	0	-0.1
Healthcare	12	8.56	42.45	+0.7	+0.1
Industrial	11	13.54	30.75	-0.7	-0.1
Other	21	10.26	31.79	-0.2	+0.05

w is the weight of investments in an industry sector in the portfolio, μ is the expected return on equity in % per year, σ is the annualized standard deviation in stock prices in %, θ is the impact alignment for a certain sector (see eq. 2-4) and the difference in θ over the last three years is given. Sector distribution based on MSCI World Index per 29 March, 2024. μ and σ are based on historical averages of primary sectors. θ and 3y difference θ are hypothetical values for illustration purposes.

In their considerations, investors can use the investments' impact alignment (θ) information in different ways. Theoretically, investors have investor impact through three mechanisms: capital allocation, active engagement and indirect mechanisms (Kölbel et al., 2020). First, investors can change allocation decisions to mitigate transition risk and to contribute to a more sustainable economy. They can tilt towards higher impact-aligned sectors with positive θ (for example, healthcare in Table 3.4) or tilt away from negative impact-aligned sectors with negative θ (for example, industrial or consumer goods), therefore avoiding negative IA. In capital markets with excess supply of capital, this premier role of investors is underexposed. When better impact aligned companies bear less transition risk and investors acknowledge so, they can finance themselves at a lower cost of capital (Sharfman & Fernando, 2008). Vice versa, companies that are negatively impact-aligned bear a transition risk premium, leading to a higher cost of capital. A cost of capital effect can induce companies to change and can occur when a certain portion of investors acts on impact alignment (see Discussion). If this effect is present, it can be observed in μ, σ and θ (see next sections for elaboration on this). Investors can also provide capital to underserved markets, which is especially interesting when it supports the acceleration of transitions.

Second, IA information provides a strong basis for active engagement. An investor identifies which sectors are transitioning, evidenced by positive trend in θ over the past three years. In Table 3.4, while four sectors show a negative θ, consumer goods show the most positive trend. This information informs the discussion on exclusion versus engagement with companies in a certain sector. Investors can actively engage with a sector that is evidencing a positive IA trend to further improve its negative IA. Investors can decide to exclude sectors or investments that evidence a negative IA trend. Investors can also use system thresholds at company level as an objective for investee companies. An investor can aim to achieve a positive impact alignment delta over the course of an engagement trajectory. For example, the Paris agreement goals have been used by activist shareholders to set a system threshold for oil & gas companies in their resolutions.

Thirdly, examples of indirect mechanisms are stigmatization of business activities, endorsement by adopting companies in indices, benchmarking and system-level activities to influence other investors, companies and regulatory changes (Kölbel et al., 2020; Marti et al., 2023). Marti et al. (2023) describe system-level influence as field building; a way to influence the economic and societal fields in which companies are embedded. The SAA process informs investors how to employ these indirect mechanisms.

Concluding, portfolio construction is a holistic consideration of risk-return-impact, where the impact potential of asset classes, as well as the trends in impact alignment scores provide investors the necessary information to allocate capital, decide on active engagement and indirect mechanisms of investor impact.

3.4 Propositions for risk-return expectations

Now that we established the integrated SAA framework, we provide propositions which can be used as a basis for hypotheses in empirical research. These propositions relate to an impact alignment objective, and the relation between impact alignment and risk and value, respectively.

Impact alignment (eq. 2 – 3) provides a measurement as to how companies are positioned against system thresholds, which are set with a view to achieving a sustainable economy. Impact alignment therefore provides investors information as to how companies are positioned against and contribute to transitions necessary to reach a sustainable economy. Today's economy is not sustainable, as six out of nine planetary boundaries are exceeded. Institutional investors generally are invested in all parts of today's economy through holding a broad worldwide market portfolio, which qualifies them as universal asset owners (Busch et al., 2016); (Hawley & Williams, 2007). Institutional investors are therefore by definition exposed to negative impact alignment through their investment portfolio. Several institutional investors by now broadened their fiduciary duty and investment beliefs to encompass not only financial returns, but also to mitigate transition risk and/or to contribute to a sustainable economy (UNEP FI & PRI, 2019). As institutional investors invest on behalf of others, they contribute to the world in which their beneficiaries live in today and tomorrow. In a real-life experiment with a pension fund, (Bauer et al., 2021) show that two-thirds of pension fund participants prefer sustainable investments. Other research also shows that moral arguments are common to both private as well as professional investors, e.g. (Barber et al., 2021; Bauer et al., 2018; Carroux et al., 2021; Riedl & Smeets, 2017).

At the same time, recent empirical evidence shows that investors do not yet allocate to optimise impact, while they are prone to see impact as a category (Heeb et al., 2023; Lee et al., 2020) or show insensitivity to the size of the realised impact (Heeb et al., 2023; Lee et al., 2020). Investors therefore can be more explicit by adopting impact alignment as an integrated investment objective. Empirical research can serve to calculate how impact alignment of an investment portfolio looks like, and what are the opportunities to improve this profile. Academic research so far mostly examined the relation between impact alignment (or sustainability related measures) and return (or risk) measures. Impact measurement as a practice in impact investing is mostly done to prove impact, rather than to improve impact (Chapter 2). With an explicit impact alignment investment objective, more research is required to examine whether measuring and managing of this impact indeed leads to an improved impact alignment profile of the investment portfolio. This leads to the first proposition:

Proposition 1: Measuring and managing investments' impact alignment allows for improving the impact alignment profile of the investment portfolio.

Beyond the impact alignment as an objective on itself, we propose to integrate impact in risk-return expectations to come to integrated risk-return-impact expectations. Impact alignment can be relevant through the risk channel (proposition 2a-2b) and the value channel (proposition 3a-3b).

For the risk channel, we build on the definition of transitions as transformational system changes taking place through a process of build-up of new regimes and breakdown of old regimes over time to achieve a sustainable economy (Hebinck et al., 2022). It is relevant to adopt a sector-level view, as transitions generally affect certain sectors significantly, while other sectors far less. For example, the food transition towards healthy food production with respect for land and water affects the agriculture and food sector most, while it is less relevant to other sectors (Schoenmaker & Schramade, 2023). An agrifood company that is ill-prepared for this transition can end up in the breakdown spiral towards phase-out, whereas a prepared competitor may benefit the transition and remain fairly stable. Transition risks emerge from for example changing consumer demand, government intervention (taxation, regulation, fines), rising natural resource prices and physical consequences of climate change and other environmental developments (Bolton & Kacperczyk, 2023). Negative impact alignment indicates that companies are not in line with the system threshold, and therefore not well positioned for upcoming transitions towards a sustainable economy. Therefore, we formulate the following proposition:

Proposition 2a: Companies with negative impact alignment are more subject to transition risk.

The question is whether investors that are exposed to negative impact alignment are subject to particular transition risk. When transition risk is priced in, companies with negative impact alignment are considered riskier, for which investors require compensation (in the form of a risk premium) in return, leading to a constant risk-adjusted return. Recent efforts by Pastor et al. (Pastor et al., 2021, 2022b) establish this theoretical point and test for a carbon risk premium that captures an increased risk due to the energy transition. This transition risk is priced in when investors anticipate and understand the transition risks that companies are exposed to. From an efficient market hypothesis notion – assuming all information available to the market at all times – this is a given. For example, oil and gas companies transitioning in time to renewable energy, bear less climate transition risk, and thus require a lower return than oil and gas companies not transitioning and thus bearing a higher climate transition risk.

Given the significant evidence from behavioural finance however, we know that investors have bounded rationality and are subject to limitations and biases. Lo (2004) therefore adopts the notion of adaptive markets, that allow for systemic changes. He establishes that financial markets reflect the prices based on what each group (e.g. retail investors, pension funds, market makers) anticipate at a certain point in time, rather than all information being available to all actors (e.g. efficient market). There are several reasons to establish that institutional investors do not anticipate and understand all transition effects. Transitions are transformational, non-linear processes, which poses a challenge to adequately price transition risks at a certain point in time. At the start of a transition, the old regime is optimising and not considered to bear transition risk. Initial indications of these risks lay in social and environmental developments – e.g. human rights violations, biodiversity loss – of which understanding is not core of investors' capabilities. Rees (1996) pointed out in 1996: "Since mainstream (neoclassical) models are blind to ecological structure and function, they cannot even properly address this question" (1996, p.195), where the question is whether the natural capital is sufficient to sustain economic activities in the 21st century. Even if transitions are apparent and considered urgent, anticipated effects may be underestimated. For example, applications of climate risk stress testing underestimates potential losses, due to a lack of a understanding of feedback effects and causal channels through which effects take place (Reinders et al., 2023). Moreover, models often rely on macro-economic models, which lack a sector level understanding of transition effects (Daumas, 2023; Reinders et al., 2023). Increasingly, investors are obtaining new capabilities to anticipate and understand upcoming transitions, but these are in build-up phase and not yet mature. Insights on potential transition risks differ in maturity, depending on investors' anticipation and knowledge of respective developments. We therefore adopt the formulate the following proposition:

Proposition 2b: Transition risk for transitions that investors do not yet anticipate and/or understand, leads to a lower anticipated risk-adjusted return.

If the proposition is rejected, transitions are adequately priced, leading to a zero risk-adjusted return. If the proposition is confirmed, transitions are inadequately priced in today's markets, and increases the urgency to separately assess transition risk from a financial point of view.

We move to the value channel, where the main argument is that positive impact alignment creates long-term value for companies, resulting in a higher company value (Kurznack et al., 2021). First and foremost, these companies' business model is ready for transition, and can even benefit from it. It can benefit their market position, as increased government regulation and taxation hits their competitors more than them, allowing them to increase market share (Schoenmaker & Schramade, 2023). A transition can benefit their cost structure, as resource-efficient processes limit the use of natural resources and lowers the energy intensity. Companies that take care of their employees, ensure that employees deliver good work and can ensure hiring people in tight labour market conditions (Krueger et al., 2022). With financial capital being abundant and social and environmental capital reaching its limits, the importance of good stakeholder relations increases the value creation potential of companies – moving from tangible to intangible capital (Haskel & Westlake, 2018).

Increasingly, excess value is derived from natural and social capital which are not part of the company's balance sheet. Incorporating stakeholder demands furthermore supports in understanding how transitions are likely to take place, further enhancing the company's positioning for it. Purpose driven organisations seek to create value for not only the own firm, but value that benefits society and the planet as a whole. In light of changing customer demands, this purpose can drive enhancing long-term value to the firm (Dyllick & Muff, 2016). Summarized, this leads to the following proposition for the value channel:

Proposition 3a: Companies with positive impact alignment generate more long-term company value, and hence a higher long-term return.

The question is whether this long-term value is priced in by investors (Lo, 2004). When this value is priced in, companies with positive impact alignment are considered to obtain a higher value (and considered less or equal risky), leading to a higher risk-adjusted return. Similar to the risk channel, we propose that this differs as to whether investors incorporate adequately to what long term value this positioning leads. Therefore, we suggest the following proposition:

Proposition 3b: Long-term value (deriving from positive impact alignment) that is not incorporated by investors, has no effect on value.

If the proposition is confirmed, it shows that part of the long-term value of companies is currently insufficiently priced in by the market. If the proposition is rejected, investors adequately price long-term value deriving from positive impact alignment, which is already leading to a higher value for those firms.

Several models can be used to test propositions 2a, 2b, 3a and 3b. (Bolton & Kacperczyk, 2023) use a characteristics model to examine carbon transition risk. This model allows for examining whether effects exist, after which a factor model can be used to examine the size of a transition risk premium. In conventional SAA, a capital asset pricing model or a factor model is used to calculate expected risk-returns. Recent papers by (Huij et al., 2023) and (Pastor et al., 2022) use a factor model to examine pricing of carbon transition risk. Similar to these models, we introduce a conventional factor model that estimates expected excess return as a function of a market risk premium (market risk minus risk-free rate, or *RMRF*) and includes the Fama and French (1993) factors of size (small minus big firms, *SMB*) and value (high minus low book-to-market value, HML) as well as the Carhart (1997) momentum factor (UMD).

Following proposition 2a, companies with negative impact alignment (NIA) operate outside system thresholds and are subject to transition risk. We therefore add a negative impact alignment factor, which indicates the size of a transition risk premium. Following Fama and French (1993), we construct the factor NIA based on a self-financing portfolio that takes a long position in the 30% companies with the largest negative IA and a short position in the 30% companies with the smallest negative IA. We thus get a negative IA minus least negative IA risk portfolio, referred to as NIA factor.

Following proposition 3a, companies with positive impact alignment (PIA) can derive extra long-term value, leading to a higher long-term return. We therefore add a positive impact alignment factor, which indicates the size of a positive IA premium. Again, we construct a factor PIA based on a self-financing portfolio that takes a long position in the 30% companies with the largest positive IA and a short position in the 30% companies with the lowest positive IA. We thus get a largest positive IA minus lowest positive IA risk portfolio, referred to as PIA factor. This leads to the proposed formula, in which excess return is defined as

$$R_i = \alpha_i + \beta_i^{RMRF} \cdot RMRF + \beta_i^{SMB} \cdot SMB + \beta_i^{HML} \cdot HML + \beta_i^{UMD} \cdot UMD +$$

$$\beta_i^{NIA} \cdot NIA + \beta_i^{PIA} \cdot PIA + \varepsilon_i \qquad (10)$$

where R_i is the excess return on stock i, α_i is the stock's risk-adjusted outperformance, the betas reflect sensitivities to $RMRF$ (market), SMB (size), HML (value), UMD (momentum), NIA (negative impact alignment

or transition risk), PIA (positive impact alignment), and ε_i as the residual term. β_i^{NIA} can be interpreted as a company's transition beta. A transition beta for companies with a large negative impact alignment indicates the existence of a transition risk premium (assuming a positive return on the NIA portfolio). Empirical testing can examine whether this transition risk premium exists. Testing for certain IA elements such as carbon risk or biodiversity risk is increasingly done, but can suffer from omitted variable bias. Accordingly, β_i^{PIA} can be interpreted as a company's long-term value beta.

To examine proposition 2b and 3b, researchers can determine – through e.g. industry reports, media analysis and interviews – what transition effects investors currently anticipate and understand, and which once are neglected. This investor attention is examined by e.g. (Bolton & Kacperczyk, 2021; Garel et al., 2024). To reject proposition 2b and 3b, β_i^{NIA} and β_i^{PIA} shows an effect, respectively. To confirm proposition 2b, companies show temporary underperformance in α_i (as long as transitions are not priced in). Institutional investors invest in a range of different asset classes, which build on other models to calculate risk-return expectations. Future research can examine how for these type of assets risk-return-impact expectations can be calculated.

3.5 Discussion

This paper presents the integrated SAA framework, which fundamental rethinks conventional SAA. It responds to the call for adapted portfolio tools (Brandstetter & Lehner, 2015; Van Dam et al., 2022) and builds on insights from several research fields. The integrated investment objective answers the need for an integrated assessment where real-world impact is considered in its own right (Busch et al., 2021). While systemic risks were considered outside investors' control, this framework presents ways in which investors can act on these. Through this, investors internalize systemic risks related to social and environmental challenges. We provide the novel insight that investments' impacts are endogenous to investors, as impact indicates how investments are affecting transitions. Impact is measured as impact alignment, where actual impacts are compared to system thresholds, indicating the end goal of a sustainable economy. This implies that investors can act to mitigate transition risk and accelerate their contribution to transitions through their investment portfolio.

The mechanisms and size of investors' impact on companies is increasingly subject of academic debate, both the investor impact through capital allocation, active engagement and indirect mechanisms. For capital allocation, scholars show through different theoretical models that a cost of capital effect may already present when a small percentage of investors acts on impact alignment and exclude companies (Angel & Rivoli, 1997; Berk & Van Binsbergen, 2025; Heinkel et al., 2001). Scholars differ as to the portion of investors sufficient to induce companies to improve their impact alignment: (Heinkel et al., 2001) state that a base of around one fourth of investors is sufficient, Angel and Rivoli (1997) show that when half of investors excludes a company the cost of equity increases by 0.32%, and Berk and Van Binsbergen (2025) state that 84% of investors is required to divest in order to impose a change of 1% in cost of capital. Angel & Rivoli (1997) find that the effects of exclusion are much larger for large, fast-growing, riskier firms than for smaller, low growth companies. The propositions in this paper provide a basis for further empirical research in this regard. Besides cost of capital effects, publicly debating or announcing exclusion of for example oil and gas companies is an indirect mechanism through which investors have investor impact (Marti et al., 2023). Investors can provide capital to underserved markets, which is especially interesting when this supports the acceleration of transitions (Eq. 1). Related to active engagement, is the academic debate on whether to exclude certain investee companies or whether to engage with them (Blitz & Swinkels, 2020). Through examining the transition risk associated with negative impact alignment, investors have a more adequate understanding of transition risk, as a basis to determine their risk appetite.

The integrated SAA framework provides a basis for empirical research (case study research) on the operationalisation of integrated SAA in investment practice. Based on the propositions in this paper, quantitative research can be done on optimising impact alignment and the relation between impact alignment and risk and return, respectively. These propositions argue that impact is endogenous to investors, a novel insight missing in previous work on integrating sustainability in SAA, e.g. (Gasser et al., 2017; Steuer & Utz, 2023). Integrated

SAA provides a theoretical framework for recent empirical academic debate on carbon risk premiums (Aswani et al., 2024; Bolton & Kacperczyk, 2021, 2023; Huij et al., 2023; Pastor et al., 2022). In the short run, the relation between impact and financial return remains unclear, as the stage of transitions (Eq. 1) is determined by processes on different levels. In the long term, we expect transitions to take place and therefore companies with positive IA (which are transition-ready) to benefit from that and the business models of companies with negative IA (which are ill-prepared for transitions) to breakdown. But, in the end, this all comes down to how developments in society take place over time. The integrated SAA thus provides a basis for further academic debate on how institutional investors can generate impact and accelerate transitions while managing transition risks.

Certain challenges arise when operationalising integrated SAA. Data availability on investments' impacts differs significantly between types of impacts, between sectors, and whether companies are listed or not. Selecting the most relevant impacts is a challenge, although there are academic research and investment practice working papers that can guide decisions in this regard (see Appendix A3.1). While system thresholds are increasingly used in setting science-based climate change targets, it may require investor collaboration to establish system thresholds for other environmental impacts. While this paper focuses on company's impact alignment, institutional investors can also apply this to real estate, infrastructure projects and so on.

3.6 Conclusion

Environmental and societal challenges are not addressed in strategic asset allocation, hampering investors to steer their investments towards a sustainable economy. This article therefore introduces the integrated strategic asset allocation framework, which consists of four steps: (1) Set an integrated investment policy (2) Form macro-economic expectations (3) Form risk-return-impact expectations and (4) Construct the portfolio. The framework integrates transitions as macro-economic variable and hence allows institutional investors to mitigate transition risk and to steer on the degree to which their investments facilitate or hamper transitions. We propose to measure company's actual impacts and compare them to system thresholds at company level. By integrating impact into the analysis of asset classes, investors can perform risk-return-impact calculations. These expectations give investors information on how companies perform against the end goal of a sustainable economy, rather than having information based on peer comparison or degree of risk mitigation.

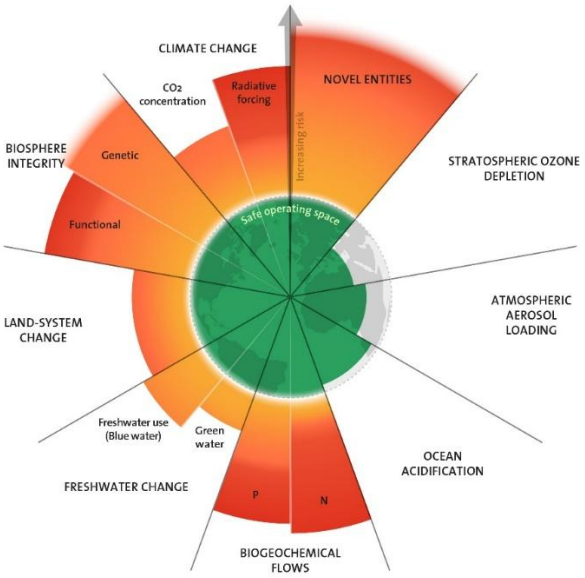
Institutional investors can use this novel approach as a basis for integrated SAA. It allows for a holistic approach through which investment beliefs and investment policy can be implemented. Through this, investors can strategically measure and manage the real-world impacts of their investment portfolio.

Appendices chapter 3

Appendix A3.1 – Environmental and social system thresholds

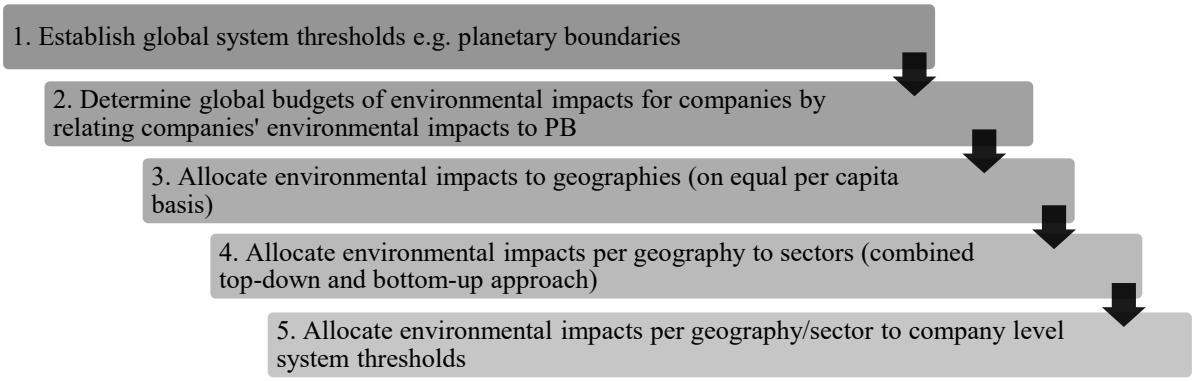
For environmental system thresholds, many scholars take the planetary boundaries by (Steffen et al., 2015), as last updated by (Richardson et al., 2023), as the basis (see Figure A3.1). The planetary boundaries show the urgency of not only climate change and biosphere integrity (measured by biodiversity loss) but also of exceeding thresholds on biogeochemical flows (phosphorus and nitrogen), novel entities (such as plastics) and land-system change (Stockholm Resilience Center, 2022). Staying within these planetary boundaries ensures a safe operating space for humanity. Figure A3.2 shows the necessary steps how to come from these global system thresholds (e.g. planetary boundaries) to system thresholds for individual companies. These steps are derived from review articles on absolute (environmental) sustainability assessments by (Bjorn et al., 2020; Chen et al., 2021; Ryberg et al., 2020).

Figure A3.1 – Planetary boundary framework (Richardson et al., 2023)



Note: This figure shows the planetary boundaries framework, where a safe operating space for humankind is ensured when environmental impacts stay within the planetary boundaries (dotted circle). The graph shows that currently humankind is exceeding several thresholds: novel entities, biogeochemical flows (phosphorus and nitrogen), freshwater change, land-system change, biosphere integrity and climate change. Compared to research of 2015 and 2018, transgression levels increased for these six boundaries. In addition, ocean acidification is close to being transgressed. Exceeding these planetary boundaries poses systemic risks to the economy.

Figure A3.2 – Determining system thresholds for company-level assessments



The first step is to establish global system thresholds, for which the planetary boundaries framework is used. These global system thresholds are measured through global indicators which are less suitable for a company assessment. The second step therefore is to determine a global budget of environmental impacts that companies *do* influence, by relating the global system thresholds to companies' environmental impacts. Global scientific collaborations such as the IPCC[8] and IPBES[9] show that companies drive climate change through their emissions (IPCC, 2023), and that companies drive nature loss through climate change, land and sea use change, exploitation of resources, pollution and invasive alien species (IPBES, 2019). By relating these drivers to environmental impacts that companies have and can measure, a global budget of environmental impacts of companies can be determined. The third step is to allocate these global budgets to geographies on an equal per capita basis, to ensure a just distribution across economies (Ryberg et al., 2020; Sahan et al., 2022). The allocation per capita is important, as often current production levels (e.g. gross domestic product) are used, which represent today's unequal distribution of resources and production across economies. This is also one of the fundamental flaws of mainstream economic models, as pointed out by Rees (1996). The fourth step is to further allocate to sectors, based on a combined top-down approach and bottom-up approach (Chen et al., 2021; Clift et al., 2017). The top-down assessment builds on international research, while the bottom-up approach shows an understanding of local contexts and development of sectors over time (Li et al., 2021). This approach is similar to what is done in climate change science-based targets approaches (CRREM, 2020; SBTI, 2021) and with guidance for science-based targets for nature (SBTN, 2023). The final step is to allocate environmental impacts per sector within a geography to company level system thresholds. It should be noted that company level system thresholds increase the uncertainty of outcomes as compared to sector or country-level thresholds (Ryberg et al., 2020). Besides limiting negative impacts, companies can also have a positive environmental impact, e.g. by sequestering emissions or by protecting and restoring nature. There is an increasing attention for companies providing nature-based solutions, especially given the global biodiversity targets set by countries (United Nations Environment Programme, 2022).

For social system thresholds, direct social impacts of companies are relevant, as well as social impacts in a company's upstream and downstream value chain. Thresholds for companies indicate when companies' social impacts are ensuring a minimum level of human well-being in its operations and value chain. While the Sustainable Development Goals by the United Nations (SDGs) and the social foundations by Raworth (2017) are well-cited, its focus on public well-being is insufficiently geared towards companies' impacts (Sahan et al., 2022). The internationally accepted expectations of companies are outlined in the United Nations Guiding Principles on Business and Human Rights (UN GP) (United Nations, 2011) and OECD Guidelines for Multinational Enterprises (OECD Guidelines) (OECD, 2011), which are seen as minimum safeguards to ensure responsible business conduct (Platform on Sustainable Finance, 2022).

Furthermore, recent research by the United Nations Research Institute for Social Development (Yi et al., 2022) aims to establish system thresholds for several social impacts. Table A3.1 outlines an illustrative overview of relevant social topics, social impacts and system thresholds. For certain social impacts, meaningful system thresholds can be set, e.g. a company providing 100% of its employees at minimum a living wage. For other social impacts, a threshold of zero is more suitable, e.g. occurrence of bribery and corruption. This poses a challenge to impact alignment calculation, as a system threshold of zero cannot be used as a denominator in impact alignment (eq. 2). Thresholds for social impacts can often be applied to all companies, but geographical differences may be relevant to consider.

[8] The Intergovernmental Panel on Climate Change

[9] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services

Table A3.1 – Illustrative overview of relevant social topics, social impacts and system thresholds

Level	Social topics	Social impacts	System threshold	Source
Direct operations	Living wages for employees	% Employees receive living wage or higher	100% of employees	Yi et al., 2022
	Development of employees	# Training hours per FTE	30 hours per FTE	Common practice corporate reporting
	No discrimination of employees	% Adjusted gender pay gap	<3% annual average	Yi et al., 2022
	Safe and healthy working environment	Number of days lost to occupational accidents, injuries and diseases	0 days annual average	Yi et al., 2022
	Customer satisfaction	Net Promotor Score (NPS) or similar impacts	Impact > 0	Common practice corporate reporting
	Fair taxation paid	Difference between statutory tax rate and effective tax rate	<5% annual average	Yi et al., 2022
Direct & in value chain	Bribery & Corruption	# Occurrence of bribery and corruption	No occurrence of bribery and corruption	OECD, 2022; United Nations, 2011
	Fair competition	# Occurrence violations of fair competition	No violations of fair competition	OECD, 2022; United Nations, 2011
In value chain	Supplier relations	# Supplier complaints	Supplier rights are ensured	Yi et al., 2022
	Living wages workers in the value chain	Living wage gap	No gap between actual wages and benefits paid to a worker and a normative living wage, so 100% living wage paid	Yi et al., 2022
	Workers' rights are ensured	Breaches of workers' rights in sectors	Zero breaches; Workers' rights are ensured, no ongoing issues relating to workers' rights	OECD, 2022; United Nations, 2011
	Human rights are respected	Breaches of human rights in sectors	Zero breaches; Human rights are respected for relevant stakeholders, no ongoing issues	OECD, 2022; United Nations, 2011

4. What do you bring to the table? Cognitive frames in investment practice [10]

4.1 Introduction

Research shows that investors have ambition in sustainable investing (Kölbel et al., 2020; Riedl & Smeets, 2017), but how this ambition translates into investment practice and the realisation of these ambitions is less understood. Integrating environmental and social issues in investment practice is challenging, as issues take many shapes and forms, sometimes contradicting established investment practices. Investment professionals hold different views on how to integrate sustainability. In recent years, there is an increased interest into these views, also referred to as sensemaking, which is "the general process through which individuals give meaning to ongoing experiences such as work" (Aguinis & Glavas, 2019, p.1058). When situations are more complex, people move from sensemaking per experience to using a cognitive frame, which is a "mental template that individuals impose on an information environment to give it form and meaning" (Walsh, 1995, p.281). The cognitive frame literature shows that people's cognitive frames influence the degree to which sustainability integration in organizations fail or succeed.

Existing studies have advanced knowledge on existing cognitive frames (Hahn et al., 2014; Van der Byl & Slawinski, 2015). Recent cognitive frame studies focused on personal sensemaking processes (Gross et al., 2025), organizational learning (Osagie et al., 2022), stakeholder relations (Menon, 2022) and how organizational efforts can influence personal sensemaking (called sensegiving, Hoppman et al., 2023). The literature however provides limited insights in the interactions between cognitive frames in collaborations for sustainability integration. We know relatively little on how these processes take place, and how the cognitive frames that people use, strengthen or weaken sustainability collaboration efforts.

To investigate *how cognitive frames interactions influence collaborations for sustainability integration in investment practice,* findings are presented of grounded theory research, conducted at a large Dutch pension provider. This is an interesting case, as the pension provider is considered a forerunner in sustainable investing and was implementing Strategy 2030 during the observation period (September 2023 – February 2024), which included an ambitious sustainability agenda. This research provides a grounded understanding of what happens in investment practice and yield emerging insights. The case study takes an inductive approach: central is the data collection through participant observation of investment practice, and through data analysis grounded theory is formed.

By developing grounded theory, the findings in this paper advance theory in two ways. First, it empirically validates the business case and paradoxical cognitive frames by Hahn et al. (2014) and identifies a novel third cognitive frame (sustainability case frame). Second, it develops a framework on cognitive frame interactions in sustainability collaborations. The findings provide insights in investment professionals' views on the three mechanisms of investor impact, as described by Kölbel et al. (2020). The study contributes to the literature on cognitive frames by grounded theory development on cognitive frame interactions in sustainability integration.

The findings illustrate how each frame has a distinct way to know, assume and belief (Cognitive content), to interpret what is going on (Cognitive structure), leading to how people act (Stance). Based on their frame, people take a pragmatic, prudent or proactive stance. The findings illustrate these stances by describing working group interactions. Through grounded theory development, a framework is presented which shows that each

[10] An earlier version of this chapter is available as working paper: Roor, A. (2025). Application of integrated SAA. *Erasmus Platform for Sustainable Value Creation*, 25.01. A revised version of this chapter is currently under consideration by a journal.

cognitive frame contributes, has concerns and can connect to other frames. Collaborations for sustainability integration can be improved by understanding and strengthening cognitive frame interactions. This study contributes to the literature on sustainable investing, sensemaking and cognitive frames.

4.2 Theoretical background

4.2.1 Cognitive frames

Over the past years, an emerging strand of literature studies how individual factors matter to organisational processes and decision-making, in particular sustainability integration (Aguinis & Glavas, 2019,Hahn et al., 2014; Hockerts, 2015; Hoppmann et al., 2023). In complex situations, people use cognitive frames, which are "mental template(s) that individuals impose on an information environment to give it form and meaning" (Walsh, 1995, p.281). A cognitive frame provides a scheme to structure what you know, assume or belief (called Cognitive content) and how to arrange that content (called Cognitive structure) (Finkelstein & Hambrick, 1996). Hahn et al. (2014) analyse managerial decision-making in sustainability issues and identify two cognitive frames: the business case frame and the paradoxical frame. Managers using a business case frame have exclusive focus on business logic and integrate sustainability insofar it aligns with the financial objectives. They take a pragmatic stance, where they propose incremental changes based on established routines and practices, which are innovative to a limited degree but can provide a workable basis for larger-scale change. Managers using a paradoxical frame accept a higher level of complexity, and address sustainability challenges at organisational level to discuss these. They take a prudent stance, where they consider more radical proposals, but are hampered in their ability to implement solutions, as they face dilemmas and try to consider all relevant arguments at the same time.

4.2.2 Sustainable investing

In the sustainable investing literature, there is a dominance of quantitative research, leading to a divide between the literature and the real-world practice of institutional investors (Cochrane, 2022). In investment practice, much more realistic ingredients exist that are hardly considered in academic quantitative work (Cochrane, 2022). This study therefore examines the role of cognitive frames in investment practice. The question to be answered is *how cognitive frames influence collaborations for sustainability integration in investment practice.*

The findings provide insights into the views of investment professionals, thus elaborating on several finance related concepts. Initial data collection focused on the Strategic Asset Allocation (SAA) process at the pension provider. SAA is the process where institutional investors, based on capital market assumptions, calculate expected risk and return and allocate investment to different asset classes. While data collection advanced, people's views on a broader range of topics seem to matter in light of their cognitive frames, such as climate change effects, consideration of transitions and investor impact mechanisms. Investor impact is the change that investor activities achieve in company impact, while company impact concerns the companies' social and environmental impact through their business model (Kölbel et al., 2020). In the context of this study, investor impact entails the difference it makes that the pension provider invests on behalf of pension beneficiaries. There are three mechanisms for investor impact: capital allocation, engagement and system-level influence (Kölbel et al., 2020).

4.3 Methodology

4.3.1 Research methodology

As put forward in the theoretical background, the dominance of quantitative research in finance has led to a divide between literature and the real-world practice of institutional investors (Cochrane, 2022). Quantitative research examines how constructs relate to each other. Constructs are abstract theoretical formulations about phenomena of interest, which are often formulated so that they can be measured (Gioia et al., 2013). This allows for in depth

research on relevant investment factors, insights on constructs like expected returns, betas, cost of capital and so on. Most of this research advances insights on known constructs. However, quantitative research has two weak points. As it examines known constructs, it can only provide further insights into these constructs. To quote Gioia, Corley & Hamilton (2013): 'Advances in knowledge that are too strongly rooted in what we already know, limit what we can know.' (2013, p.16). Rather than constructs, research is also needed on concepts, which are more general, less well-specified notions, describing or explaining phenomena of interest. Concepts are precursors to constructs, in the understanding of organisational and investment practice. The second weakness is that quantitative research does not provide insight into how organisations and people within those organisations use and apply these constructs (Crifo et al., 2019; Schoenmaker & Schramade, 2019).

This study does provide insights on how people use and apply constructs and examines concepts in investment practice. The research methodology is grounded theory research, applied in a single case study. Grounded theory is the discovery of theory from data, systematically obtained (Glaser & Strauss, 2017). The Gioia methodology (Gioia et al., 2013) is a common approach for conducting grounded theory research. This methodology builds on the assumption that people in organisations can explain their thoughts, intentions and actions; by giving these people voice in the research, opportunities for discovery of new concepts is created. The heart of data collection is therefore the semi-structured interview, where respondents can easily express their thoughts and views. A case study is characterized as research in practice, without controlling the context but studying phenomena in real-life settings through several data collection methods (Gibbert & Ruigrok, 2010). Case studies at a single organisation have shown to be powerful in providing new paradigms and insights (Dyer & Wilkins, 1991). The Gioia methodology prescribes three rounds of data analysis, from first order coding, second order coding to aggregate dimensions. The researcher starts to identify emerging theory from the data through this data analysis process. In tandem, existing theory can be considered to further build theory from the data (Gioia et al., 2013). In applying grounded theory research through a single case study, the study does not only provide relevant insights but also serves as an example of qualitative research bringing forth novel insights in the finance field.

4.3.2 Research setting

The case study is performed at PGGM, a pension provider for pension administration and asset management. This study focuses on the asset management activities of PGGM, but in fact the pension administration is the larger part of the business, in terms of personnel and number of clients (PGGM, 2024a). PGGM is the second largest institutional investor in the Netherlands, investing the assets of the Dutch pension fund for healthcare and welfare professionals (Pensioenfonds Zorg & Welzijn, PFZW). PGGM managed over €240 billion assets under management and employed 501 people by the end of 2023 (PGGM, 2024a). PGGM has the goal to become a single client organisation, by the end of 2023 99% of its assets under management (€237.9 billion) was for PFZW.

During the observation period (September 2023 – February 2024), PGGM used a project structure with several project working groups to operationalize Strategy 2030. Strategy 2030 lays down expectations with regards to the participant, investing, health and welfare sector and pension administration. In investing, it lays down a focus on creating long-term value for pension beneficiaries by combining financial return, risk and impact. The ambition for 2030 is that each invested position can be justified from a return, risk and impact dimension. The strategy outlines two key objectives: 1) A sustainable portfolio, which reflects the return, risk and impact dimensions 2) Investing with impact, to make visible impact on issues important to the participant and to contribute to important transitions. While 'impact' is stated as a term in Strategy 2030, in the implementation process this is operationalised to the broader sustainability agenda and targets, which includes the specific impact investing definition and target. The execution of this strategy entails end-to-end integration of sustainability throughout the investment process. To achieve this, several success factors are mentioned, among which change management skills and approach, and sharp concrete goals and milestones.

4.3.3 Data collection

The author gained unique access to internal processes as 'Research intern' at the pension provider. As the initial research setup focused on the process of Strategic Asset Allocation, the author joined the Strategy department, which is responsible for this process. The author had the role of participant-observer: being a member of the Strategy department, while employees were aware of the status as researcher. During the observation period (September 2023 – February 2024) the author spent on average 2 days a week at the pension provider. A range of data collection methods were applied: interviews, observation in meetings, observing daily work interactions, document analysis and focus groups. 48 interviews are conducted (average length 32 minutes) with a diverse group of employees, from the Strategy department, the Strategy 2030 working groups and the management (see Table 4.1). While most of the interviews were semi-structured, 16 closed interviews were held to gather respondents' views on specific topics and identify their cognitive frame. The interview question list for the closed interviews and the original Dutch quotes are included in Appendix A4.1. 24 specific meetings were observed, both Strategy 2030 working groups and Strategy team meetings, while many daily work interactions were observed. The Strategy 2030 working groups focused on integrating sustainability in investment practice. For document analysis, 65 documents were coded in detail (53 internal documents and 12 publicly available documents). In total, 2,248 first order codes were given to the interview data (1,186) and through the document analysis (1,149).

Table 4.1 – Summary of data collection

Data source	Breakdown data source	Total data collected
Interviews (48)	36 interviews recorded & transcribed 12 interviews coded based on detailed notes	25,5 hours of interview data 48 interviews, average length 32 minutes 1186 codes
Observation interactions	20 Strategy 2030 working group meetings 4 Strategy team meetings Daily interactions between employees	18,5 hours of meeting observations 24 meetings, average length 46 minutes Detailed notes taken on meetings and interactions
Documents (65)	53 internal documents 12 publicly available documents	65 documents 1149 codes
Total first order codes: 2248 codes		

4.3.4 Data analysis

The data analysis consisted of four analytical steps. These are presented successively, while in reality they occurred in an overlapping manner. The theorization and interaction with literature is interwoven in the analytical process, as is common to grounded theory research.

The first step was initial data gathering to obtain an overview of the conventional Strategic Asset Allocation process and sustainability integration, including reflections on past practices and discussions on sustainability integration going forward. Data saturation for understanding these processes was reached after two months. The second step was analysing recurring themes: what stood out was that respondents viewed the current and possible future sustainability integration quite differently, although all were working towards implementing the same organizational strategy. Personal views seemed to matter in light of ongoing discussions. Therefore, closed interviews were held to specifically collected respondents' views on four relevant themes (see Appendix A4.1).

In the third step, the Gioia methodology for systematic coding and data structuring was applied. While the Gioia methodology prescribes three coding rounds, the large number of first order codes (2,248) lead to four coding rounds. In summary, the 2,248 first order codes were grouped to 586 coding groups, further grouped to 145 themes, leading to 9 aggregate dimensions. The first order codes are labels given to passages in interviews and documents, where the researcher tried to adhere faithfully to terms used. In second order coding, the researcher identified emerging themes on concepts that support the explanation of observed phenomena (Gioia et al., 2013). The data structure shows a structured overview of the second order code groups, themes and aggregate dimensions (Appendix A4.2), while the complete list of 145 2nd order themes is included in Appendix A4.3.

The fourth step was the emerging of grounded theory. The closed interviews provided explicit views on a range of topics. Analysing this data led to the identification of three cognitive frames of sensemaking (Table 4.2). The identification of these frames was done inductively and emerged from the data analysis. It involved repeatedly analysing interview data, comparing codes and categorising respondents into three groups with shared beliefs and views. These can be described as the neoclassical market economy convinced, the climate informed and the sustainability convinced respondents. A literature search provided theoretical understanding of these empirical insights, as the identified groups seemed to relate to the cognitive frames by Hahn et al. (2014) and to employee sensemaking in sustainability efforts, as described by Aguinis & Glavas (2019). The first and second identified group largely align with the business case and paradoxical cognitive frame by Hahn et al. (2014), providing a structure for the findings on cognitive content, cognitive structure and stance. The empirical results enrich theory by inductively identifying a third cognitive frame and providing a framework on cognitive frame interactions, thus developing grounded theory. This shows the iterative approach of grounded theory, where going back and forth between the data and existing theory leads to novel insights.

4.4 Findings

The initial data collection focused on the integration of sustainability in the Strategic Asset Allocation (SAA). As the rest of the findings are grounded in cognitive frame literature, the findings related specifically to the SAA process are included in Appendix A4.4. This appendix includes a visualisation of the pension provider's conventional strategic asset allocation process (Panel A), an overview of current and possible future practices to integrate sustainability per SAA step (Panel B) and descriptions of these practices per SAA step (Panel C).

The data analysis lead to the identification of three cognitive frames. In case study wordings, these are the neoclassical market economy convinced, climate informed and sustainability convinced (Table 4.2). The first and second frame align largely with the business case and paradoxical frames by Hahn et al. (2014), while the third cognitive frame, emerging from the data, is called the sustainability case frame. Rather than a perfect individual fit, these ideal-type cognitive frames provide a means to understand what people know, assume and belief (Cognitive content), how people understand and interpret what is going on (Cognitive structure), leading to how people act (Stance).

Table 4.2 summarizes the Cognitive content, Cognitive structure and Stance for each cognitive frame. Respondents using the business case frame consider sustainability insofar it aligns with the financial objective. They structure the information in a simple manner and take a pragmatic stance in the process. Respondents that use a paradoxical frame embrace multiple objectives with different rationales, and try to integrate sustainability whenever possible. This leads them to adopt a prudent stance. Respondents using the sustainability case frame integrate financial and sustainability objectives and consider them to be jointly achievable. In this way, they also try to simplify the cognitive structure and adopt a proactive stance in the process. The next sections describe the findings for each of the three elements in detail.

Table 4.2 – Overview cognitive frames

Cognitive frame	**Business case frame**	**Paradoxical frame**	**Sustainability case frame**
Case study description	Neoclassical market economy convinced	Climate informed	Sustainability convinced
Cognitive content	Only integrate sustainability insofar it aligns with financial objective	Juxtaposition of financial and sustainability objectives, even if contradictory	Convinced that financial and sustainability objectives can be jointly achieved
Cognitive structure	Low degree of complexity	High degree of complexity	Medium degree of complexity
Stance	Pragmatic stance	Prudent stance	Proactive stance

4.5.1 Cognitive content

The cognitive content was mostly examined through semi-structured interviews, where respondents directly expressed what they know, assume and believe. Table 4.3 shows the key topics where differences between frames were identified and is based on the data structure (Appendix A4.1). Illustrative quotes provide representative examples from the data.

The beliefs of the business case frame are (in)formed by neoclassical market economy principles, e.g. rational behaviour (individuals act based on rational preferences), utility maximization (individuals maximize utility in their own interest) and market efficiency (individuals and financial markets reflect all relevant market information at each point of time). Given these principles, their beliefs build on the notion that sustainability can be integrated insofar it aligns with the financial objective. They describe the pension fund mission as to create the best allocation possible to achieve the financial objective; all deviations are potential violations as you construct an optimal portfolio on your risk-return objective function. Respondents belief financial markets are highly efficient. They therefore experience tension between two of the pension fund's investment beliefs; between the belief that the pension fund takes no view on short term market developments (consistent with efficient markets) and the belief that the pension fund factors in sustainability risks and opportunities. Respondents experience the second belief as taking a short term market view. As for climate change effects, respondents state that those affect the economy, but in similar ways to other ongoing transitions, where the market incorporates a consensus of expectations in market prices. This logic follows the neoclassical market principles dominant in academic economic education. The business case frame builds on these principles as a solid basis for investing. They retain a narrow focus on research in the finance field, rather than looking into other academic fields or looking at evidence contradicting neoclassical market principles (Hahn et al., 2014). This narrow focus allows the business case frame to keep the content concise but also leads to a confirmation bias (Hahn et al., 2014). Respondents describe that the pension fund has limited investor impact, as the pension fund's investment portfolio is only a fraction of the worldwide capital market. Whether the pension fund holds an equity position or some other investor, does not matter in their view. To them, integrating sustainability is mostly important as a way to show pension participants their pensions are invested in a responsible manner.

The paradoxical frame experiences a juxtaposition of financial and sustainability objectives but wishes to consider them even if they are contradictory. These respondents do not experience a tension between the investment beliefs on taking a view on short term market developments on the one hand, and factoring in sustainability on the other hand, as sustainability mostly concerns long term developments. They do note that the investment beliefs leave room for interpretation, e.g. the belief 'The pension fund makes a valuable contribution to a more sustainable world' is expressed quite vaguely. They belief financial markets are not efficient, as many climate change effects are uncertain and thus not reflected in market prices. They share that climate change effects matter, but as the transition direction and speed is uncertain, effects are difficult to navigate and price. This point was made by a substantial number of respondents; the raising and acknowledging of paradoxes is typical for this frame. On investor impact, respondents using a paradoxical frame mention several elements of investor impact that matter to them, such as an explicit selection of the investment universe, the capital allocation role, engagement with companies and impact investments. Respondents generally view these practices as a positive way to take responsibility as an investor.

Table 4.3 – Detailed overview cognitive content

Cognitive frame	Business case frame	Paradoxical frame	Sustainability case frame
Cognitive content	**Only integrate sustainability insofar it aligns with financial objective**	**Juxtaposition financial and sustainability objectives, even if contradictory**	**Convinced that financial and sustainability objectives can be jointly achieved**
Mission pension fund	Best allocation possible, all deviations are potential violations of financial objective	Where possible, contribute to sustainability	Best allocation possible to jointly achieve risk, return and sustainability
Investment beliefs coherence	Tension between no view on short term and factoring in sustainability	Sustainability is long term; beliefs give room for interpretation	Sustainability is long term; to make a valuable contribution aligns with mission
Efficient markets view	Markets have shown to be highly efficient	Markets not efficient, as many effects are uncertain and thus not reflected	Markets not efficient, as investors do not adequately assess climate change
Climate change effects view	A consensus of the expectations (e.g. ongoing transitions) is incorporated	Climate change effects are not priced in as it is uncertain how they will take place	Sustainability is not priced in, so need to identify and act on sustainability (risks)
Investor impact view	Small player in financial markets, what we do matters mostly to our beneficiaries.	Considers capital allocation and active ownership	Considers capital allocation, active ownership and system-level influence
Illustrative quotes	[Quote 1] "It is more on the belief that short term market developments are not easy to predict. You could say, climate change is not something that is only relevant in the short term, but also on the long term. Even so, acting on the incorrect pricing of climate risks assumes that you have a better vision than what is currently priced in in the market." [Quote 2] "I don't see much added value in engagement, and I see those results to a limited extent. The fact that we make our portfolio more sustainable does not necessarily make a difference; for us 10 others that buy the share and then we are not engaging with this company. (…) Our added value is close to zero, nothing more than a kind of market signal, in which I do think we are a frontrunnertogether with other Dutch investors."	[Quote 3] "The problem is that climate change is not about measurable risks, but about unmeasurable uncertainties and ambiguities. There is an accumulation of these: the future climate is uncertain, how that will affect the economy is uncertain, and how that affects investments is uncertain. And how all those layers of uncertainty interact via transmission channels, is also uncertain."	[Quote 4] "Look, the physical trends are clear enough, and the physical consequences, those are also fairly clear. I mean, you can probably predict the climate better than the dollar rate." [Quote 5] "I think that the pension fund can really make a contribution, partly by seeing the trends in transitions and investing in them, but also largely by being a role model, that you attract other investors on the market with: 'it can be done differently'."

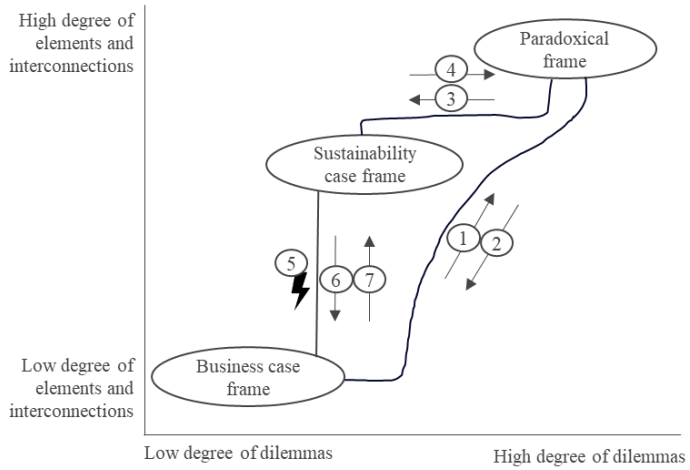
Respondents using the sustainability case frame are convinced that financial and sustainability objectives can be jointly achieved. They deem it the pension fund's mission to achieve the best allocation possible to achieve the integrated objective of risk, return and sustainability. Like the paradoxical frame, they view the investment beliefs are coherent as sustainability is long term as opposed to short term market developments. These respondents are convinced that financial markets are not efficient, as investors do not adequately assess climate change effects. Some respondents comment on the business case frame's narrow focus on finance-related literature, while evidence from climate change research is abundant. As important climate change effects are not priced in, they see a need to identify and act on those risks. They state that the world will need to act on climate change effects, sooner or later, regardless of which climate change scenario ultimately plays out. This leads to a strong view on the need for investors to act now. They feel encouraged by the pension fund's investment belief on making a valuable contribution to a more sustainable world. They describe examples that relate to all three roles of investor impact – capital allocation, engagement and system-level influence –. For example, setting and working to achieve impact targets is a way in which investor impact can be achieved. Respondents state that the pension fund has a role to play in facilitating transitions. As financial results can be achieved in various ways, there is sufficient opportunity to also contribute to a more liveable world at the same time.

In summary, differences in cognitive content reveal varying views on the pension fund's mission and the degree to which investor impact can be and should be achieved. These views translates to how people understand and interpret what is going on, which is analysed next.

4.5.2 Cognitive structure

Cognitive structure concerns "how the content is arranged, connected or studied in the executive's mind" (Finkelstein & Hambrick, 1996: 57). It concerns the understanding and interpreting of content. Table 4.4 summarizes the cognitive structure per cognitive frame, and illustrates these by quotes. The degree of elements and interconnections, and the degree of dilemmas, can be visualised as continuums where cognitive frames can be plotted on, see Figure 4.1. While the vertical axis is also described by Hahn et al. (2014)[11], this case study shows that also the degree of conflicting relationships between these elements matter to respondents. The lines between the frames in Figure 4.1 indicate the general continuum or development that people can have.

Figure 4.1 – Cognitive structure of cognitive frames



Generally, respondents move from the business case frame towards the paradoxical frame (arrow 1), towards the sustainability case frame (arrow 3). Between the business case frame and sustainability case frame,

[11] In line with Walsh (1995), Hahn et al. (2014) refer to the number of elements within a frame as differentiation and the degree of interconnectedness among these elements as integration. For clarification purposes, I refer to these jointly as the degree of elements and interconnections.

there is a lack of understanding as they use a different set of elements and interconnections (lightning 5). The other developments (arrow 2, 4, 6 and 7) are not observed in the case study.

The number of considered elements and interconnections considered by the business case frame is low, as only information relevant to the financial objective is considered. This leads to a low degree of dilemmas, as sustainability considerations are left when not aligned with the financial objective. For example, climate change effects are only relevant as a source of investment risk, and not as to how the pension fund's investments contribute to climate change. Only finance related literature is considered (directly) relevant to investment practice.

Respondents using a paradoxical frame consider a high number of frame elements and a high degree of interconnections. They see a plurality of reinforcing, neutral and conflicting relationships, creating a challenge to navigate these (Hahn et al., 2014). They identify many dilemmas and experience a high degree of complexity.

Respondents using a sustainability case frame experience a medium degree of complexity, as their belief that the financial and sustainability objective can be jointly achieved, solves certain conflicting relationships troubling the paradoxical frame. They see several interconnections, but try to proactively establish reinforcing and neutral relationships, supporting the 2030 Strategy implementation.

Rather than static cognitive frames, individuals can develop alongside frames. Although these developments were not directly observed during the research period, as in Hoppmann et al., 2023, several respondents did reflect on their development alongside these frames (Figure 4.4). Some respondents shared they held business case thinking initially, then starting to examine climate change effects, facing more elements as well as dilemmas (arrow 1). Upon integrating financial and sustainability considerations, certain respondents moved towards the sustainability case frame (arrow 3) and were then faced with less dilemmas. Individuals can also develop in the opposite direction (arrow 2 and 4), but this was not observed. In adopting many considerations, the paradoxical frame can understand both the business and sustainability case frame. There is however less understanding between the business case frame and sustainability case frame, due to a lack of shared understanding of relevant elements (lightning 5). The differences in cognitive content and low acceptance of dilemmas creates a lack of ability to understands each other's standpoints. Moving directly between these two frames is not observed in the case study (arrow 6 and 7). Moving from a business case frame to a sustainability case frame (arrow 7) can be caused by an explicit experience or acknowledgment on how environmental and social developments relate to the economy. The next section explores how the cognitive content and structure underpin the adoption of specific stances.

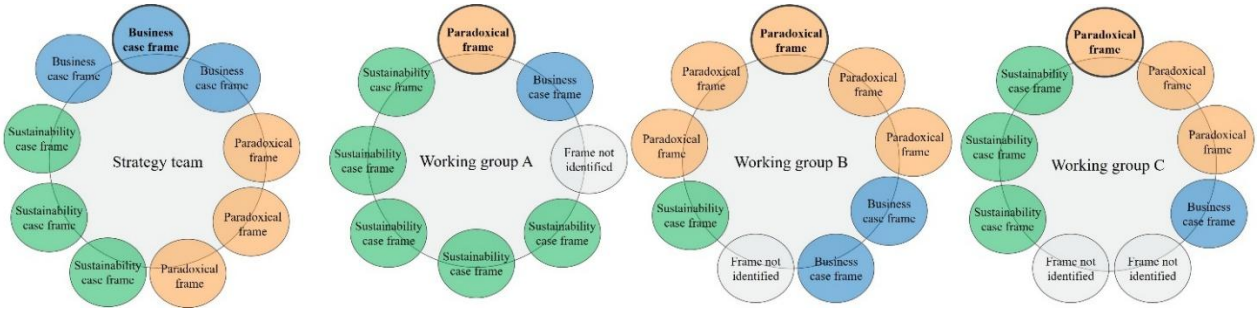
Table 4.4 – Detailed overview Cognitive structure

Cognitive frame	Business case frame	Paradoxical frame	Sustainability case frame
Cognitive structure	**Low degree of complexity**	**High degree of complexity**	**Medium degree of complexity**
Degree of elements	Low number of frame elements	High number of frame elements, by considering all relevant information	Medium number of frame elements, coherent narrative of integrated objective
Degree of interconnections	Low degree of interconnections, as focus on achieving financial objective	High degree of interconnections with a plurality of reinforcing, neutral and conflicting relationships	Medium degree of interconnectedness with proactively establishing relationships and solving conflicting relationships
Degree of dilemmas	Low	High	Low-medium
Illustrative quotes	[Quote 6] "This is your base scenario and no matter how you look at it, in the end only three factors really matter: inflation, interest rate and economic growth, or stock returns. Then things can go well or go wrong, so then you only have eight possibilities. A few possibilities are very unlikely or useless, so then you have about 5 stress scenarios left. (…) Actually, you don't need any storytelling at all. In fact, you can state: (…) it doesn't matter whether there is an oil crisis, or that China goes into lockdown, or that Saudi Arabia is on fire; in the end they are all positive or negative supply shocks, and you end up in stagflation. This never made it, because you notice that board members want to understand what a stagflation scenario entails. What does it mean? What happens in such a scenario? Then I can't come up with a positive or negative supply shock, doesn't matter where it comes from, you end up here."	[Quote 7] "I think that if we make a wrong estimate on the impacts of climate risks, then that might affect the risk-return. And maybe we even make wrong estimates on climate change itself." [Quote 8] "A company can try to transition, but that does not mean I want to invest in it. Maybe I do not believe that it is agile enough; that if it makes a few changes, it can transition. I can believe a renewable energy transition takes place, but do I believe in hydrogen, wind energy, solar energy or perhaps something completely different, geothermal energy? I don't know which will win. There is so much uncertainty that I would not position myself on this. So, in my analysis of a wind energy company, I will therefore consider that wind energy might not be attractive."	[Quote 9] "What I think is spoon-fed is the idea that there is always something of a 'reversal to the mean'. You have a dip, but you work your way out of it. Whereas a physicist or someone who studied beta science, knows that it can break. Then you have a completely different pathway, that is an absolute direction, not a relative direction. That is a completely different profession. These are all relative guys: they are already happy if they beat the benchmark by x basis points. But if you end up in a completely different scenario, where it really just breaks, that is unimaginable. (…) So the cloud is not big or actually not creative enough to come up with that kind of scenario, so to speak (...). I think that we are not nearly creative enough in thinking of what may happen. I don't think that is in our models. I think it would be very wise for our organisation to work with systems thinkers much more. With transition thinkers who are indeed creative enough to map these kinds of developments."

4.5.3 Stance

A stance is a mental attitude towards an issue or process, leading him or her to act in certain ways (Hahn et al., 2014). Each cognitive frame takes a particular stances in integrating sustainability: respectively a pragmatic stance, prudent stance and proactive stance. This section illustrates these stances by describing interactions in the observed Strategy team meetings and working group meetings. Figure 4.2 provides a visual representation of the meeting compositions; all meetings included people using the three cognitive frames and the meeting chair is indicated by a thicker line.

Figure 4.2 – Cognitive frames compositions in observed meetings



The Strategy team

The Strategy team is responsible for investment policy as well as the SAA process. The team manager, holding a business case frame, was challenged by management to integrate sustainability, but he saw limited relevance of sustainability considerations for the SAA process. This process relies mostly on a linear median path of economic expectations, which does not allow for incorporation of non-linear transitions, scenario thinking and multiple sustainability objectives.

Team members in the Strategy team with a business case frame made mostly incremental proposals, based on established routines and practices. For example, to the yearly asset allocation advice the impact of allocation changes on realising sustainability targets was added. Adding this information provides insights, but does not directly influence decision-making. Generally, incremental proposals bear little risk, produce little disruption but are also novel to a limited degree. On the other hand, incremental changes can also form the basis for larger-scale changes proposed by others. For example, two deterministic climate scenarios were developed, called 'Delayed transition' and '3-degree global warming', using widely accepted information from NGFS (2024)[12]. These scenarios showed limited effects compared to the base scenario. Respondents acknowledged that these scenarios underestimate climate change effects as not all relevant effects are included. The year after therefore, scenarios with stronger assumptions were added, to examine how a 'Climate disaster' or 'Climate headwind' would play out[13]. Respondents with a sustainability case frame shared that scenarios in decision making will grow over time, given that ongoing transitions are insufficiently accounted for in the base scenario. They found that the pension provider could take steps by indicating the likelihood of scenarios and by identifying potential steps to mitigate associated risks. On the other hand, respondents with a business case frame warned against the dependence on expert judgment in these scenarios.

Although sustainability case frame respondents generally developed novel practices, the prevailing influence of business case frame respondents limited the introduction of more radical, time-consuming approaches and focused on workable solutions in the short run. While an iterative cycle of incremental steps is

[12] These scenarios are based on the NGFS scenarios 'Delayed transition' (high transition risk, low physical risk) and 'Current policies' (low transition risk, high physical risk)

[13] Climate disaster is a short-term Minsky type of shock scenario where extreme weather events hit production and lower consumer trust, thus lowering economic growth. Climate headwind argues from a less extreme but longer-term effect through consistent high inflation.

proposed to advance practice, so far the adopted practices are incremental in nature and limited to climate change effects.

Working group A

In general, the working groups implementing Strategy 2030 were working on more radical proposals. The goal for working group A was to develop impact targets on portfolio level on climate change and biodiversity. The group was dominated by sustainability case frame members, while being chaired by a paradoxical frame member. On the energy transition, a respondents states [Quote 10]: "We argued outside-in like: where is capital needed? What are the specific challenges within the energy transition that investors can contribute to? Then we look at impact investments with measurable impacts." Members were excited on setting targets, as it would allow the pension provider to steer top-down on their impact ambition. When interviewing the only business case frame respondent in this group, he shared his concern for the potential financial consequences of sustainability focused decisions. This concern lead him to be generally quiet in the meetings and not attending all meetings. His contribution to the process therefore was limited.

Working group B

Working group B was working on a new investment mandate for equities, including sustainability and impact integration. Since this could significantly alter the equity allocation, discussions focussed on decision-making and procedures. During a meeting, a business-case frame member took the role of critic caster. He questioned what paying 10 extra basis points for integrating sustainability objectives would add, asking: "What am I getting in return?"

The working group mainly consisted of business case and paradoxical frame members. The main driver for more radical proposals therefore came from management, seeking to implement Strategy 2030, rather than from within the working group. The chair stated during a meeting he was content with management giving mandate to integrate sustainability, but stated that it was up to the working group to work this out in a prudent manner. The working group proposed a phased in process to gradually implement changes. In proposals, they found it important to make uncertainties and dependencies explicit, so that management was aware of these points in decision-making. Through an iterative process, the business case frame's concern on moving too quickly was heard.

At the end of one of the meetings, the chair encouraged the group they were moving in the right direction, and asked how people were feeling about the progress. This invited working group members to express their concerns, if present.

Working group C

Working group C worked on a portfolio-level risk framework for investment risk and transition risk, in order to be able to actively steer on return, risk and sustainability on a portfolio level. For transition risk, they were assessing a novel quantitative database which included equities and bond information, but lacked private investments information. The group discussed when data is of sufficient quality to steer the portfolio on. A paradoxical frame members mentions: "The last thing we want is that the pension fund board steers too fast on this". Others with the same frame add that describing disclaimers is important. A sustainability case frame member responds, stating: "My point is that we should not put disclaimers and then stop taking next steps. No, we have disclaimers and now we take next steps." He is referring to Strategy 2030 and raises the question what is required to achieve the goal of actively steering on risk, return and sustainability. The working group gathers information some several investment consultants to see what are the latest developments in this regard.

4.5 Theoretical framework

The stances that people take in collaboration take are summarized in Table 4.5; each cognitive frame has a particular way to contribute, to have concerns and to connect to other frames to enhance the collaboration. Based on the grounded understanding of cognitive frame interactions, the theoretical framework in Figure 4.3 visualising the interactions between cognitive frames in collaboration for sustainability integration (Figure 4.3).

The business case frame is characterized by a pragmatic stance. People using this cognitive frame take the role of critic caster and make incremental proposals. As they are based on established practice, emerging sustainability related risks can remain underestimated (Hahn et al., 2014). They contribute to collaboration by bringing finance logic and the emphasis on proper academic substantiation of decision-making. Their concern is that potential financial consequences of sustainability focused decisions are insufficiently considered. As shown in Figure 4.1, they have a limited shared cognitive structure with the sustainability case frame. Their connection to this frame is therefore more difficult than with the paradoxical frame (indicated by a longer connection line), but possible when more elements, interconnections and dilemmas are taken into account.

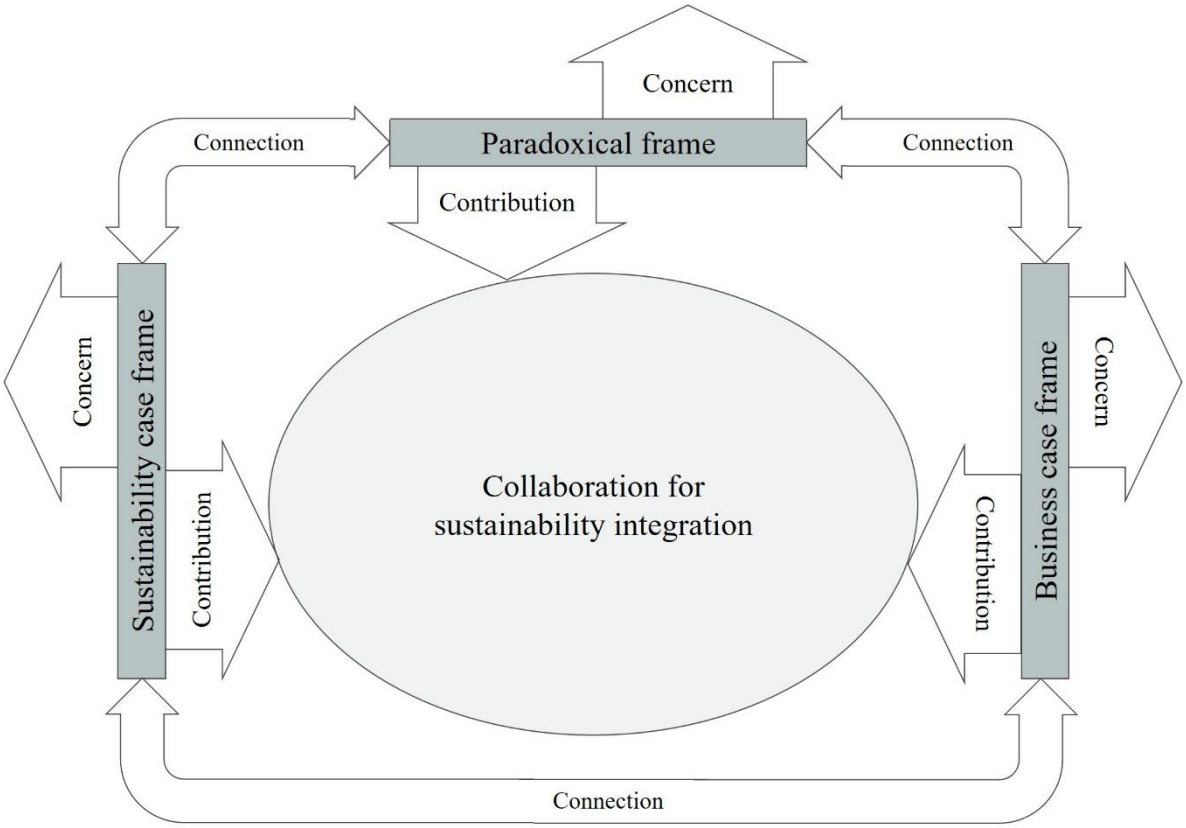
Respondents using the paradoxical frame take a prudent stance. They bring forth the richness of relevant elements, interconnections and resulting dilemmas. This can limit their ability to develop and implement workable solutions, considering potential conflicting or undesired side effects (Hahn et al., 2014). This case study however also shows that people with a paradoxical frame go beyond their ambivalence, by proposing iterative cycles of learning and taking no-regret options in order to overcome the identified uncertainties and complexities. Interim-decision making can address the concerns of the other frames, which are concerned for too slow and too fast decision-making. In bringing all arguments to the table, the paradoxical frame connect to both other frames and act as a translator between them. They have the ability to structure relevant considerations, using both finance logic as well as a broader logic of other fields of expertise.

Respondents using the sustainability case frame adopt a proactive stance, characterized by the role of designer or innovator. This proactive stance was not identified in the work by Hahn et al. (2014), and is defined as proactive considering of unusual and more radical departures from established routines, proposing new solutions that can bring about large-scale change. They provide solutions to some of the conflicting relationships by broadening the scope of relevant fields of expertise, such as environmental sciences and psychology. Based on their integrated view on achieving financial and sustainability goals simultaneously, they are less hesitant to make proposals but keen to develop new processes and frameworks. Their main concern is that people get stuck in ‘old thinking’ and excuses, and hence that the organization will act too late. Respondents using the sustainability case frame can connect to the other frames by acknowledging dilemmas and the potential financial consequences of sustainability focused decisions.

Table 4.5 – Detailed overview Stance

Cognitive frame	Business case frame	Paradoxical frame	Sustainability case frame
Stance	**Pragmatic stance**	**Prudent stance**	**Proactive stance**
Role	Critic caster Makes incremental proposals	Constructive, Structuring Proposes iterative cycles of learning	Designer, Innovator Makes radical proposals
Contribution	Finance logic, need for academic evidence	High degree of relevant elements, interconnections and resulting dilemmas	Provide solutions to conflicting relationships, bring integrated narrative, broaden information scope
Concern	Concern of potential financial consequences of sustainability focused decisions	Concern of acting too quickly or wrong on transitions, due to uncertainties and complexities	Concern of being stuck in 'old thinking' and excuses, concern of acting too late
Connection	Consider more elements, interconnections and dilemmas	Connect with other two frames through structuring relevant considerations	Acknowledge dilemmas and potential financial consequences of sustainability focused decisions
Illustrative quotes	[Quote 11] "If you assume that transition risk premiums are not priced in yet, and that there will be a time when they will be priced in; then you better be on the right side. (…) But that has never been explicitly stated. I would like to find out whether that is indeed a belief. So, if you believe that in this case the government will intervene, that creates transition risks for companies ill-prepared, then I understand what that implies. But that is an assumption." [Quote 12] "Can you steer your portfolio on this? So does this give you a signal like: take a little more equity or real estate. Well, that is the main point we made in the memo last time. The test ultimately is: we don't just want to talk about it but also take climate change into account in the portfolio. At the moment, that is still difficult to impossible at the level of asset classes."	[Quote 13] "If you really want to push buttons – you want to reduce physical climate risk and you are going to look at which asset classes have the lowest risk – then you want to do that in a consistent way. Because otherwise, it would mainly be which party you use for that or which data you use that would determine how you push the buttons. I wouldn't want to surrender to that at the moment, that's putting quite a lot of trust in something that also potentially has quite of lot of impact." [Quote 14] "I think this is the best we have. I just think you should put a big exclamation mark on it, saying: know that this only quantifies a part of all the effects and that a vast majority cannot yet be estimated. (…) It is already much larger than what the numbers show, only we don't have a clue of the order of magnitude, the direction or how that works out exactly. Either it cannot be modelled or there is insufficient data for it, there are enough limitations, this is the best we can do."	[Quote 15] "The ALM has all sorts of calculations and bandwidths for return and risk. Within those bandwidths, I can make different choices in the portfolio: sustainable choices and less sustainable choices. As long as I can promise a pension result that will be delivered with a certain degree of probability in the long term, as indicated in the ALM analysis, then I still have room to make choices on sustainability. So that also makes 3D investing possible."

Figure 4.3 – Framework cognitive frames interaction in sustainability integration collaboration



The framework sheds light on potential risks in collaboration for sustainability integration. When concerns are insufficiently addressed, people can withdraw from the table, either physically, by acting passively or taking opposing positions. The pace and quality of decision making – too slow or too fast – is the key driver of withdrawal for respectively the sustainability and business case frame. When connections are made insufficiently, arguments are brought to the table, but do not lead to a joint process of understanding and decision making.

4.6 Discussion and conclusion

This grounded theory study examines the cognitive frames interactions in integrating sustainability in investment practice. This study advance the literature on sustainable investing, sensemaking and cognitive frames in several ways. First, it expands the work by Hahn et al. (2014) by identifying a third cognitive frame (sustainability case frame) and by illustrating how these in investment practice interact. Second, it develops a theoretical framework on cognitive frame interactions for sustainability integration. Third, Appendix A4.5 provides specific insights on the SAA process and possibilities for further sustainability integration in this process.

The cognitive frames in this article expands the work by Hahn et al. (2014) by identifying a third cognitive frame (sustainability case frame). Respondents using a sustainability case frame explicitly combine integrated financial and sustainability objective. This leads them to adopt a proactive stance, where they advance more radical proposals to achieve this integrated objective. Compared to the paradoxical frame by Hahn et al. (2014), respondents using a paradoxical frame in this study go beyond their ambivalence by proposing iterative cycles of learning and by proposing no- or least regret options. The results relate to a larger research body on cognitive frame (or archetype / typologies) in sustainability. There are similarities with the sustainability typologies by Dyllick & Muff (2016) and Loorbach et al. (2020), but this study advances insights based on empirical evidence. Oberlack et al. (2019) find in their systematic review on this literature that archetypes are

mostly emerging, context-sensitive models, which increase in validity when confirmed throughout several cases. Therefore, empirical research can further advance the emergence and development of cognitive frames at financial institutions.

The developed theoretical framework informs how organizational change for sustainability integration can be advanced, responding to a need for further research on this by (Burbano et al., 2024) First, it shows that all cognitive frames have something to bring to the table. While Hoppman et al. (2023) mostly identifies processes in which frames limit sustainability integration, this study identifies contributions for all three cognitive frames. Second, the framework shows that concerns need to be addressed, in order to keep all frames involved in the collaboration for sustainability integration. Third, the frames need to connect to other frames in order to advance collaboration. When collaborations get stuck due to a lack of shared understanding, it is worthwhile the time to share people's underlying beliefs and understanding (Cognitive content and structure), to understand where stances originate from. This is in line with the acknowledgment that personal sensemaking factors – e.g. social norms, personal moral norms, environmental values – matter to the advancement of an organisation's sustainability agenda (Aguinis & Glavas, 2019; Lülfs & Hahn, 2014). Osagie et al. (2022) identify three key characteristics in organisational learning: leadership for change (people motivating to learn and embrace change), system connection (being open to adjust practices based on community needs) and group learning. The latter can be especially relevant to discuss emerging insights and advance a shared understanding and language in sustainable investing (Loorbach et al., 2020). The findings shows that respondents can shift their cognitive frames over time (Figure 4.1), in line with recent work on sensemaking cycles (Gross et al., 2025) and sensegiving processes (Hoppman et al., 2023).

This study contributes to literature on investor impact by grounding investor impact views as part of the cognitive content of cognitive frames. The business case frame respondents see limited investor impact, as the pension fund's capital allocation is only marginal in the total's capital market, and thus has limited influence on how companies act. This argument relates to studies examining the portion of investors needed to induce companies to improve sustainability impacts (Berk & Van Binsbergen, 2025; Heinkel et al., 2001). They do acknowledge that what the pension provider does has value towards the pension participants, as it can matter to them that pension money is invested responsibly. Both the paradoxical and sustainability case frame put forward engagement with companies, the determination of the investment universe and impact investing (both capital allocation role) as important investor impacts. In line with the call for reorientation towards impact aligning investments and impact generating investments (Busch et al., 2021), the pension provider operationalised its impact investment definition as impact generating investments. The work by Kölbel et al. (2020) and Marti et al. (2023) provide further insights into the academic evidence for engagement and system-level influence.

This study is relevant to all organizations seeking to integrate sustainability in decision making, most particularly institutional investors. It provides insights in how people's actions are informed by their views and understanding of information. In a context where views on sustainable investing are shifting, this study shows that underlying convictions on investor impact, efficiency of markets, climate change effects drive how people collaborate for sustainability integration in investment practice. The presented framework provides a basis for understanding these dynamics, and the discussion provides ways forward to advance and strengthen these collaborations.

Appendices chapter 4

Appendix A4.1 – Information on interview data

Overview questions for RQ2 in closed research setting

These interviews focused on the following four questions, which were shared in advance of the interview with the respondent:

1. Do you think that the physical consequences of climate change, and how we act (climate change mitigation and adaptation) is adequately priced in, in financial markets?
2. Does what you think about this (question 1), matter to how you think PFZW should consider climate-related risks?
3. PFZW formulated investment beliefs, in which she states that 'Market developments are difficult to predict, especially in the short term' (belief 2), 'Factoring ESG risks and opportunities into investment decisions results in a better portfolio' (belief 4) and 'PFZW makes a valuable contribution to a more sustainable world' (belief 5). How do you think these beliefs relate to each other?
4. Which impact can PFZW make as an investor through impact investing? Which role does setting targets have in this? In investment decisions, how can a good consideration be made between risk, return and impact?

Quotes of paper in original wording (Dutch language)

Quote 1 - Het gaat meer om het belief dat als je op de korte termijn gelooft dat marktontwikkelingen niet goed te voorspellen zijn. Je zou ook kunnen zeggen, klimaatverandering is niet iets wat alleen op de korte termijn speelt, maar ook op de lange termijn. Maar dan nog, het acteren op het niet correct ingeprijsd zijn van klimaatrisico's gaat ervan uit dat jij een betere visie hebt dan wat er standaard in de markt ingeprijsd is.

Quote 2 – Ik zie niet de meerwaarde in engagement, en zie vrij beperkt de resultaten daarvan. Dat wij onze portefeuille verduurzamen, zet ook niet per se zoden aan de dijk; voor ons 10 anderen die het aandeel wil kopen en dan zijn wij niet in gesprek met zo'n bedrijf. (…) Onze toegevoegde waarde is daarin nihil, niets anders dan een soort marktsignaal, waarin we denk ik wel een voorloper zijn samen met andere Nederlandse partijen.

Quote 3 – Het probleem is dat het bij klimaat niet over meetbare risico's gaat, maar om onmeetbare onzekerheden en ambiguïteiten. Er is sprake een stapeling daarvan: de toekomst van het klimaat is onzeker, hoe dat de economie zal raken is onzeker, en hoe dat beleggingen zal raken is onzeker. En hoe al die lagen van onzekerheid via terugkoppel-mechanismen verder op elkaar inwerken, is ook onzeker.

Quote 4 – Kijk, de fysieke trends zijn duidelijk genoeg en de fysieke consequenties, dat heeft men ook redelijk duidelijk. Ik bedoel, je kunt het klimaat waarschijnlijk beter voorspellen dan de dollarkoers.

Quote 5 – Ik denk dat PFZW echt een bijdrage kan leveren, deels door de trends in transities zien en erin beleggen, maar ook grotendeels door de voorbeeldfunctie, dat je andere beleggers op de markt meetrekt met: 'het kan ook anders'.

Quote 6 – Dit is je basisscenario en hoe je het beestje ook wendt of keert, uiteindelijk zijn er maar 3 factoren echt belangrijk: inflatie, rente en economische groei, lees aandelenrendementen. En dat kan mee of tegenzitten, dus dan heb je eigenlijk maar 8 mogelijkheden. Een paar mogelijkheden zijn zeer onwaarschijnlijk of onnuttig, dus dan heb je maar een stuk of 5 stress scenario's. (…) Eigenlijk heb je helemaal geen storytelling nodig. Sterker nog, je kan ook zeggen van: (…) het maakt niet uit of er een oliecrisis is, of dat China op slot gaat, of dat Saudi-Arabië in de fik gaat; uiteindelijk zijn het allemaal positieve of negatieve aanbodschokken en kom je in stagflatie terecht. Dit heeft het nooit gehaald, omdat je merkt dat bestuurders gevoel willen hebben bij een stagflatie scenario. Wat is dat dan? Wat gebeurt er in zo'n scenario? Dan kan ik niet aankomen met: een positieve of negatieve aanbod schok maakt niet uit waar die vandaan komt, je komt hier op uit.

Quote 7 – Ik denk dus dat als we een verkeerde inschatting maken over de manier waarop die klimaatrisico's impact kunnen hebben, dat dat impact kan hebben op risico-rendement. En misschien ook wel dat we klimaatverandering op zichzelf verkeerd inschatten.

Quote 8 – Een bedrijf kan wel proberen de transitie mee te maken, maar dat wil niet zeggen of ik daarin wil investeren. Misschien heb ik wel geen geloof heb dat ze wendbaar genoeg zijn; dat als ze een paar wijzigingen doen, er ook zijn. Ik kan wel geloven in de transitie naar andere energiebronnen, maar of ik geloof in waterstof, windenergie, zonne-energie of misschien nog wel iets heel anders, geothermie? Ik weet niet welke er gaat winnen. Daarmee zit er zoveel onzekerheid dat ik hier niet op zou positioneren. En in mijn analyse van een windenergie bedrijf, zal ik dus meenemen dat windenergie mogelijk niet aantrekkelijk kan zijn.

Quote 9 – Wat volgens mij met de paplepel ingegoten is, is het idee dat er altijd iets van een 'reversal to the mean' is. Je hebt een dip, maar je werkt je er wel weer uit. Terwijl een natuurkundige of iemand die fysische wetenschap heeft gestudeerd, die weet dat het kapot kan. Dan heb je een heel andere koers om op te varen, dat is een absolute koers, niet een relatieve koers. En dat is een totaal ander vak. Dit zijn allemaal relatieve jongens: die zijn allang blij als ze de benchmark verslaan met x basispunten. Maar als je straks in een heel ander scenario terecht komt, waarbij het echt gewoon kapot gaat, dat is onvoorstelbaar. (…) Dus de wolk is niet groot, of eigenlijk niet creatief genoeg om dat soort scenario zeg maar te bedenken (...). Ik denk dat we nog lang niet creatief genoeg in het doordenken wat er allemaal kan gebeuren. Dat zit volgens mij niet in onze modellen. Ik denk dat heel verstandig zou zijn om ook als PGGM veel meer met systeemdenkers in zee te gaan. Met transitie denkers die inderdaad creatief genoeg zijn om dit soort ontwikkelingen in beeld te brengen.

Quote 10 – Dus dat is vanuit die outside-in gedachte van: waar is het kapitaal nodig? Bij de energietransitie. Vervolgens binnen de energietransitie: Welke uitdagingen zijn daar specifiek waar beleggers aan kunnen bijdragen? Dan kijken we naar impact investeringen die we kunnen meten en weten.

Quote 11 – Als je natuurlijk de aanname hebt dat transitie risicopremies nog niet in de prijs zitten, dat er een tijd komt dat die wel ingeprijsd gaat worden; dan kan je maar beter aan de goede kant kunt zitten. (…) Maar dat is alleen nog nooit expliciet gesteld. Daar wil ik dan wel achter zien te komen of dat inderdaad een belief is. Dus als jij gelooft dat in dit geval de overheid gaat optreden, waardoor er transitie risico's ontstaan voor bedrijven die die niet daarop zijn voorbereid, dan snap ik wel wat er wat dat betekent. Maar het is wel een aanname.

Quote 12 – Kan je hiermee je portefeuille sturen? Dus geeft dit nou het signaal van: doe nou wat meer aandelen of vastgoed. Nou ja, dat is het hoofdpunt wat wij maakten in die notitie vorige keer. Ja, voor ons is uiteindelijk de toets: we willen niet alleen er over praten, maar ook rekening houden met klimaat in de portefeuille. Dat is op dit moment gewoon nog op het niveau van beleggingscategorieën nog steeds moeilijk tot onmogelijk.

Quote 13 - Als je echt aan de knoppen zou willen draaien – je wil je fysieke klimaatrisico verlagen en je gaat kijken welke asset classes het laagste risico hebben - dan wil je dat wel op een consistente manier doen. Want anders zou vooral welke partij je daarvoor gebruikt of welke data je gebruikt, bepalen hoe je aan die knoppen gaat draaien. Daar zou ik me op dit moment niet aan willen overleveren, dat is nogal een groot vertrouwen in wat ook een potentieel grote impact heeft.

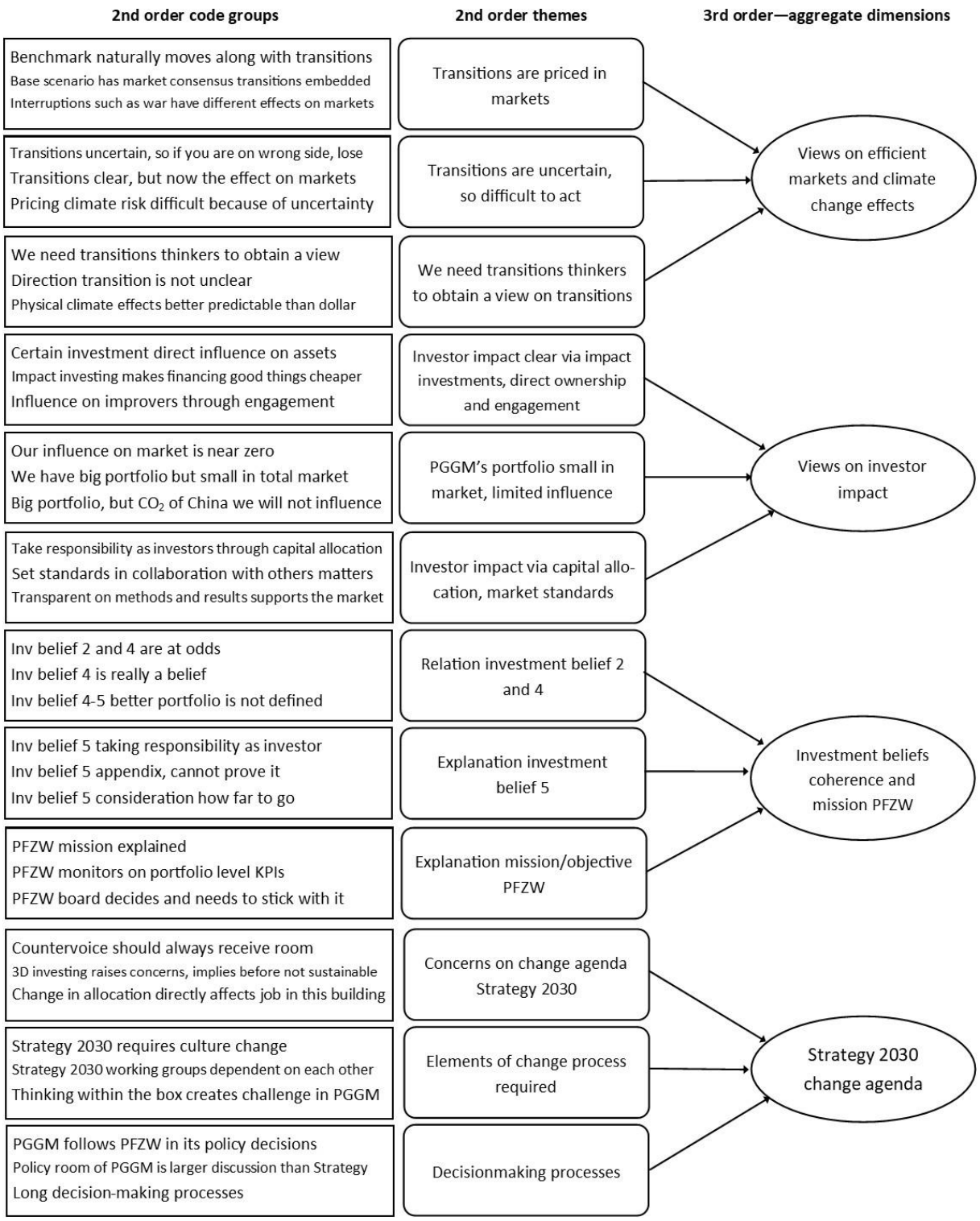
Quote 14 – Het is denk ik het beste wat we hebben. Ik denk gewoon dat je daar een groot uitroepteken bij moet zetten met: weet dat dit slechts een deel van alle effecten kwantificeert en dat een overgroot deel nog niet in kaart gebracht kan worden. (…) Dit is al veel groter dan wat de cijfers aantonen, alleen hebben we geen idee van de ordegrootte van de richting of hoe dat precies uitwerkt. Of het is niet te modelleren of er is niet genoeg data voor, er zijn genoeg beperkingen, dit is het beste wat we kunnen.

Quote 15 - De ALM heeft allerlei sommen en bandbreedtes voor rendement en risicobereidheid. Binnen die bandbreedtes kan ik dus verschillende keuzes in de portefeuille maken, duurzame keuzes en minder duurzame keuzes. Zolang ik een pensioenresultaat kan beloven die met een bepaalde mate van waarschijnlijkheid op langere termijn geleverd gaat worden, dat laat de ALM analyse zien, dan houd ik nog steeds bewegingsruimte om keuzes te maken in duurzaamheid. Dus dat maakt 3D beleggen ook mogelijk.

Appendix A4.2 – Data structure (page 1/2)

This Figure shows the result of the Gioia methodology rounds of data analysis (see Data analysis): First order codes (not included in Figure) are grouped to 2nd order code groups, which are further grouped to 2nd order themes and again grouped to 3rd order aggregate dimensions.

Data structure (page 2/2)



Appendix A4.3 – Overview 2nd order themes

This overview displays the 145 2nd order themes, by aggregate dimensions

How to act on climate change effects	
Act on transitions with low- or no regret options	Climate risk managed through KRIs CO2 intensity and Paris Alignment
Climate change effects already identified in certain asset classes	Climate risk need to use credible sources
Climate change effects are underestimated	Climate risk risk department responsible monitoring
Climate change effects / NGFS first results show limited effects	Difference ambition 1.5 degree and realistic expectation 3 degree world
Climate change effects important to develop own view	Emerging markets mostly affected by climate change
Climate change insights will improve over time	ESG risk gross and net too immature in 2015
Climate change new scenarios to increase effects on portfolio	Expert judgment so be careful in changes based on that
Climate risk less relevant on SAA level, more on asset level	In SAA combination top-down macroanalysis and bottom-up analysis way forward

3D investing is iterative process	
3D beleggen meer actief beleggen	PFZW geeft opdracht, PGGM voert uit, afstemmen tempo van change
3D investment cases work in progress	3D nog niet klaar voor allocatie advies wijziging
3D beleggen iteratief proces	3D credit discussion on implications third D
3D investing many sustainability goals at same time	3D credit more easy than 3D equities
Tegenstem over consequenties en rendement te weinig gehoord	Verantwoorde basis waarschijnlijk kleiner universum
Beleggen is meer kunst dan wetenschap, moeilijk te erkennen	3D in ALM is difficult
Pensioenresultaat staat centraal voor pensioenfonds	

Setting & steering sustainability targets	
Biodiversity potential in a few asset classes, inside and outside current portfolio	Regulatory requirement for sustainability targets
CO2 target important, also because of stakeholders	SAA sustainability considerations already 2013
CO2 target while Paris alignment is more forward looking	SDI target is on impact-aligned investments
Global south need investment, but risk also higher	Sector or region level in SAA not likely
Impact investing clear to pension participants	Smaller investment universe to mitigate negative impact
Impact investing climate solutions	So far, steering sustainability targets not effective
Impact investing is just investing	Specific mandate to stimulate sustainable investing
Impact investing limited because of constraints	Stakeholders to Strategy 2030/3D investing process
Impact investing measurable output-outcome high threshold	Steering on impact bridge too far
Impact investing intentionality important	Steering on impact iterative process
Impact investing relates to transitions	Steering on impact structured in committee
Impact investing theory of change and narrative important	Sustainability data different maturity financial data
Impact investment important and tangible for beneficiaries	Sustainability data insufficient for decisionmaking
Impact potential is next step	Sustainability target important to be able to steer
Impact target challenging to set	Sustainability targets now achieved by where is possible, not top-down steering

Insurance is risk mitigation, not sustainable investing	Sustainability targets on portfolio level matter
Not all asset classes have climate related target	Transparency on targets important
Participant research important for impact preferences	Zorg & Welzijn sector expliciet in beleggen
PFZW needs to decide on sustainability targets	Academic evidence important in deciding on policy

Steering risk, return, impact on portfolio level

Risk, return, impact afweging is nog zoeken	Liquidity is not actively considered like sustainability
Impact potential per asset class meewegen	In portfolio, asset classes have their own role
Potential to steer on lowering climate risk	Renteafdekking veel geld verloren, maar weinig aandacht gekregen omdat werking bekend is
Identify transition/climate risk is work in progress	Active risk, return, impact consideration is way forward
Allocation signals are sensitive to inputs	Different risk measures used and valued within PGGM
ALM decisions matter most to investment portfolio	Risk framework goal new risk measures to implement 3D investing, to have risk, return- impact consideration
Room for integration sustainability in SAA	Risk, return, impact afweging is nog zoeken
Goal of climate integration is to find useful allocation signal	Separate sustainability/impact mandate not end solution
ALM is behind, but has some ideas for sustainability integration	Realizing impact most important in impact investing
As long as climate risk doesn't affect growth, interest and inflation, it does not change ALM	(Un)clear whether impact can cost return
Stochastic modelling not suitable for climate integration	Risk, return, impact consideration possible if you know risk
Investment policy is lacking on portfolio-SAA level	Strategy wants to be best advisor on sustainable investing
Benchmark spiegel voor monitoring, maar geen doel	Total portfolio management is useful
Conventional SAA explanations	
Risk measures portfolio explained	Risk measures portfolio explained
ALM-SAA connection described	SAA process include many sources and assumptions
Base scenario explained	SAA process and roles explained
PFZW, PGGM staff role in process	Scenario memo explained
Certain asset classes explained	Strategy/FA not responsible for execution
Investment beliefs coherence	Agnostic on climate scenario due to inv belief 2

Explanation mission/objective PFZW

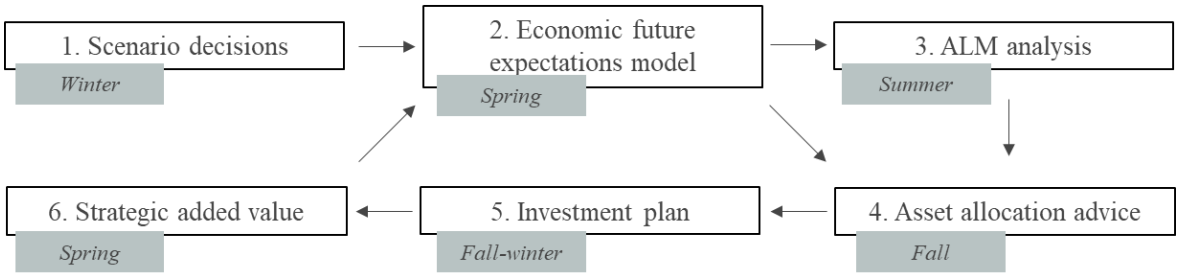
Inv belief 2 and 4 at odds	Inv belief 5 taking responsibility as investor
Inv belief 2 don't know tomorrow, so little active management	Inv beliefs in investment practice active consideration
Inv belief 2 short term and 4-5 long term	Investment belief important to motivate academically
Inv belief 4 can potentially provide return	Investment beliefs are wishing, because board acts on short term
Inv belief 4 is a real belief	Investment beliefs mandatory and prominent displayed
Inv belief 4-5 a better portfolio is not defined	PFZW bestuur kiest richting en moet vasthouden
Inv belief 5 appendix, cannot prove it	PFZW monitors on portfolio level KPIs
Inv belief 5 consideration how far to go	

Several aspects of investor impact	
Inv impact differs per asset class	PGGM does not want to stand alone in sustainability decisions, but to face uncertainty with market is OK
Inclusion (verantwoorde basis) is motivating your investment universe	Inv impact through capital allocation
Inv Impact through direct influence on investments-set up asset class	Inv impact through market standards, market view and by being transparent
Inv impact through impact investments	PGGM's portfolio small in total investment market, limited influence
Inv Impact as investor you are at other side of profit distribution than employee	Be clear on that governments and companies also need to act
Inv Impact through engagement	How you view inv impact PGGM differs per employee
Transitions are uncertain, acting depends on your perspective	
Climate change effects changes world, so also e.g. mean reversion	Transitions are priced in markets
Efficient markets depend on the investor's perspective	Transitions are uncertain, so difficult to act
Megatrends geïdentificeerd en beschreven	Transitions uncertain, so if you are on wrong side, lose
Profit from transitions if you are on the right side of it	Transition effects are lacking in SAA/portfolio construction
Transition thinkers needed to obtain transition view	Transitions are clear, but not how financial markets are affected

Change process Strategy 2030
Concerns on change process Strategy 2030
Elements of change process required
PFZW, PGGM staff role in process

Appendix A4.4 – Description SAA process and sustainability integration practices

Panel A: Visualisation pension provider's conventional strategic asset allocation process



Panel B: Overview current and possible future practices to integrate sustainability per SAA step

SAA step	Current and possible future practices to integrate sustainability
1. Scenario decisions	- Transition analysis and influence of transitions on deterministic scenarios - Deterministic climate scenarios
2. Capital market assumptions	- Indication climate risk per asset class based on ND-Gain index, carbon pricing, and Alladin Climate module - Potential per asset class for reaching impact and sustainability targets
3. ALM analysis	- None
4. Asset allocation advice	- Impact of allocation advice on the realisation of sustainability targets - Impact of limiting 10% climate risk on allocation advice - Allocation advice based on climate risk assessment and potential per asset class for impact and sustainability targets
5. Investment plan	- None
6. Strategic added value	- Tracking effect of exclusions in equity investments on return - Indication per asset class whether 'on track' for sustainability targets
Investment cases	- ESG risk exposure and impact/sustainability potential of asset class - Contribution of asset class to portfolio-level sustainability targets
Change agenda Strategy 2030	- Impact targets on portfolio level - Development risk framework; portfolio steering on risk, return, sustainability

Panel C: Description current and possible future practices to integrate sustainability per SAA step

In the period before 2022, there were several initiatives to integrate transitions and sustainability into the SAA process. The earliest notion is a memo drafted February 2007 on climate change consequences and potential actions for PGGM. Approaches in the years after proposed certain elements, but these were not implemented or discontinued at some point. Three developments lead into the phase starting in 2022, where the findings section focuses on. First, the Strategy 2030 includes explicit ambitions on integration of sustainability (see Research setting). Second, a gap analysis on the DNB Good practices on ESG risk management pension funds showed that climate risk integration on the SAA level was missing. Third, a paper by Jaap van Dam (in this period Principal Director Strategic Policy Advice at PGGM) and two others describes five ways in which sustainability can be integrated into SAA, including a call to action.

1. Scenario decisions

In the first SAA phase the base case scenario and deterministic scenarios are decided on, as well as an analysis of megatrends, jointly called scenario decisions. The base case scenario for the investment policy is the result of stochastic modelling, which is a cloud of 1000 scenarios for the coming 15 years around a chosen median path. PGGM's modelling is based on a fundamental economic equilibrium, where relevant adjusted given capital

market assumptions by IMF14 and OECD15. In the base case scenario memo, it is described that transitions have effects on economic growth, but that the combined effect is heavily debated, e.g. technological developments, climate change. Moreover, it is noted that so far, most economists' best-efforts estimations show that climate change has less impact on economic growth potential than other transitions. In discussion documents on integrating climate change effects in stochastic modelling, the PGGM Strategy team identifies a few possibilities, but brings forth that these will likely not inform the asset allocations decisions in a meaningful way. The key message is that climate change impact in SAA is mostly related to currently unmeasurable uncertainties and ambiguities rather than measurable risks, which is not suitable for probability-based stochastic modelling.

The integration of climate change effects is thus most explicitly done through adopting climate deterministic scenarios. Deterministic scenarios are scenarios with a single determined pathway, typically on a five-year horizon. They are used to perform robustness checks and sensitivity checks to the initial investment policy. In these scenarios, such as stagflation and deflation, certain capital market assumptions change, leading to changes in expected risk and return. Deterministic scenarios are deemed most suitable to integrate transitions, as these describe one scenario rather than a set of possibilities. Per scenario, the difference in capital market assumptions compared to the base scenario is calculated, which also leads to expected impact on the expected risk and return.

In 2023, two deterministic climate scenarios are included: a 'Delayed transition' and '3-degree global warming' scenario (NGFS, 2024)16. These scenarios showed only limited effects compared to the base case scenario, which indicates that there is limited climate 'stress' and that they are not tail risk scenarios. Moreover, the scenarios have a 15-year time horizon, while the NGFS scenarios have more extreme effects after this period. Respondents comment that the NGFS scenarios underestimate climate change related effects, as not all relevant effects are included. Therefore, two scenarios with strong climate 'stress' are added in 2024: 'Climate disaster' and 'Climate headwind'17. Climate disaster is a short-term Minsky type of shock scenario where extreme weather events hit production and lower consumer trust, thus lowering economic growth. Climate headwind argues from a less extreme but longer-term effect through consistent high inflation. These scenarios are deemed a useful addition as they show stronger climate change effects on the portfolio. More generally, some respondents state that the importance of scenarios in decision-making will grow over time, while other respondents warn against the dependence on expert judgment in these scenarios.

Beyond deterministic scenarios, there are transitions over the years which can influence this base scenario. The pension fund board in the past inquired for the effect of some of these trends on the base case, such as climate change, geopolitical tensions and ageing. The PGGM Strategy team thus identified and describes six key transitions in a so-called 'megatrends' memo. The memo argues that the average expectation of a megatrend is included in the base case, and the analysis is thus on megatrends turning out differently than expected. For example, if because of ageing, work force decreases sooner than anticipated, this can have a negative effect on economic growth. Or, in the case of China's demographic developments, where a respondent comments: 'Does it grow old before it gets rich?'. The megatrends memo indicates whether transitions affect economic growth, inflation and interest rate in a negative, positive, neutral way or whether this is unknown.

Reflecting on these practices, scenario analysis seems a better fit for integrating transitions, than integration in the base case scenario. The climate scenarios are however recently developed and there is ongoing debate on whether these scenarios include all relevant effects on the economy, and thus on the investment

[14] International Monetary Fund
[15] Organisation for Economic Cooperation and Development
[16] These scenarios are based on the NGFS scenarios 'Delayed transition' (high transition risk, low physical risk) and 'Current policies' (low transition risk, high physical risk)
[17] In Dutch: Klimaatramp and Klimaattegenwind

portfolio. So far, the scenarios are discussed in an agnostic manner, whereas investors could also indicate what the likelihood of scenarios are and what are potential steps to mitigate associated risks.

2. Capital market assumptions model

Using a quantitative model, the ALM and Strategy team set capital market assumptions on economic growth, inflation and interest rate on a 15-year time horizon. Transitions are considered integral part of the capital market assumptions. Based on these, expected risk and return is calculated for each asset class. These risk-return expectations are informed by the investment cases for each asset class (see Investment cases). The model used for the calculations builds on strong assumptions, making it sensitive to what is put in. It is described as a tool and the use of it 'more art than science'. The level of expert judgment is considered inherent part of this calculation and less described as a problem than a respondent does for expert judgment in scenario analyses. An example of the sensitivity is that based on the capital market assumptions the expected risk-return on real estate is much higher than anticipated.

Based on the set of climate scenarios, in 2023 two graphs (transition risk and physical risk) are included, which indicate the exposure per asset class to relatively low, medium or high climate risk, including concise explanations. Physical risk is based on climate risks associated with physical locations, as calculated based on the Notre Dame Global Adaptation Initiative (ND-GAIN) (University of Notre Dame, 2024). This score measures the vulnerability of countries to physical climate change effects and the ability to adapt to these effects. The transition risk is calculated as the impact of carbon pricing on investees' revenue streams, based on sector level calculations. The results are accompanied with the explicit notion that transition effects are broader than carbon pricing. During the observation period, PGGM was analysing the results of the Alladin Climate module, to see if it can be used for the capital market assumptions too. The results should concentrated impact in a few sectors, therefore showing limited climate risk on the portfolio's return until 2050. Respondents deem this a underqualification of how climate change will affect the economy, as is the case with the NGFS scenarios, but also appreciate that the module provides a way in which the total portfolio can be consistently assessed on physical climate risk, with results comparable across asset classes.

The scenarios and calculations made so far, and its limitations, lead to discussions on the aggegrate dimension of how to act on climate change effects. Respondents share that approaches so far underestimate climate change effects as climate change effects are wider than the transmission channels used. The need to calculate climate risks with credible source is also raised. Some respondents see the need to form an own explicit view on climate change scenarios, while other respondents deem this too much subject to individual knowledge or preferences. Given these considerations, a respondent comments on the level of comfort needed to use the scenarios and calculations in the allocation advice (step 4).

Going forward, possible future practices relate to adding the impact or sustainability potential per asset class. This concerns the degree to which asset classes can contribute to achieving the sustainability targets, including the specific targets on impact.

3. Asset liability management (ALM) analysis

The ALM team provides an ALM analysis on the pension fund level: how to invest the assets in order to meet the liabilities to the pension beneficiaries. Certain indicators calculated and advised on are part of the pension legislation in the Netherlands. In its liabilities, the age distribution of beneficiaries, as well as average life expectancy are large factors. The ALM analysis contains advice on how to constitute the investment portfolio's three building blocks: a return portfolio, a matching portfolio and advice on interest rate hedging. So far, there are no elements integrated relating to transitions or sustainability. This is partly due to the peak in work related to pension law changes and partly due to the fact that certain respondents see limited opportunities for integration in this step. Two quotes illustrate how respondents view the opportunities for integration differently.

4. Asset allocation advice

The asset allocation advice then follows, including advice on a further allocation to asset classes. The advice mostly explains the proposed changes as compared to previous years and the considerations therein, where some changes are part of longer-term phase out periods and others relate more to recent decision-making. The portfolio resulting from the advice is assessed against several criteria, such as optimalisation, liquidity, ALM criteria, steerability, costs and the upcoming pension law changes. The advice also includes graphs of what asset classes add compared to the most liquid alternative (e.g. equities or liquid credit), in order to show the added value of each asset class in the portfolio.

Currently, the advice already includes the impact of the proposed allocation changes on three sustainability targets (CO_2 emissions, Paris Alignment and SDG investments). For example, if the allocation to an asset class with low carbon emissions is lowered, the average portfolio's carbon intensity will increase. As the sustainability targets are or cannot be measured for all asset classes (see Research setting), the potential impact of allocation changes is not always straightforward. The advice also includes an analysis on a hypothetical limit on climate risk, by indicating the impact of a 10% reduction in physical and transition climate-related risk on the allocation. As transition risk is currently measured through carbon pricing, effectively asset classes with relative low exposure to high emission sectors are then preferred over asset class with high exposure to high emission sectors.

Going forward, several possible future practices for integration are put forward. The allocation advice could include advice based on the climate risk assessment as well as based on the potential per asset class for reaching impact and sustainability targets. The climate risk assessment is developing practice, as bottom-up analysis and top-down analysis are being calculated and advancing over time (see Capital market assumptions).

5. Investment plan

Based on the decisions taken in the CB where the asset allocation advice is discussed, the investment plan is approved by PFZW, which includes the decision-making on ALM and strategic asset allocation for the following year. So far, this plan does not include practices relating to transitions and sustainability. Going forward, whenever decision-making relating to transitions and sustainability is being done in the ALM and allocation advice steps, these could be integrated in the investment plan.

6. Strategic added value

The last step of Strategic added value is a reflection on whether the allocation indeed led to the intended results. This reflection is the starting point for the new SAA cycle, in terms of the discussion points and agenda within the next cycle and combines quantitative analysis with interpretation of figures and graphs. In terms of current integration practices, it includes an analysis of the effect of exclusions on return, within equity investments. It shows how deviations from the total investable equity universe affected the return of the equity portfolio over the years, which is limited. Second, an indication is included per asset class on whether it is 'on track' towards achieving the sustainability targets. As this document is less discussed in interviews, limited views are shared on the possible future practices to further integrate transitions and sustainability.

Appendix A4.5 – Integrated SAA (Chapter 3), PGGM's application and possibilities for further integration

Panel A: Overview Integrated SAA (Chapter 3), PGGM's application and possibilities for further integration

Integrated SAA (Chapter 3)	PGGM's current & future practices	Possibilities for further integration
1. Set an integrated investment policy • **Formulate mission and investment objectives (return, risk, impact)** • **Adopt investment beliefs, including impact beliefs** • **Determine risk appetite**	**Case study research: Research setting** • Investment beliefs include both outside-in ESG risk and inside-out impact • Sustainability objectives set in Strategy 2030	• Formulate clearly end objective SAA in order to identify practices beyond current modelling and methods that may be complementary to achieve the objective • Determine and agree on risk, return and sustainability objectives on the portfolio level
2. Form capital market assumptions • **On growth, interest rate, inflation and transitions** • **Transitions requires a sector view**	**Case study research: Phase 1, 2 and 3** • Transition analysis and influence of transitions on deterministic scenarios • Deterministic climate scenarios • Consider consensus of transitions embedded in stochastic modelling	• Call for academic research to build on environmental science to identify expected effects on and of investment portfolios • Acknowledge current gaps in climate scenario's and develop qualitative approaches to fill these gaps in the meantime • Consider the sector and geographical distribution of investments, to analyse transition effects • Identify 2-3 relevant transitions, develop transitions pathways, and identify relevant risks and opportunities in the investment portfolio, discuss and take actions based on identified insights
3. Form risk-return-impact expectations • **Integrate impact alignment as a separate dimension** • **Extend to risk-return-impact expectations on all asset classes, informed by sector views**	**Case study research: Phase 2 and 4, investment cases, change agenda Strategy 2030** • Impact of allocation advice on the realisation of sustainability targets • Allocation advice based on climate risk assessment and potential per asset class for reaching impact and sustainability targets	• Each asset class (and sectors and geographies) provide different potential for achieving risk, improve risk profile and achieve sustainability targets. These insights can be provided in overviews, simplified objective functions and/or visualised in figures • Consider investor impact levers (e.g. capital allocation, active engagement and indirect impact) and how to employ these
4. Construct the portfolio • **Stochastic modelling and scenario analyses using macroeconomic and transition factors** • **Results in different asset mixes with different risk-return-impact characteristics** • **Construct a portfolio by optimising expected risk-return-impact, informed by sector views**	**Case study research: Phase 4, 5 and 6** • Development of risk framework with portfolio steering on risk, return, impact • Per asset class indicated whether investments are 'on track' for achieving sustainability targets	• Adopt decision-making steps or options, to structure the integrated decision-making, combining top-down steering on sustainability objectives, and bottom-up analysis for sustainability potential • Reflect whether assumptions in portfolio construction decisions indeed resemble the realisation, so that the room for active 3D considerations accurately describes the insights in investment practice to date

Panel B: Descriptions possibilities for further integration sustainability in SAA

Panel A provides a reflection of the observed practices towards the integrated strategic asset allocation framework (Chapter 3). For each step, possibilities for further integration are identified. While the observed case study practices relate mostly to climate change effects, the possibilities going forward include all relevant environmental and social transitions and impact. In general, possibilities arise when a broader range of expertise is considered, beyond the finance field.

In the investment policy (step 1), setting a clear end objective in SAA can support to identify practices beyond the current modelling and methods that may be complementary to achieve the Strategy 2030 objectives. It is important that risk, return and sustainability objectives (and their interrelations) are determined and agreed upon on portfolio level, as this provides steering throughout the investment process. In forming climate market assumptions (step 2), the case study shows that climate change effects are underestimated in current practices, in line with Reinders et al. (2023). The starting point going forward therefore lays in applying climate science insights to identify expected effects on and of investment portfolios. This is in the first place a call for further academic research, where climate science and finance research in collaboration advance much-needed insights (Reinders et al., 2023), for cross-sector collaborations to co-create knowledge and momentum (Busch et al., 2024), as this goes beyond the scope of one institutional investor. In the meantime, investors can acknowledge knowledge gaps and develop qualitative approaches to fill these gaps in current practices. Investors can analyse transition effects by considering the sector and geographical distribution of the investment portfolio. Transitions affect certain sectors and geographies more clearly and significantly than that they affect certain other sectors or asset classes. This relates to the fundamental acknowledgment that transitions hit the real economy, build up in sectors and located in countries, rather than that the financing structure of companies or projects (leading to asset classes) determines the exposure to transitions. An investor can identify two or three transitions that matter most, either because it anticipates the largest risks and opportunities in these or because it wants to impact these transitions positively. Investors develop transitions pathways, providing insights in the current positioning of the portfolio: investments at risk, investment opportunities and potential no- or least-regret actions or real options to take.

In forming risk-return-sustainability expectations for the portfolio (step 3), the future practices mentioned in the case study could advance practice significantly: to base the allocation advice on the climate risk assessment and the potential per asset class to reach sustainability targets. This will show that asset classes (and sectors and geographies) provide a different potential for achieving return, to improve the risk profile and/or achieve sustainability targets. These insights provide a basis to discuss what objective can be best achieved where. These insights can be provided in overviews, simplified objective functions and/or visualised in figures, in line and beyond the current asset allocation advice. A relevant consideration in this step is to consider that the ability for investors is to have investor impact (e.g. capital allocation, active engagement and system-level influence).

In the last step, construct the portfolio, decision-making takes place based on previous steps. By adopting decision-making steps or options, decisionmakers can be guided in this step. In the end, it comes down to a combined top-down steering on sustainability targets, and bottom-up analysis of where the sustainability potential is. In reflecting on decision-making, it is important to analyse whether portfolio construction decisions indeed resemble the realisation, so that the room for active risk-return-sustainability considerations accurately describes the insights in investment practice to date.

5. Do SDG contributions matter to asset prices? First evidence

5.1 Introduction

Investors can have a significant influence on companies through their (sustainable) investments. They can assess companies both through financial and corporate sustainability information. There is extensive literature which examines the relation between returns and corporate sustainability, on environmental, social and governance (ESG) ratings (Alves et al., 2025; Friede et al., 2015), carbon risk (Bolton & Kacperczyk, 2023; Pastor et al., 2022) and more recently on biodiversity (Flammer et al., 2024; Garel et al., 2024). This research aims to assess the value relevance of corporate sustainability, but often fails to measure the actual impact of companies' products and services. Moreover, ESG ratings are criticized for their relative measurement and validity problems (Berg et al., 2022; Chatterji et al., 2016; Kotsantonis & Serafeim, 2019).

In response to this, there is an emerging research strand focusing on companies' impacts and how investors can assess these (Busch et al., 2024; Chapter 2). Impacts are the results of an organisation's activities on individual stakeholders, society, and the environment[18]. Chapter 2 shows that academic literature gives only limited attention to how companies' impacts are incorporated into investment decisions. Over the past decade, contributions to the Sustainable Development Goals (SDGs) emerged as a new method for providing a more direct measurement of companies' impacts. SDG contributions entail measuring how companies' products and services contribute to achieving the SDGs. The SDGs were established in 2015 by the United Nations (UN). Since their inception they have served as a powerful framework for advancing sustainable development by 2030 (the SDGs' target year). SDG contribution data can offer investors relevant investment decision information (Bauckloh et al., 2024; Maniatakou et al., 2024). While Van Zanten (2025) finds that SDG contributions align more closely with investor and regulator views than ESG ratings, Baukloh et al. (2024) displays dispersion in SDG ratings and thus the lack of a clear SDG signal to investors.

With these initial insights in SDG contributions, the question arises whether SDG contributions matter to asset prices. Do investors care about SDG data? The ultimate aim of corporate sustainability measurement is to provide investors with the relevant information so that investors are able to incorporate companies' impacts on individual stakeholders, society, and the environment. Empirical research can provide insights into how investors value firms' SDG contributions. Initial studies into this relation find a negative relation between returns and SDG performance for the Chinese market (Chen et al., 2025a), or between financial performance and SDG performance for an U.S. sample (Mhiri & Ajina, 2026). Given the novelty of the data, research covering a global sample has not yet been published.

This paper is the first empirical study examining the relation between excess stock returns and SDG contributions in a global setting. Theoretically, there are two main channels through which SDG contributions might be expected to affect stock returns: the value channel and the risk channel. The value channel builds on the argument that a company's SDG contributions may lead to long-term value, translating into a higher company value and higher returns. The risk channel posits that SDG contributions may signal transition risk (or transition readiness), which can be reflected in a transition risk premium (or transition benefit) or the materialization of transition risk through lower realized returns. This study aims to provide empirical insights into this issue, as the two channels lead to opposing effects. The study employs the SDG dataset developed by Robeco. Robeco is an asset manager which developed the dataset originally for its own investment products and later made it publicly available for research purposes. The database has a relative long history, from 2010 onwards. After merging with other datasets, the sample comprises over a million observations, from 15,141 unique firms across 46 countries.

[18] The complete impact definition in Chapter 2 includes that impacts include 'intended and unintended, positive and negative, and short-term and long-term effects'.

The empirical results provide initial evidence for the risk channel: the results show that higher negative SDG contributions are associated with higher excess returns, and higher positive SDG contributions with lower excess returns. This relation is stronger for negative SDG contributions than for positive SDG contributions, and the relation is more pronounced in North-America, Emerging Countries and the Industrials sector.

These initial empirical results make a valuable contribution to the academic debate on corporate sustainability, particularly in valuing real-world impacts. It is the first empirical study to draw on a global sample to examine whether SDG contributions matter to asset prices. While SDG contributions were developed as an opportunity focused framework, the results provide the novel insight that negative SDG contributions seem to matter more than positive SDG contributions. This can inform investors that harming the SDGs (negative SDG contributions) is seen as a source of transition risk. Positive SDG contributions seem to matter less to asset prices, which can be explained in two ways: they do not enhance financial performance, but for investors seeking to contribute to the SDGs they do not harm performance either.

The rest of this paper is structured as follows. Section 5.2 provides the hypothesis development. Section 5.3 provides an overview of the methodology, including data collection and the estimations used. The results are presented in Section 5.4, followed by the discussion and conclusion (Section 5.5).

5.2 Hypothesis development

5.2.1 SDG contributions as a novel measure

SDG contributions measure the contribution of firms' products and services to the global goals as set by the UN. The SDGs address a broad spectrum of global challenges that matter to all people, businesses and countries, e.g. No poverty, Good health and well-being, Life on land. To reach these SDGs, societies and economies need to change over time. The required systemic changes are also referred to as transitions. Transitions are transformational system changes taking place through a process of buildup of new regimes and breakdown of old regimes over time to achieve a sustainable economy (Hebinck et al., 2022). The stage of transitions is driven by developments on different levels, such as public policies, technology and science, consumer preferences, innovation and how companies position themselves for transitions (Geels & Schot, 2007). SDG contributions serve as a proxy for how companies position themselves for transitions, as the SDGs relate to the main ongoing transitions, such as the energy transition, food transition, social transition and circular economy transition (Schoenmaker & Schramade, 2023)[19]. SDG contributions thus provide insights in companies' contribution to the main ongoing transitions.

SDG contributions differ from conventional ESG ratings in several ways. The main difference lays in what is measured: SDG data measures the contributions of a company's products and services (*what*), whereas ESG ratings generally only include business conduct and controversy related measures (*how*). SDG data measures a firm's impacts more directly, whereas ESG ratings focus on business operations and management of ESG topics (Edmans, 2023). ESG ratings are usually based on scores on a large number of sustainability topics, for which there are no agreed upon standards. The resulting combined scores are compared to peers, the market or the degree of risk mitigation (Kotsantonis & Serafeim, 2019). The ESG scores provide limited information as to whether company impacts improve over time and whether the economy becomes more sustainable as a whole. SDG contribution data is based on how companies contribute to a sustainable economy as formulated by the United Nations. It measures objective revenue streams and is not based on relative scoring. For example, in the case of energy transition, it includes adopting clean technologies and innovation opportunities for new products and services. These elements are absent from the 'E' scores in ESG ratings, as the 'E' scores focus on a firm's current business operations. Moreover, ESG ratings are based on self-reported (often unaudited) company

[19] SDG 7 Affordable and Clean Energy and 13 Climate action relate to the energy transition; SDG 2 Zero hunger, 14 Life below water, 15 Life on land relate to the food transition; SDG 1 No poverty, 8 Decent work and economic growth, 10 Reduced inequalities relate to the social transition and SDG 12 Responsible consumption and production relates to the circular economy transition.

information and the main ESG data providers are owned by rating agencies, leading to agency issues (Bekaert et al., 2023). While some SDG ratings are also owned by rating agencies, the SDG data in this paper is developed by an asset manager and made public for academic research purposes (see Section 3.1.1). To assess whether SDG contributions indeed capture different information than ESG ratings, a robustness test including the LSEG ESG data is included in the findings (see Section 4.5).

Certain challenges that apply to ESG ratings may also apply to SDG ratings. While the 17 SDGs provide a more normative framework, the SDG rating is still a combined score on a broad range of topics, creating potential noise similar to ESG ratings (Bams et al., 2022). In the case of the Robeco SDG data, the measure also include business operation contribution and controversy scores. There is a low level of agreement between ESG ratings (Berg et al., 2022), and initial evidence shows that this is also the case for SDG ratings (Bauckloh et al., 2024). While aiming to be more forward-looking and objective, current SDG data is mostly based on retrospective company information.

Compared to climate change and carbon related measures, SDG contributions encompass a broader range of objectives, by including social objectives and environmental objectives beyond climate change. This is an important difference, as social objectives are less examined in the literature than environmental objectives. Given that the theoretical arguments underlying carbon risk premia may extend to SDG pricing, this strand of literature provides a relevant theoretical basis and is therefore discussed in Section 5.2.4.

There are two primary channels that link SDG contributions to investors' excess returns, forming the central question in this paper: do SDG contributions enhance firm value (the Value channel) or do they proxy for transition risk (the Risk channel)? This distinction relates to the longer standing debate on the value relevance of corporate sustainability measures (Alves et al., 2025; Atilgan et al., 2025). A third channel is investor preferences for companies that contribute to SDGs; not described as a separate channel as this is more difficult to measure and capture. The value channel is mostly argued for in the ESG rating literature by documenting realised outperformance (Atilgan et al., 2025). The risk channel is generally supported in the asset pricing literature, more particularly literature on carbon risk. These strands of research often rely on different theoretical argumentation, reflecting disciplinary perspectives and research traditions (Hornuf & Yüksel, 2024). Given that SDG contributions are a relatively novel measure of corporate sustainability, it is interesting to examine which of these channels, if any, exists for SDG contributions. This study studies realized returns, which includes both expected returns and unexpected returns; the Discussion and Conclusion section (Chapter 5.5) reflects upon this difference.

5.2.3 The Value channel

First, the Value channel builds on the notion that SDG contributions create long-term value for companies, resulting in a higher company fundamentals (Kurznack et al., 2021). As these company fundamentals are gradually priced in by investors, stocks of firms with positive SDG contributions can yield higher excess returns (Battiston et al., 2025).

Over the course of transitions, SDG contributions can lead to higher company fundamentals through traditional value levers, e.g. grow revenue, increase profitability and improve investment efficiency (Cornell & Damodaran, 2020). SDG contributions can also improve alignment with customer preferences for sustainable products and reduce cost through lower environmental impacts (e.g. lower resource and energy use) (Battiston et al., 2025; Coqueret et al., 2025). In light of changing customer demands, a company adopting a broader societal purpose can drive enhancing long-term value to the firm (Dyllick & Muff, 2016). Companies' contributions to transitions are valued by society and stakeholders. With financial capital abundant and social and environmental capital approaching their limits, the importance of good stakeholder relations increases firms' value creation potential– shifting from tangible to intangible capital (Haskel & Westlake, 2018). Increasingly, excess value is derived from natural and social capital which are not recorded on the company's balance sheet. Incorporating stakeholder demands also helps to understand how transitions are likely to occur, thereby improving the company's positioning. Transition-readiness and products that increase in sales once transitions take place create

a competitive advantage, leading to increasing market share (Schoenmaker & Schramade, 2023; Yang et al., 2024).

Conversely, higher negative SDG contributions can indicate that a firm is ill-prepared for upcoming transitions, and that a firm is losing its legitimacy and license to operate (Dowling & Pfeffer, 1975). For example, firms that harm the SDGs may face reduced consumer demand, public scrutiny, and higher costs for its environmental impacts, either through increased prices and/or increased taxation (Edmans, 2023). In summary, there are several reasons why positive SDG contributions may positively affect firm value, while negative SDG contributions negatively affect firm value, associated with higher and lower excess returns for investors (Value channel).

The literature on the value relevance of ESG ratings generally builds on the value channel argument. To date, the research on ESG ratings shows mixed results – majority outperformance, but also insignificance and underperformance – , conclusions on the value relevance remains inconclusive (Berg et al., 2022; Friede et al., 2015; Hernuf & Yüksel, 2024). The realised outperformance in the ESG rating literature is attributed by Pastor et al. (2022, 2024) to unexpected returns. Unexpected returns represent the difference between expected and realised returns. Possible explanations of unexpected returns lie in demand pressure of sustainable investors (Van der Beck, 2025), news on future cash flows or news on future expected returns. For example, rising climate concerns (Pastor et al., 2022) and higher absolute emissions relating to higher earnings surprises (Atilgan et al., 2025). These unexpected returns are stronger within short sample periods, which are typical for studies in this field. Pastor et al. (2022, 2024) argue that unexpected returns only lead to temporary outperformance, once corrected by adequate pricing of investors it no longer exists. However, Hong and Stein (1999) and Dasgupta et al. (2011) show that gradual diffusion of information can lead to higher returns over a longer period. While investor preferences may drive excess returns in the short term, as transitions take place these may drive longer term excess returns (Battiston et al., 2025).

5.2.4 The Risk channel

The second channel for SDG contributions is the Risk channel, which main argument is that higher (or lower) transition risk is valued by investors with a risk premium (or discount), associated with lower (or higher) excess returns (Risk channel). The central argument is that firms are exposed to transition risks emerging from systemic changes in society: e.g. changing consumer demand, government intervention (taxation, regulation, fines), rising natural resource prices and physical consequences of climate change and other environmental developments (Bolton & Kacperczyk, 2023; Hsu et al., 2023). Transition-ready companies that operate more resource-efficient are less affected than their competitors by increased government regulation and taxation, e.g. carbon taxes, human rights due diligence, taxation on material use (Schoenmaker & Schramade, 2023). The degree to which governments act to support transitions influences the transition risk pricing, especially whether negative SDG contributions are priced by investors as firm specific risk (Atilgan et al., 2025). In summary, there are several reasons for SDG contributions to proxy for transition risk and thus lead to lower excess returns for positive SDG contributions (a transition discount) and higher excess returns for negative SDG contributions (transition premium) (the Risk channel).

In the literature, the risk channel is mostly examined in the context of climate change effects and carbon risk (Bolton & Kacperczyk, 2023; Pastor et al., 2022). In recent research, by Pastor et al. (2021), Pedersen et al. (2021) and Zerbib (2022), scholars argue that high carbon emitters are priced with a carbon risk premium. Empirical studies documenting a carbon risk premium attribute this to increased investor 'green' preferences and/or as compensation for increasing climate risk (Bolton & Kacperczyk, 2023; Pastor et al., 2022). Other authors attribute green outperformance to a gradual pricing in, towards a new climate-aware equilibrium (Pástor et al., 2021; Pastor et al., 2022; Pedersen et al., 2021). Zhang (2025) finds that, as firms' carbon data closely aligns with sales, the carbon premium is partly due to the forward-looking firm performance information that is embedded in carbon data. When accounting for a proper release lag on carbon data, carbon returns in recent years appear to mostly align with gradual pricing in towards a climate-aware equilibrium. This process can influence returns over a long period of time (Dasgupta, 2011). The academic debate on the carbon risk premium is ongoing,

e.g. on whether emission intensity or unscaled emissions is the adequate measure for carbon risk (Aswani et al., 2024; Bolton & Kacperczyk, 2024; Pastor et al., 2024).

Broader, there is academic debate on how physical and transition climate change effects affect financial markets (Cosemans et al., 2022; Fang et al., 2019; Reinders et al., 2023). The academic debate widened towards another environmental risk pricing, such as water and biodiversity risk. This latter strand of literature provides early evidence on the pricing of biodiversity risk, both in public and private markets (Coqueret et al., 2025; Flammer et al., 2024; Garel et al., 2024), while Xin et al. (2025) find that biodiversity measures are not related to returns.

5.2.5 SDG contributions research

The literature on SDG contributions is in an early stage. Van Zanten (2025) argues that SDG data better aligns with investors' sustainability preferences and regulators' views than ESG ratings. So far, there are a few studies examining the relation between SDG contributions and (excess) returns or firms' financial performance. Chen et al. (2025a, 2025b) also employ the Robeco SDG data. Chen et al. (2025a) find a negative SDG-excess return relation for the Chinese market, and find that SDG performance alleviates financial constraints and lowers financial risk, but does not increase financial returns. Chen et al (2025b) test for the biodiversity-related SDGs specifically and find a negative relation with short-term financial performance, particularly in developed countries. Mhiri & Ajina (2026) find for a sample of 337 U.S. firms over 2015-2021 that firms with higher SDG contributions have a lower cost of equity. They conclude that SDG contributions thus reduces perceived risk and improves a firm's risk profile in capital markets. Chini et al. (2024) observe mutual fund flows and find that funds with investments contributing to the SDGs only attract more inflows if they have an explicit sustainability mandate. Furthermore, investors' actions seem more to avoid harm, divesting from funds that have negative SDG contributions, rather than shifting capital towards positive SDG contributing funds. Yang et al. (2024) attribute a new outflow of SDG companies in the Chinese market to potential greenwashing behaviour.

Other studies examine SDG scores in a broader context. Sharma et al. (2025) find that firms contributing to the SDG bear a lower firm risk, by looking at investor confidence, agency cost and ESG performance. Bauckloh et al. (2024) show by comparison of 5 SDG-ratings that ratings differ significantly, leading to a lack of clear signal on SDG contributions to investors. They furthermore show that investors are exposed to different risk factor exposures when using different SDG ratings. Vasileva et al. (2024) find that firms contributing to the SDGs are less involved in scandals and if so, they are less severe. They thus interpret SDG contributions as an indicator of corporate legitimacy. Other recently published studies focus on SDG disclosures, for example by analysing annual report texts (Gabrielli et al., 2025; Ogrean et al., 2026) or by big data analysis of company's SDG contributions (Bekaert et al., 2023). These measures relate more to transparency and stakeholder management than to transition risk exposure.

Summarizing, the literature so far describes SDG contributions as a proxy for different concepts. This study takes SDG contributions as a proxy for impact, as defined in Chapter 2. Initial empirical studies find a negative relation between SDG contributions and returns or financial performance. This study is the first to examine the empirical relation between SDG contributions and excess returns in a large global sample. The question to be answered is whether SDG contributions affect asset prices and whether there is evidence for the Value or the Risk channel. This paper contributes to the literature on SDG performance, and broader to the field of corporate sustainability and asset pricing.

5.3. Methodology

5.3.1 Data collection

The SDG dataset (Table 5.1) assesses the SDG contributions by companies and is set up by Robeco, an asset manager based in the Netherlands. The dataset has a long history (2010 – now) compared to other SDG ratings and a large coverage of companies (Bauckloh et al., 2024).

After constructing this SDG rating for its own investment products, Robeco decided to make their methodology and scores publicly available (Robeco, 2025). Robeco calculates an SDG score, which takes an ordinal value between -3 and +3. Robeco employs a three-step rule-based approach where they assess:

Step 1) The extent to which a company's products and services contribute to the SDGs

Step 2) Whether the company's business conduct contributes to the SDGs, and

Step 3) Whether the company has been involved in controversies such as corruption, fraud or environmental accidents.

For step 1, around 200 indicators (e.g. share of revenue in certain products and services) are linked to positive impact on SDG targets. Both positive and negative contributions to all 17 SDGs are determined. In the Food sector for example, a certain revenue percentage in healthy foods leads to different contribution scores to SDG 3 'Health and well-being'. If a firm has limited revenue in healthy foods (<10%) it receives a -1 score, between 10-33% of revenue a neutral score, >33% revenue a +1 score and if over two-third of revenues is in healthy foods (>66%), the firm receives a +2 score (Robeco, 2025). The total SDG score is calculated with a min-max rule: companies without a negative SDG contribution receive their highest positive score (max), companies with a negative SDG contribution receive the lowest score as its overall SDG score (min). In case of the Food sector example, let's say there are two firms with >66% revenue in healthy foods, leading to score +2. One of the firms has no negative scores and thus receives the overall score +2, the other firm has a controversy (leading to score -1) and thus an overall SDG score of -1. In the calculation contributions to different SDGs are weighted equally.

The novelty of SDG data in general lays in the classification of products and services (*what*), as the well-established ESG ratings generally only include business conduct and controversy related measures (*how*). SDG data thus measures more directly the firm's impacts, with impacts defined as the results of organisation's activities on people and the environment (Chapter 2). Moreover, He et al. (2025) show that the Robeco SDG dataset does not have the size and location bias that most ESG ratings have. Van Zanten (2025) argues that the construct validity of the Robeco SDG dataset is larger than ESG ratings, as SDG data aligns better with investors' sustainability preferences (revealed through sustainable thematic funds and exclusion criteria) and regulators' views (revealed through the EU Taxonomy criteria). Robeco does not provide a further breakdown of the SDG score into the *what* (step 1) and the *how* (step 2 and 3) of companies, making it unfortunately not possible to test these elements separately.

The SDGs are set by the United Nations in 2015, and Robeco started the methodology and dataset in 2018. Based on this methodology, Robeco calculated SDG scores starting from 2010 on an annual basis. This results in an annual timeseries of 15 years at the time of research, covering a large universe of listed firms. Robeco releases an update each January, where they update SDG scores based on available company information of the preceding year. For the January 2025 release for example, Robeco analyses during 2024 the published 2023 Annual report to calculate the revenue % (Step 1) and to assess business conduct (Step 2), and analysed the controversies known to date (December 2024). At the time of the SDG data release, the updated scores are based on information already available to investors. Thus, the SDG data is effectively already lagged, and no further lagging is required in the statistical testing. Each January update is applied in the sample to monthly observations January-December, thus there is no variation in the Robeco SDG score within the respective year. It can be expected that SDG contributions are relevant to investors already before the SDG were announced (2015) and the methodology developed (2018), as the SDGs encompass a range of goals related to companies' impacts, which can be seen as firms' transition preparedness (see Hypothesis development). The SDG data thus entails a broader measure of companies' impacts and transitions preparedness, given also that Robeco backfilled the data (2010-2017) and given that SDG data is less commonly used by investors than financial information.

Related to the Hypothesis development, Robeco argues for the SDG value channel in its marketing materials for the Global SDG Equities strategy (Robeco, 2025). It states that new markets are created through technological progress, regulation, and consumer awareness. Sustainable companies thus have a competitive advantage. Investments in companies with strong operational sustainability and financial attractiveness lead to

higher risk-adjusted return. See also the information available on the Robeco website. The calculation of the PNSDG factor is included in Formula (2); further insights in the SDG data is included in Section 5.4.1.

Table 5.1 – Variable definitions and calculations Robeco SDG dataset

Variable	Definition	Calculation	Database
SDG	SDG score	SDG score* based on classification rules (see Section 3.1.2). Ranges from scores -3, -2, -1, 0, 1, 2, 3.	Robeco database
SDG pos	Positive SDG contribution	Positive SDG contributions* of the SDG score, where observations have their positive contribution score (1,2,3) and value 0 otherwise (in case of SDG score 0,-1,-2 and -3).	
SDG neg	Negative SDG contribution	Negative SDG contributions* of the SDG score, where observations with a negative SDG contribution (-1,-2,-3) get assigned values 1,2,3 respectively, and value 0 otherwise (in case of SDG score 0,1,2 and 3).	
PNSDG	Positive minus Negative SDG factor	The PNSDG Factor* is computed by value-weighted average returns of 2x2 portfolios, with companies sorted to size based on above and below the median market cap (Big and Small) and companies with SDG score of 2 or 3 (Positive) and SDG score of -2 or -3 (Negative). The PNSDG Factor is calculated as ½(Pos_Small-Neg_Small)+ ½ (Pos_Big - Neg_Big).	Robeco database, CRSP, Compustat North-America, Compustat Global

* No lagging required as SDG data updates are based on information already available to the market

For the empirical analyses in this paper company and stock market data is collected from Compustat Global for all countries except North-American countries. Data for US companies is taken from the Center for Research in Security Prices (CRSP) and for Canadian companies from Compustat North America. Excess returns are calculated by determining monthly returns for company *i* and subtracting the 1-month Treasury bill rate (rate differs per region). A detailed explanation of the calculation is included in Table 5.2A. Excess returns are winsorised at 0.5% and 99.5% cut-off points to mitigate the effect of outliers.

For the panel regressions (Formula 4-5), relevant stock characteristics are selected, based on Alves et al. (2025), Bolton & Kacperczyk (2023) and Huij et al. (2024). The data for stock characteristics is collected from Compustat Global and Compustat North-America (for US and Canadian firms); stock return data is used to calculate momentum and volatility. Table 5.2B provides a detailed overview of the stock characteristics definitions. All variables that denote amounts in local currencies are multiplied by the USD exchange rate, so that all tests are conducted in USD. The variables are winsorised at the 1% and 99% levels to mitigate the effect of outliers.

For the time series regressions (Formula 1-3), data is collected from the Kenneth French's library: regional Fama-French 5 factors, Momentum factor (Carhart, 1997) (see Table 5.2C) and the 1-month Treasury bill rate (used to calculate excess returns, see Table 5.2A). Descriptions of factor calculations can be found in Fama & French (2023) for US firms, in Fama & French (2015) for Europe and Asia Pacific and on the French's library website for Emerging Countries. The times-series regressions includes the Fama-French 5 and Momentum factors: the market risk premium (market risk minus risk-free rate, or *RMRF*), size premium (small minus big firms, *SMB*), value premium (high minus low book-to-market value, *HML*), the profitability premium (robust minus weak, *RMW*), the investment factors (*CMA*) and the Momentum factor (*UMD*). The Fama-French 5 factors are available for the regions North-America, Europe, Asia Pacific, Japan and a selection of emerging countries[20]. These regional factors are assigned to company observations based on firms' country of incorporation (fic) for

[20] **North-America** includes United States of America and Canada; **Europe** includes Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, Great Britain, Greece, Ireland, Italy, Netherlands, Norway, Portugal Sweden; **Asia Pacific** includes Australia, Hong Kong, New Zealand, Singapore; **Japan** includes Japan; **Emerging countries** includes United Arab Emirates, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, Indonesia, India, South Korea, Kuwait, Mexico, Malaysia, Peru, Philippines, Poland, Qatar, Saudi Arabia, Thailand, Turkey, Taiwan, South Africa.

the SDG portfolio time series regressions (Table 5.4 Column (1)-(4) and the developed market factors are used in Table 5.4 Column (5).

For the robustness tests controlling for an ESG rating, the ESG rating by London Stock Exchange Group is used (LSEG, previously called ASSET4 and Refinitiv ESG; see Table 5.2D). The ESG rating calculates an ESG rating which combines three pillar scores (environmental, social and governance) compiled from 186 underlying metrics (LSEG, 2024). The ESG and underlying pillar scores include this a wide range of topics such as resource use, human rights, and product responsibility. The scores range from 0 to 100, where scores above 50 indicate that a company has good relative ESG performance and above average transparency in reporting ESG data publicly. See also the information available on the LSEG website.

Table 5.2 – Variable definitions and calculations

Variable	Definition	Calculation	Database
A. Stock market data			
Monthly returns	Monthly returns	Monthly returns are calculated as ($Price_t$ x $TRFM_t$ /$AJEXM_t$)/ ($Price_{t-1}$ x $TRFM_{t-1}$/$AJEXM_{t-1}$)-1)x100. $Price_t$ denotes the closing stock price at month t. By dividing by adjustment factor $AJEXM_t$ and multiplying by $TRFM_t$, we adjust for dividends and stock-splits. For Compustat Global observations, dividends ($DVPSXM_t$) are added to $Price_t$ as $TRFM_t$ is not available. $Price_t$ and $Price_{t-1}$ are winsorised at 1% and 99% cut-off points and Monthly returns are winsorised at 0.5% and 99.5% cut-off points.	CRSP, Compustat North-America, Compustat Global, Kenneth French's library
R_i	Excess monthly return	Excess monthly return is calculated as Monthly returns minus 1-month T-bill rate. For the 1-month T-bill rate, the regional risk-free factor from Kenneth French's library is applied to observations based on country of incorporation.	
B. *Stock characteristics*			
Size	Company size	Natural logarithm of market capitalisation (in millions of US$)˜, where market capitalisation˜ is defined as shares outstanding multiplied by share price at the end of month *t-1*˜.	CRSP, Compustat North-America, Compustat Global
B/M or BM	Logarithm of the Book-to-market ratio	Book-to-market ratio˜ is book value of equity*˜ divided by market capitalisation˜at the end of month *t-1*. In line with Alves et al. (2025), book value of equity is calculated as the sum of Compustat items *seq, txditc* minus *pstk.* If *seq* is missing, then it is calculated as the sum of *ceq* and *txditc*. If *txditc* is missing, then it is calculated as the sum *seq*, *txdb*, *itcd* minus *pstk*.	Compustat North-America, Compustat Global
ROE	Return on equity	Return on equity is net income*˜ divided by total shareholders' equity*˜	
Lev	Leverage	Leverage*˜ is calculated as long term debt* (Compustat items *dltt*˜and *dlc*˜) divided by total assets* (Compustat item *at*˜)	
Beta	Market beta	Market beta˜ is the regression slope of a regression of monthly excess stock returns on the regional Fama and French (1993) market factor (North-America, Europe, Asia-Pacific, Japan, Emerging countries) over the previous 24 months. Minimum 12 months of valid excess return observations must be available Window set as *t-24* to *t-1* to avoid look-ahead bias in month *t*.	CRSP, Compustat North-America, Compustat Global, Kenneth French's library
Beta_within	Within-firm market beta	The within-firm variation of market beta. Used to mitigate the effects caused by perfect multicollinearity between Market beta and year-month fixed effects.	
Vol	Idio. volatility	Idiosyncratic volatility˜ is the annualised standard deviation of residuals of a 2-year rolling window regression of stock *i*'s monthly returns on the regional Fama and French (1993) market factor. Window set as *t-24* to *t-1* to avoid look-ahead bias in month *t*. Minimum 12 months of valid excess return observations must be available.	
Mom	Momentum	Momentum˜ is calculated as the cumulative return over the past 12 months excluding the most recent month.	
C. *Fama-French factors*			

RMRF	Market premium	Market premium is obtained by 1-year rolling window regression of stock i's daily returns on the Fama and French (1993) market factor.	Kenneth French's library, regional factors applied based on a company's country of incorporation
SMB	Size premium	Difference between the returns on a diversified portfolio of small stocks minus the return on a diversified portfolio of big stocks (Fama & French, 2015).(Fama & French, 2015).	
HML	Value premium	Difference between the returns on diversified portfolios of high and low book-to-market stocks (Fama & French, 2015).	
RMW	Profitability	Difference between the returns on diversified portfolios of stocks with robust and weak profitability (Fama & French, 2015), included in Fama-French 5 factor model.	
CMA	Investment factors	Difference between the returns on diversified portfolios of the stocks of low and high investment firms, which we call conservative and aggressive (Fama & French, 2015), included in Fama-French 5 factor model.	
UMD	Carhart Momentum factor	Difference between the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios (French, 2025).	
D. LSEG ESG score			
Combined ESG Score	LSEG ESG Score (previously called ASSET4 and Refinitiv ESG)	Combined score of three pillar scores (see next row); score ranges from 0 to 100, where scores above 50 indicate that a company has good relative ESG performance and above average transparency in reporting ESG data. Weight of social and environmental pillars in total score differs per industry; governance pillar weight is same across industries.	LSEG
Env. Score, Soc. Score, Gov. Score	LSEG Environmental, Social and Governance scores	Individual pillar scores, each pillar score ranges from 0 to 100. Each pillar consists of combined score of a few themes: environmental for emissions, innovation and resource use; social for community, human rights, product responsibility and workforce and governance for CSR strategy, management and shareholders.	

* Lagged with 6 months to avoid look-ahead bias; ˜ winsorised at 1% and 99% cut-off points

5.3.2 Time-series regressions

The first models are time-series regressions, where an initial analysis is done how the SDG contribution data relates to the Fama-French 5 factors and Momentum factor (FF5 and Mom).

In the first model, portfolios are constructed with monthly equally-weighted excess returns, based on the SDG contributions. Four portfolios are constructed: a Positive SDG contribution portfolio (observations with SDG score of 1,2,3), a Neutral (SDG score 0), a Negative (SDG score -1,-2,-3) SDG contribution portfolio and a Positive minus Negative portfolio. The following model is used:

$$R_{j,t} = \alpha_j + \beta F_t + \varepsilon_{j,t} \qquad (1)$$

where $R_{j,t}$ is the return of portfolio *j* in month *t*, α_j denotes abnormal return, the vector F_t includes the FF5 factors (*RMRF, SMB, HML, RMW, CMA*) and the Carhart momentum factor (*UMD*), and $\varepsilon_{j,t}$ as the residual term. The returns of portfolio *j* are the average returns of each SDG group (positive, neutral, negative) in each month, while the Positive minus Negative portfolio consists of the excess return difference between the Positive and Negative portfolio. Standard errors are adjusted for heteroskedasticity and autocorrelation using Newey-West (1987) estimators with four lags. This analysis is similar to Bauckloh et al. (2024), but they focus on the daily continuously compounding returns in 2021 only. They employ standardized SDG groups (Top, Middle, Bottom) using z-scores. Formula (1) is estimated with groups based on the SDG score itself, while Bauckloh et al. test for five separate SDG ratings with different methods, requiring standardization. Their sample consists of companies

rated by all five raters, resulting in a sample that is more similar to broad market indices and a smaller sample size than this study (1,057 companies) (Bauckloh et al., 2024).

In the second model, the total returns of the MSCI World Index are regressed on the FF5 and Mom, and a Positive-minus-Negative SDG factor (PNSDG) is added to examine whether the SDG scores have additional explanatory power for excess returns. PNSDG is calculated as a self-financing portfolio that takes a long position in stocks with SDG score 2 and 3 (Positive) and a short position in stocks with score -2 and -3 (Negative). The tails of this factor are not equal, as more firms are in the positive tail (28% observations) than firms in the negative tail (11% observations, see Table 5.3B). It is not possible to set up a factor with equal tails, as the SDG score only take one of seven integer values (-3 to 3). A double-sorted PNSDG factor is constructed, where stocks are sorted above and below the median market capitalisation (Big and Small) to account for a size effect. The PNSDG factor is calculated as

$$PNSDG = \frac{r_{Pos\_Small} - r_{Neg\_Small}}{2} + \frac{r_{Pos\_Big} - r_{Neg\_Big}}{2} \quad (2)$$

The computation of PNSDG follows similar logic as the Fama-French factors and is previously applied in sustainable asset pricing studies including the double sorting to account for a size effect, e.g. ESG ratings (Halbritter & Dorfleitner, 2015) and carbon risk premium (Huij et al., 2023; Pastor et al., 2022). The following model is estimated:

$$R_{j,t} = \alpha_j + \beta PNSDG_t + \beta F_t + \varepsilon_{j,t} \quad (3)$$

where $R_{j,t}$ is the excess returns on the MSCI World Index total returns in month *t*, α_j denotes abnormal return, the vector F_t includes the FF5 factors (*RMRF, SMB, HML, RMW, CMA*) and the Carhart momentum factor (*UMD*), and $\varepsilon_{j,t}$ as the residual term. The excess returns of the MSCI World Index are calculated using total return data, including reinvested dividends. This ensures consistency with FF5 & *UMD*, which are constructed based on total returns. $PNSDG_t$ does not require lagging, as the score is based on information already available to the market (see Section 5.3.1).

5.3.3 Panel regressions with SDG scores

Second, two panel regressions are run where excess returns are regressed on respectively the SDG scores only and controlling for stock characteristics. A panel regression with stock characteristics is suitable to provide a comprehensive picture of the cross-sectional variation and variation over time in stock-level returns. Bolton & Kacperczyk (2021, 2023) show that these characteristics are relevant to carbon emissions, and as this is the first global empirical study using SDG data, it is interesting to see whether this holds for SDG scores too. These models test for the ordinal SDG score from the database (a company score ranging from -3 to 3), making the results intuitive to interpret. The SDG scores are not normally distributed; observations are concentrated around the values 0,1 and 2 (combined 76% obs.). The cross-sectional variation is larger than the variation in stock-level returns over time. This is due to the fact that SDG scores take one out of seven integer values, and as the dataset is updated annually there is no variation on firm level within a year. The SDG scores gradually change over time, with firms' SDG scores correlating for 91.68% to the previous year (*t-12*, n=853,571) and correlating for 74.09% to the score 10 years earlier (*t-120*, n=113,303). This relates to the fact that scores are partly determined by revenue percentage in certain products and services, which for most firms are fairly stable over time. The time variation however, is theoretically interesting as it examines whether a firm's change in SDG contributions correlates to changes in excess returns. The scoring based on revenue streams also implies that SDG scores are by nature related to sector classifications. Sector-fixed effects are therefore included (GICS sectors). Year-month fixed-effects are included to account for time-specific dynamics.

The first panel regression regresses excess returns on the SDG scores only. The following model is used:

$$R_{i,t} = \gamma SDG_{i,t} + \alpha_j + \lambda_t + \varepsilon_{i,t} \quad (4)$$

where $R_{i,t}$ is the excess return on company *i* in month *t*, it includes sector fixed effects for *j* sectors (α_j) and year-month fixed effects (λ_t). Regional or country-based fixed effects are not included as SDG does not seem to have location based biases (He at al., 2025). $SDG_{i,t}$ does not require lagging, as the SDG scores are based on information already available to the market (see Section 5.3.1). $\varepsilon_{i,t}$ as the residual term; standard errors are clustered on firm level. γ is the coefficient of interest, as this shows the sensitivity on the SDG score of company *i* in month *t*. To analyse whether the SDG effect survives including common stock characteristics, these are added to Formula (1). This leads to the following model:

$$R_{i,t} = \gamma SDG_{i,t} + \gamma X_{i,t-1} + \alpha_j + \lambda_t + \varepsilon_{i,t} \qquad (5)$$

where the additional vector $X_{i,t-1}$ contains common firm characteristics: *Size*, *B/M*, *Beta or Beta_within*, *Vol*, *Mom*, *ROE* and *Lev*. *ROE* and *Lev* are lagged by 6 months to allow for incorporation of information from published annual reports; the other firm characteristics are lagged with one month to avoid look-ahead bias related to market information (see Table 5.2). As *Beta* has perfect multicollinearity with the year-month fixed effects (tested by regressing *Beta* on monthly dummies, with $R \approx 1$), two estimations are done: one including *Beta* and excluding year-month fixed effects, and another including *Beta_within* (the within-firm variation of the market beta, mean-centered) and year-month fixed effects. Controlling for firm characteristics is important, as the firm's revenue percentages where the SDG score is based on, is linked to sales information (in a similar manner as Zhang (2025) finds for carbon intensity).

5.4. Results

5.4.1 Descriptive statistics

After data collection and merging of the datasets, the total dataset includes over 2.5 million observations of 18,228 unique firms. For roughly 1.1 million of these observations an SDG score is available. Appendix A5.1 displays the descriptive statistics of the total dataset, which shows that the average monthly return is 0.957% and the average monthly excess returns is 0.876%. The average monthly return is in line with Alves et al. (2025), where the average monthly returns in the full dataset and ESG samples range from 0.876% – 1.069%.

After removing observations without SDG scores, the sample for this Chapter contains over a million monthly return observations from 15,141 unique firms. Table 5.3A shows the key descriptive statistics for the sample. The average monthly return is 0.700% and the average excess monthly return is 0.530% (annualized 6.36%). The average returns are lower than in Alves et al. (2025), which can be explained by the sample composition. First, the dataset is heavily concentrated in the 2021–2024 period, which accounts for 52.32% of total observations. This period is characterized by substantially lower average monthly excess returns (0.220%) compared to 2010–2020 (0.870%)[21]. Second, North American firms constitute a relatively small share of the sample (31.33% of observations), while exhibiting higher monthly excess returns (0.808%) than in the other regions (Europe 0.319%, emerging countries 0.469%, Asia-Pacific 0.150% and Japan 0.468%). For comparison, as of Jan 30, 2026 the MSCI World Index allocates 71.24% to U.S. based firms, 5.69% to Japan and 23.07% to all other countries. In addition, the sample has an overweight in sectors Industrials and Materials, and underweight in Information Technology relative to the MSCI World Index (see Appendix A5.II, panel C). The sample comprises all firms for which Robeco assigned an SDG score and for which the required financial data were available from other sources. It is therefore constructed to address the research question of this chapter rather than to replicate an investable portfolio or a representative benchmark such as the MSCI World Index. Consequently, the descriptive statistics should not be interpreted as evidence regarding the (potential) performance of SDG investing.

The variable *Size* (natural logarithm of market capitalisation) has a mean (median) of 8.043 (7.857). The *B/M ratio* (natural logarithm) has a mean (median) of -0.935 (-0.847). Average return on equity is 0.071 and average leverage 0.247. The average (median) firm has a *Market beta* of 0.895 (0.892) and annualised

[21] Moreover, the samples by Alves et al. (2025) include data up until 2020, thus excluding 2021-2024.

idiosyncratic volatility of 35.181%. The descriptive statistics for *Size*, *B/M*, *Lev* and *Vol* are in line with Alves et al. (2025). The descriptive statistics for *ROE* are in line with Bolton & Kacperczyk (2023)[22]. The momentum has an average of 8.484. As the average returns are lower, the average momentum is also lower than in Alves et al. (2025). The average market beta is stock markets is by definition 1, but in this sample slightly below one (0.895) due to the sample composition. The market beta is computed using the regional Fama and French market factors. Further analysis on country-specific market betas confirms that the standard deviation in this sample is indeed low[23].

The correlation table (Table 5.3B) shows that the SDG score has a limited correlation with the stock characteristics. This can be partly explained by the fact that the SDG scores have limited variation (see Section 5.3.2). The sample shows autocorrelation for the excess returns and SDG scores and thus standard errors are clustered on firm level.

Table 5.3C displays the distribution of the SDG scores: on average, firms score a positive score (0.524 on the range of -3 to 3). One-fifth of firms score a negative score (-3,-2,-1), 22% a neutral score and over half of the firms (57%) a positive score (1,2,3). As the SDG contributions methodology assigns certain revenue proportions as positive or negative, it can be expected that scores align with the sector distribution. Table 5.3D with the distribution of scores per sector shows that this is indeed the case. In the sectors Consumer Staples, Energy and Utilities there are relatively many firms with negative SDG scores; in the sectors Materials and Real Estate majority of the scores is neutral; in the sector Financials, Health Care and Information Technology the far majority of firms have positive scores.

[22] Alves et al. (2025) does not include ROE as a stock characteristic. Bolton & Kacperczyk (2023) winsorised ROE at the 2.5% level, resulting in a higher average and lower standard deviation compared to winsorizing at the 1% level (this article).

[23] Country specific market betas are calculated as the weighted average of stock market returns in each country and month, with weights proportional to the market capitalization of each stock.

Table 5.3 – Descriptive statistics SDG dataset

The table reports descriptive statistics on the variables used in the analysis (see Table 5.1 & 5.2 for variable definitions). Panel A reports summary statistics and Panel B the distribution of Robeco's SDG scores in the sample. This sample consists of the intersection between CRSP, Compustat Global, Compustat North-America, Robeco SDG dataset and Kenneth French's library. The sample period is January 2010 to December 2024.

Panel A – Descriptive statistics variables

	N.o. Obs	Mean	SD	1%	5%	25%	Median	75%	95%	99%
Return (in % per month)	1,009,554	0.700	11.146	-28.818	-15.895	-5.110	0.075	5.852	18.800	37.944
Excess Return (in % per month)	1,009,554	0.530	11.151	-29.009	-16.084	-5.288	-0.054	5.699	18.624	37.733
Robeco SDG score	1,009,554	0.522	1.456	-3	-3	0	1	2	2	3
Size	891,456	8.043	1.897	4.017	5.315	6.723	7.857	9.165	11.672	12.728
Book/Market ratio (logarithm)	714,790	-0.935	1.268	-4.434	-3.169	-1.695	-0.847	-0.092	1.017	2.066
Return on Equity	757,377	0.071	0.246	-1.168	-0.271	0.035	0.093	0.158	0.341	0.685
Leverage	908,186	0.247	0.200	0.000	0.001	0.078	0.219	0.368	0.614	0.932
Market beta	1,008,302	0.895	0.104	0.737	0.751	0.793	0.892	0.969	1.067	1.077
Market beta (within firm)	1,008,302	-0.000	0.098	-0.171	-0.149	-0.087	-0.004	0.061	0.160	0.178
Idiosyncratic Volatility (in %)	1,009,481	35.181	14.754	11.750	14.630	24.383	34.063	42.184	63.031	66.106
Momentum (in %)	984,946	8.484	35.701	-88.174	-47.510	-11.814	6.630	27.085	70.113	118.856

Panel B – Correlation table SDG and stock characteristics

All correlations are significant at 1% level. Correlation table based on 696,266 observations.

	SDG	Size	B/M	ROE	Leverage	Market beta	Idio. Volatility	Momentum
SDG	1.000							
Size	-0.081	1.000						
B/M	-0.066	-0.564	1.000					
ROE	-0.069	0.203	-0.037	1.000				
Leverage	-0.123	0.123	-0.079	-0.067	1.000			
Market beta	0.013	0.030	-0.007	0.008	0.010	1.000		
Idio. Volatility	0.010	-0.134	-0.019	-0.073	0.013	0.025	1.000	
Momentum	-0.007	0.129	-0.203	0.023	0.013	0.127	0.052	1.000

Panel C – Distribution SDG scores (-3 to 3) in sample

Robeco SDG score	N.o. Obs	Perc.	Cum. Perc.
-3	51,706	5.12	5.12
-2	60,898	6.03	11.15
-1	94,307	9.34	20.50
0	225,206	22.31	42.80
1	293,407	29.06	71.87
2	247,543	24.52	96.39
3	36,487	3.61	100.00
Total	**1,009,554**	**100**	

Panel D - Distribution SDG scores (-3 to 3) per GICS sector and total (as % of observations)

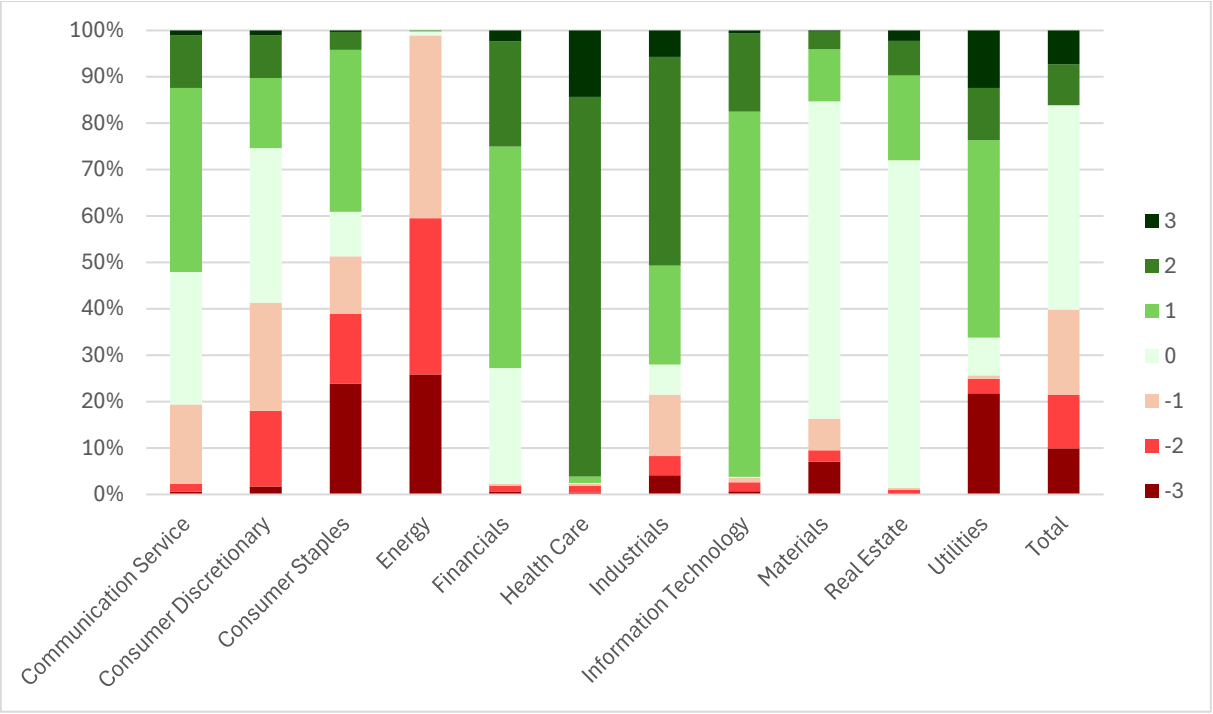
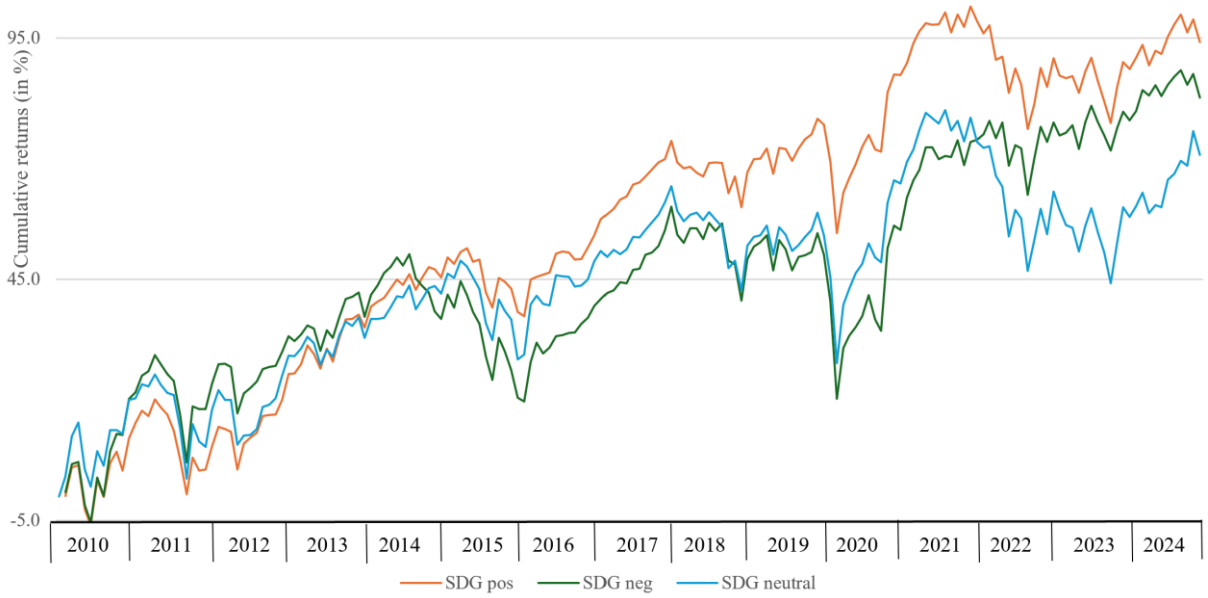


Figure 5.1 shows the development of cumulative excess returns over the sample period (January 2010 - December 2024) for the Positive (SDG score 1,2,3), Neutral (SDG score 0) and Negative SDG (SDG score -1,-2,-3). It shows that the Positive SDG portfolio performed best (cumulative excess returns 94.2% over sample period), 11.6% more than the Negative SDG portfolio (82.6%) and 23.5% more than the Neutral SDG portfolio (70.7%). The returns of these portfolios are further examined in the time-series regressions in the next Section (5.4.2).

Figure 5.1 – Cumulative excess returns 2010-2024 Positive, Neutral and Negative SDG
The figure shows the development in cumulative excess returns for the Positive (SDG score 1,2,3), Neutral (SDG score 0) and Negative SDG (SDG score -1,-2,-3) portfolios.



Appendix A5.II provides insights in the sample composition geographically (Appendix A5.IIA), over time (Appendix A5.IIB) and per GICS sector (Appendix A5.IIC). The firm observations are from 46 countries, with the largest countries represented the United States (28% of firm obs.), Japan (14%) and China (9%). The distribution of observations across years is unbalanced, with 13,813 observations in 2010 gradually increasing to 170,209 observations in 2024. The dataset is concentrated in the 2021–2024 period (52.32%). The sample is distributed across GICS sectors, the largest sectors being Industrials (19%) and Financials (14%).

5.4.2 Results time series regressions

This section outlines the results for the time series regressions, controlling for the Fama French 5 and momentum factors (FF5 and *UMD*). Table 5.4 Column (1)-(4) show the results for the SDG portfolio groups (Positive, Neutral and Negative SDG) and the Positive minus Negative SDG portfolio (Formula 1), while Column (5) displays the results for the MSCI World Index, controlling for the PNSDG factor (Formula 3).

The results in Columns (1)-(3) show that there is a positive abnormal return (α) for the Positive SDG portfolio and insignificant abnormal returns for the Neutral and Negative SDG portfolios. Given that the sample composition does not mirror the overall market (see Section 5.4.1), the external validity of these findings may be limited. The results are therefore compared in detail with the findings by Bauckloh et al. (2024). The adjusted R^2 shows that the FF5 and *UMD* factors explain around 90% of the variation in the excess returns.

The abnormal positive return for the Positive SDG portfolio (16 bps monthly excess returns) shows that the Positive SDG portfolio is slightly outperforming the market in this sample. The exposure to the market risk factor *RMRF* is higher for the negative SDG portfolio (0.924) than for the neutral (0.868) and positive SDG portfolio (0.844), indicating that negative SDG firms are more exposed to systematic market risk. This finding is

consistent with Bauckloh et al. (2024), who also find for the Robeco SDG portfolios that from Bottom to Top, the portfolios are more to least exposed to *RMRF*. The sample comprises a broad range of firms, including both large- and small-cap companies, resulting in an overweight exposure to small-cap stocks relative to the market. The *SMB* factor exhibits statistically significant effects across all portfolios, with the neutral SDG portfolio displaying the largest loading (0.534). Bauckloh et al. (2024) also find that the Top and Middle portfolio are exposed to small caps, the Middle portfolio with a larger effect. All three portfolios have a positive *HML* beta, implying that these portfolios have a tilt towards value stocks (rather than to growth stocks). This exposure is larger for the neutral and negative SDG portfolio (0.198 and 0.289, respectively) than for the positive SDG portfolio (0.083, statistically insignificant). Bauckloh et al. (2024) also find a tilt towards value stocks for the Bottom portfolio, but find a tilt to growth stocks for the Middle portfolio and no tilt for the Top portfolio. The *RMW* and *CMA* loadings in Table 5.4 are mostly insignificant, except for the *CMA* factor in the positive SDG portfolio, which indicates a tilt towards aggressively investing firms (with high asset growth) rather than to conservative firms (with low asset growth). The Positive and Negative SDG portfolios have a negative momentum (*UMD),* with a relative small economic size and significant on 10% and 5% conf. level, respectively. Bauckloh et al. (2024) find no significant results for the *RMW* factor, only on a 10% sign. level for *CMA* and their analysis does not include *UMD*.

Column (4) reports the results for the Positive minus Negative SDG portfolio. This portfolio delivers an positive abnormal return of 0.092, although the estimate is statistically insignificant. It exhibits a negative loading on the market factor (*RMRF*), suggesting lower systematic market exposure relative to the benchmark. In contrast to the separate portfolios, the Positive minus Negative portfolio has a tilt towards growth stocks (negative *HML*), and exposure towards large stocks, although statistically insignificant (negative *SMB*). These factor loadings are consistent with Bauckloh et al. (2024) and Pastor et al. (2022). Pastor et al. (2022) find that the Green minus Brown portfolio (GMB) has exposure towards large stocks and growth stocks, and furthermore a tilt towards recent winners (*UMD*). The tilt toward large and growth stocks is consistent with the notion that sustainable firms are often characterized by stronger innovation capacity, intangible capital intensity, and lower carbon exposure, as documented in Pastor et al. (2022). In their study, the GMB portfolio earns a statistically significant abnormal return of 0.47, and the authors attribute this performance to climate-related risk exposures and changes in investor preferences for green assets. This latter finding contrasts with findings in Column (4), as the outperformance is statistically insignificant.

In their analysis of five different SDG ratings, Bauchloh et al. (2024) show that by applying an SDG rating for setting up an investment portfolio, investors are exposed to different factor exposures depending on their SDG rating choice. While the results in this study are mostly comparable, the differences with Bauckloh et al. (2024) also show that the factor exposures of SDG portfolios are sensitive to the sample composition, time period and frequency of data (daily or monthly).

Table 5.4 – Time series regression SDG portfolios and MSCI World Index

This table reports the results of estimating Formula (1) for three equally-weighted SDG group portfolios: Positive SDG contributions (score 1,2,3, Column 1), Neutral (score 0, Column 2) and Negative (score -1,-2,-3, Column 3), Positive minus Negative SDG portfolio (Column 4) and Formula (3) for MSCI World Index (Column 5). Regional Fama-French factors are assigned based on firms' country of incorporation (fic) (Column 1-4) while Column (5) employs the developed market factors only. The sample period is from January 2010 – December 2024. Portfolio monthly returns are % on monthly basis, so α and β's are denoted in basis points. Standard errors are Newey–West (1987) with four lags. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable:	*Monthly excess return in %*				
	(1) Positive SDG	(2) Neutral SDG	(3) Negative SDG	(4) Pos – Neg	(5) MSCI World Index
α	0.160**	0.072	0.068	0.092	0.002
	(0.071)	(0.094)	(0.129)	(0.126)	(0.015)
RMRF	0.844***	0.868***	0.924***	-0.080**	0.998***
	(0.022)	(0.033)	(0.048)	(0.039)	(0.005)
SMB	0.360***	0.534***	0.440***	-0.079	-0.143***
	(0.053)	(0.060)	(0.107)	(0.091)	(0.009)
HML	0.083	0.198**	0.289***	-0.206***	-0.000
	(0.058)	(0.086)	(0.071)	(0.077)	(0.012)
RMW	-0.085	0.067	0.021	-0.106	0.050***
	(0.077)	(0.101)	(0.167)	(0.156)	(0.016)
CMA	-0.174**	-0.083	0.109	-0.283**	0.011
	(0.073)	(0.097)	(0.099)	(0.116)	(0.019)
UMD	-0.061*	-0.074	-0.091**	0.030	0.006
	(0.032)	(0.049)	(0.041)	(0.044)	(0.006)
PNSDG					0.008
					(0.008)
N.o. time periods	179	179	179	179	179
Adj. R2	0.944	0.922	0.896	0.300	0.998

Column (5) displays the time series regression results where the MSCI World Index total returns is regressed on the PNSDG factor, FF5 and *UMD* factors (Formula 3). The intercept indicating abnormal return (α) is statistically insignificant, as expected, given that the MSCI World Index closely corresponds to the developed market universe underlying the FF5 and *UMD* factors. The estimated market beta is close to one (0.998), consistent with the index representing a broad market portfolio. The adjusted R^2 shows that over 99% of the time-series variation in the excess returns is explained by the factors in the model, suggesting a very strong model fit. The PNSDG factor show an insignificant result (t= 0.98). This suggests that the PNSDG factor does not provide incremental explanatory power beyond the established FF5 and *UMD* factors. However, this specification captures only time-series variation, while the dataset contains more cross-sectional variation than time variation. The following section therefore employs panel regressions that account for both time-series and cross-sectional dimensions of the data.

5.4.4 Results panel regressions

Table 5.5 shows the panel regression results where excess returns are regressed on SDG scores (taking values of -3 to 3, Column 1) and stock characteristics (Column 2 and 3). Column (2) excludes year-month fixed effects, as these would be perfectly collinear with the market factor. To account for this, Column (3) includes a mean-centred market beta, thereby isolating within-firm variation in beta over time. The coefficient for the market beta has a large effect size (7.585) in Column (2), indicating a strong relation between excess returns and the market beta. The results for the stock characteristics are in line with the literature, with a negative coefficient for *Size* and a positive coefficient for *B/M, ROE* and *Lev*. *Vol* shows a negative relation with excess returns and *Mom* a positive

but small effect. Together with the fixed effects, the included control variables capture the key cross-sectional return patterns established in the asset pricing literature. The relatively low adjusted R^2 values are consistent with the literature, as panel regressions with firm-level stock returns contain substantial idiosyncratic variation, which generally cannot be explained by stock characteristics.

Column (1)-(3) show a statistically significant negative relation between excess returns and the SDG score. This negative relation contradicts the finding of the positive outperformance of SDG positive portfolio (Table 5.4) and may relate to the panel regression also capturing the cross-sectional variation in the sample. In the panel regressions, an increase in the SDG score of +1.5 (one standard deviation) is associated with a lower monthly excess return of between 5.2 and 6.8 basis points (bps), which translates ceteris paribus to –0.62% to –0.82% on an annual basis. These results seem to confirm hypothesis 2a that firms with higher SDG scores bear a lower transition risk and thus yield lower excess returns.

Table 5.5 – Panel regressions SDG scores and stock characteristics

This table reports the results of estimating Formula (4) and (5). The sample period from January 2010 – December 2024. Monthly excess returns are % on monthly basis, so γ's are denoted in basis points. Standard errors are clustered at the firm level. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable	*Monthly excess return in %*		
	(1)	(2)	(3)
SDG	-0.068***	-0.052***	-0.058***
	(0.010)	(0.012)	(0.011)
Size		-0.138***	-0.118***
		(0.013)	(0.014)
B/M		0.139***	0.120***
		(0.020)	(0.020)
ROE		0.548***	0.467***
		(0.092)	(0.088)
Leverage		0.752***	0.490***
		(0.083)	(0.078)
Market beta		7.585***	
		(0.133)	
Market beta (within firm)			-7.411***
			(0.669)
Idio. Volatility		-0.037***	-0.082***
		(0.001)	(0.020)
Momentum		0.004***	0.008***
		(0.001)	(0.001)
Constant	1.135***	-4.232***	11.534***
	(0.214)	(0.174)	(0.732)
Sector fixed effect	Yes	Yes	Yes
Year-month fixed effect	Yes	No	Yes
N.o. Obs.	969,500	667,521	667,521
Adjusted R2	0.134	0.009	0.151

Table 5.6 outlines the results when SDG positive (SDG pos) and SDG negative (SDG neg) scores are included separately; negative SDG contributions are defined as positive values (see Table 5.1). In Column (1), SDG pos has a negative relation, but when controlling for stock characteristics, the relation with excess returns becomes insignificant (Column 2 and 3). All three regressions show a significant positive relation between excess returns and the negative SDG score, with the effect size ranging from 0.090 to 0.123. An increase in SDG neg of +1 (e.g. from SDG score 0 to -1, or -2 to -3) is associated with a higher monthly excess return of between 11.1 and 15.1 basis points (bps), translating ceteris paribus to 1.33% to 1.82% annually[24]. Twenty percent of the firm observations has a negative SDG score, so these results reflect the return behaviour in this part of the sample.

Table 5.6 – Panel regressions positive and negative SDG scores and stock characteristics

This table reports the results of estimating Formula (4) and (5). Column (1)-(3) include same variables as in Table 5.5, but for overview purposes, only the effects of positive and negative SDG are shown. The sample period from January 2010 – December 2024. Monthly excess returns are % on monthly basis, so γ's are denoted in basis points. Standard errors are clustered at the firm level. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable	*Monthly excess return in %*		
	(1)	(2)	(3)
SDG pos	-0.048***	0.028	0.006
	(0.017)	(0.021)	(0.020)
SDG neg	0.090***	0.123***	0.115***
	(0.019)	(0.021)	(0.020)
Stock characteristics	No	Yes	Yes
Sector FE	Yes	Yes	Yes
Year-month FE	Yes	No	Yes
N.o. Obs.	969,500	667,521	667,521

The results in Table 5.5 and 5.6 constitute the main results of this study and show a negative relation between excess returns and SDG contributions of –0.62% to –0.82% on an annual basis, when controlling for stock characteristics. This empirical evidence seems to confirm the Risk channel. The results are consistent with the literature on SDG contributions; Chen et al. (2025a, 2025b) find a negative SDG-excess return relation and Mhiri & Ajina (2026) find that for US firms that higher SDG contributions are associated with a lower cost of equity, indicating lower transition risk. Furthermore, when differentiated between positive and negative SDG contributions, the results seem to indicate that this relation is stronger for SDG neg than for SDG pos. This may point towards the pricing of transition risk (SDG neg), rather than a discount on transition readiness (SDG pos). This is consistent with the finding by Chini et al. (2024) that the inflows for SDG investment funds are mostly driven by the negative SDG contributions. This may indicate that investors focus more on avoiding harm than on contributing to the SDGs.

[24] *SDG neg* has a standard deviation of 0.813, so SDG neg increase of +1 equals to an increase in excess returns of 1/0.813*γ.

5.4.5 Results regional and sectoral effects

To examine whether the results differ per region and sectors, the regressions are rerun per region (Table 5.7) and per GICS sector (Table 5.8). The results in Table 5.7 show the SDG contributions has a significant negative effect in North-America and Emerging Countries; the effect sizes (-0.064 and -0.098 respectively) are larger than in the main results. The pricing in North-America and Emerging Countries does not appear to be driven by more variation or on average higher SDG scores, as the mean SDG and standard deviations are comparable across regions. For Europe and Asia-Pacific, the estimated coefficients are negative but economically small and statistically insignificant ($t = -0.76$ and $t = -0.33$, respectively), indicating no robust evidence of SDG-related pricing effects in these markets. For Japan, the estimated coefficient is economically negligible and statistically insignificant ($t = 0.05$), providing no evidence of an SDG-related pricing effect in the Japanese market.

Table 5.7 – SDG scores and stock characteristics – Regional effect

This table reports the results of Formula 5 per region[25]. For overview purposes, only the effects of SDG are shown. Monthly excess returns are % on monthly basis, so γ's are denoted in basis points. Standard errors are clustered at the firm level. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable:	*Monthly excess return in %*					
Region:	(1) North America	(2) Emerging countries	(3) Europe	(4) Japan	(5) Asia Pacific	(6) Total
SDG	-0.064***	-0.098***	-0.019	0.001	-0.014	-0.052***
	(0.023)	(0.020)	(0.025)	(0.024)	(0.042)	(0.012)
Stock characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	No	No	No	No	No	No
N.o. Obs	232,815	196,126	114,764	94,769	30,287	667,521

Differences between SDG reporting in regions relate to an interplay of cultural, institutional and stakeholder factors (Van der Waal, 2024). In Western countries, businesses can enhance their corporate credibility by showing their contribution to sustainable development in a general sense, while in Asian countries corporate sustainability relates first to the direct group membership, e.g. employees, family and local society (Van der Waal, 2024). He et al. (2025) show in their study that the Robeco SDG scores in different regions do not significantly differ[26]; this study deepens this analysis by showing regional differences in the pricing of SDG contributions. When reflecting on the carbon risk literature, considering SDG as a transition risk indicator, Zhang (2025) finds a negative relation between returns and carbon intensity for developed markets and insignificant results for emerging markets.

The sector-level regressions (Table 5.8) suggest that the relation between excess returns and SDG contributions varies across sectors, with negative estimated coefficients in most sectors and positive coefficients in Consumer Discretionary, Health Care and Information Technology. These sectors provide products and services that contribute to transitions and the SDGs, hence these are sectors where the value channel is most likely, e.g. SDG contributions as value enhancing factors. The health care sector for example directly contributes to SDG 3 Good health and well-being. When considering carbon risk, the risk channel can be expected more

[25] **North-America** includes United States of America and Canada; **Emerging countries** includes United Arab Emirates, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, Indonesia, India, South Korea, Kuwait, Mexico, Malaysia, Peru, Philippines, Poland, Qatar, Saudi Arabia, Thailand, Turkey, Taiwan, South Africa; **Europe** includes Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, Great Britain, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Sweden; **Asia Pacific** includes Australia, Hong Kong, New Zealand, Singapore.

[26] They show this in a linear mixed effects model where SDG scores are regressed on size variables, a dummy variable for development markets and control variables.

pronounced for carbon-intensive sectors such as Energy, Materials, Utilities (when fossil-based) and to some extent Industrials. Marijnissen et al. (2025) estimated the transition risk by quantifying impacts and find the highest transition risk for resource-related sectors, e.g. Energy and Materials. However, the results for the Energy and Materials sectors are insignificant in Table 5.8 (with t= –1.44 and t= –0.63, respectively). The insignificant sectoral effects (for all sectors except Industrials) may reflect the lower within-sector variation (see Table 5.3D for the within-sector SDG score distribution) or reduced statistical power in the sector-specific regressions. For the Industrials sector, the estimated effect is significant and larger in magnitude (-0.099) than in the full sample results. This may indicate the presence of the risk channel for this sector specifically.

Overall, the subsample analyses suggest that the negative relation between SDG and excess returns is not uniformly distributed across regions and sectors, but is more pronounced in North America and Emerging Countries, and the Industrials sector. This initial evidence however needs further research to enhance insights in this regard.

Table 5.8 – SDG scores and stock characteristics – Sectoral effect

This table reports the results of Formula 5 per GICS sector. For overview purposes, only the effects of SDG are shown. Monthly excess returns are % on monthly basis, so γ's are denoted in basis points. Standard errors are clustered at the firm level. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable: *Monthly excess return in %*						
GICS Sector:	Communication Services	Consumer Discretionary	Consumer Staples	Energy	Financials	Health Care
SDG	-0.040	0.049	-0.034	-0.127	-0.103	0.041
	(0.058)	(0.031)	(0.029)	(0.088)	(0.065)	(0.053)
Stock characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	No	No	No	No	No	No
N.o. Obs.	36,267	92,993	41,901	31,966	30,235	75,394
GICS Sector:	Industrials	Information Technology	Materials	Real Estate	Utilities	Total
SDG	-0.099***	0.005	-0.026	-0.108	-0.014	-0.052***
	(0.020)	(0.055)	(0.042)	(0.077)	(0.031)	(0.012)
Stock characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-month FE	No	No	No	No	No	No
N.o. Obs.	147,752	83,062	78,376	19,030	30,545	667,521

5.4.6 Robustness test ESG rating

This section includes a robustness check to determine whether SDG contributions indeed differ from ESG ratings, as outlined in Section 5.2.1. Formula 2 is rerun controlling for an ESG rating, by overall score and by Environmental, Social and Governance pillar scores, in separate regressions.

Table 5.9 shows that the relation between excess returns and SDG contributions is robust for controlling for an ESG rating; effect sizes (-0.055 and -0.053) align closely with the main results (-0.052). The ESG rating itself has a small positive significant relation with excess returns (0.010, Column 1), mainly due to the Social and Governance pillar score (Column 2). The ESG rating thus has a positive relation, while the SDG contributions have a negative relation to excess returns, suggesting distinct impacts on returns. The results show furthermore that the Social and Governance pillar scores in this sample have additional explanatory power in explaining excess returns.

Table 5.9 – SDG scores and stock characteristics – Robustness test ESG rating

This table reports the results of Formula 5, controlling for an ESG rating (Column 1) and the separate Env. Score, Soc. Score and Gov. Score (Column 2). For overview purposes, only the effects of SDG and ESG scores are reported. Monthly excess returns are % on monthly basis, so γ's are denoted in basis points. Standard errors are clustered at the firm level. *,** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Dependent variable	*Monthly excess return in %*	
	(1)	(2)
SDG	-0.055***	-0.053***
	(0.013)	(0.013)
ESG Score	0.010***	
	(0.001)	
Env. Score		-0.001
		(0.001)
Soc. Score		0.008***
		(0.001)
Gov. Score		0.002***
		(0.001)
Sector fixed effect	Yes	Yes
Year-month fixed effect	No	No
N.o. Obs.	496,081	495,879
Adjusted R2	0.009	0.009

5.5 Discussion and conclusion

This paper empirically analysis the relation between Robeco's SDG contributions and excess returns in a global sample from 2010 to 2024. The SDG-return relation can be argued from two sides. First, as a Value channel, building on the argument that companies create value leading to higher returns. Second, as a Risk channel, where investors perceive SDG contributions as transition risk (or readiness), leading to higher (or lower) returns.

The timeseries regressions show negative SDG portfolio is more exposed to systematic market risk than the neutral and positive SDG portfolio. All three portfolios have a tilt towards small caps and value stocks. These findings are in line with the literature. The results furthermore show an positive abnormal return for SDG positive portfolio, which contradicts the findings in the panel regressions. Controlling for the FF5 and *UMD* factors, the PNSDG factor does not exhibit incremental explanatory power for the excess returns of the MSCI World Index.

The empirical evidence in the panel regressions provide initial evidence for the Risk channel. The main results show a negative relation between excess returns and SDG contributions of –0.62% to –0.82% on an annual basis. The results are consistent with the literature on SDG contributions who also find a negative SDG-return relation (Chen et al., 2025a, 2025b; Mhiri & Ajina, 2026). The results indicate that this relation is stronger for negative SDG contributions than for positive SDG contributions. This may point towards the pricing of transition risk rather than a discount on transition readiness, indicating that investors focus more on avoiding harm than on positively contributing to the SDGs.

Further analysis shows that the negative SDG-return relation shows dispersion across regions and sectors, and is more pronounced in North America, Emerging Countries, and the Industrials sector. A robustness test including the LSEG ESG scores shows the SDG-return relation remains stable. The LSEG ESG score shows a small positive effect, which suggests that SDG contributions are a different measure than ESG ratings.

This study contributes to the literature on corporate sustainability; more particularly on SDG measurement and transition risk. The study assesses companies' impacts by means of novel SDG contributions, serving as a proxy for transition risk. It operationalizes transition risks broader than just carbon risk, and signals firms' contributions to transitions. As the first empirical study studying the SDG-return relation in a global sample, it shows initial evidence for the Risk channel. The results show dispersion across regions and sectors.

While SDG scores are developed as an opportunity focused framework, the results show the novel insight that SDG contributions seem more a measure to identify companies' transition risk rather than transition-related growth opportunities. Furthermore, the study provides initial insights into the economic relevance of SDG contribution data, by showing that the SDG-return relation differs from traditional ESG ratings and by showing that SDG contributions lack incremental explanatory power beyond standard factor models. Collectively, the findings advance our understanding of how capital markets incorporate corporate sustainability measures.

This study provides insights to investors and the society at large. As SDG scores are set up as an opportunity focused framework, the findings provide the novel insight that SDG contributions seem to be more relevant to identify 'sin stocks' than to identify 'tomorrow's winners'. On the other hand, if investors seek to contribute to the SDGs without harming their financial performance, insignificant results between returns and positive SDG contributions supports their strategies in this regard. Investors can incorporate SDG contribution data in their decision-making and direct capital away from harmful activities towards better outcomes to society and the environment. Regional differences lay in different appreciation of SDG data by society and investors and the institutional frameworks. For sectors contributing to the SDGs, it can be a value-creating factor, while for sectors violating the SDGs, it can lead to a (carbon) risk premium. Investors can thus analyse transitions and SDGs, and anticipate for which sectors SDGs (or particular companies) it can be value-enhancing and for which is can lead to increased environmental and social risk premia. In this, convergence in SDG ratings would enhance adequate risk pricing in the market (Bauckloh et al., 2024).

This preliminary evidence in this study requires further investigation to deepen the understanding of underlying economic mechanisms. Does the negative relation between realized excess returns and SDG contributions reflect the pricing of transition risk, the materialization of such risks in realized returns, shifts in investor preferences, or a gradual pricing in towards a new equilibrium? While this debate has been extensively examined in the context of carbon risk, it extends naturally to the broader and novel measure of SDG contributions considered here. The asset pricing literature attributes unexpected returns to increased investor demand, news on future cash flows or news on future expected returns. Hong and Stein (1999) and Dasgupta et al. (2011) show that gradual diffusion of information can lead to higher returns over a longer period. SDG contribution data is (partly) based on relatively stable revenue streams, entailing limited surprises. Van der Beck (2025) shows that institutional investors' flow into ESG funds lead to outperformance of the market throughout the 2012–2023 period. The rising climate concerns that Pastor et al. (2022) describe as temporary effects, may in fact drive longer term excess returns as transitions take place (Battiston et al., 2025). Investors may start to price companies' impacts on several SDGs, relating to climate change, biodiversity and social concerns. On the other hand, articles examining the asset price corrections in ESG funds find that outperformance tends to be short-term (Jha et al., 2025). Future research could compare the expected and realised returns related to SDG contributions, and examine a potential proxy for the unexpected returns to see if the observed results are temporary. Atilgan et al. (2025) do this for the carbon risk premium and find that it partially might arise from pricing of companies' impacts (e.g. carbon emissions), or in their words, unpriced externalities. Through differentiating between expected and realised returns, such an analysis will shed further light on the value and risk channel.

Another way of analysing underlying mechanisms is to study the company characteristics that are the channel for the risk pricing, e.g. through profitability, innovation, carbon risk. While the focus of this study was on excess returns, the study provides limited in depth results on how this channel works, and thus leaves opportunities for future academic work. This study examined Robeco's total SDG score, and did not test for specific SDGs. Future research could investigate the SDG-return relation for certain topics, such as Chen et al. (2025b) do for biodiversity, or examine the SDGs that are most associated with ongoing transitions only. The Robeco's data may be subject to subjectivity and self-selection bias, leading to biased findings. The sample shows on average lower returns than the market, which may limit its external validity. Future research on other SDG ratings therefore can enhance insights in the SDG-return relation.

This study concludes with a reflection on the academic endeavor to find the right corporate sustainability measure. A few decades of ESG data resulted in many ESG ratings with low agreement (Berg et al., 2022). There

is an ongoing debate on what the right carbon measure is (Aswani et al., 2024; Bolton & Kacperczyk, 2024; Pastor et al., 2024). Recently, the Trump administration in the United States started to erode climate data (Economist, 2026). Initial insights in SDG ratings also show low agreement (Bauckloh et al., 2024). Baukloh et al. therefore conclude that SDG ratings so far fail to give a clear signal to investors on companies' contribution to the SDGs. Another conclusion can be that the 'right' corporate sustainability measure lays in the eye of the beholder. While there is substantive literature on measurement, there is limited research on how investors actually use this information in investment decision-making (Chapter 2) and whether the use of this data actually leads to improved real-world impacts (Chapter 3). Research on measurement is indispensable; measuring impacts with absolute thresholds should be the focus going forward (Chapter 3). But academic research nor investment practice will ever find the 'right' corporate sustainability measure. The aim should rather be that investors use relevant corporate sustainability information in their decisions, so that asset prices incorporate how companies affect the people and planet. This study contributes to the emerging research strand focusing on companies' real-world impacts and how investors assess this (Busch et al., 2024). This early empirical evidence sparks interest to further examine how investors can use this information to enhance their investment decisions and improve the societal, environmental and financial impact of their investments.

Appendices chapter 5

Appendix A5.I Descriptive statistics total dataset

The table reports descriptive statistics on the total dataset, including observations for which the SDG score is missing. The table display the statistics after data collection from CRSP, Compustat Global, Compustat North-America, Robeco SDG dataset and Kenneth French's library. The sample period is January 2010 to December 2024. It is included for transparency purposes and to compare the average monthly (excess) return of the full dataset to those of the sample (Table 5.3A).

	N.o. Obs	Mean	SD	1%	5%	25%	Median	75%	95%	99%
Return (in % per month)	2,616,762	0.957	12.077	-29.801	-16.667	-5.190	0	6.019	20.805	43.666
Excess Return (in % per month)	2,387,581	0.876	11.999	-29.535	-16.589	-5.266	-0.010	5.944	20.567	43.104
Robeco SDG score	1,145,538	0.483	1.478	-3	-3	0	1	2	2	3
Size	2,379,016	6.888	2.072	1.879	3.667	5.540	6.761	8.091	10.690	12.728
Book/Market ratio (logarithm)	1,889,238	-0.777	1.292	-4.795	-3.109	-1.499	-0.677	0.058	1.180	2.307
Return on Equity	1,975,263	0.049	0.271	-1.543	-0.361	0.023	0.083	0.149	0.321	0.685
Leverage	2,493,644	0.232	0.206	0.000	-	0.054	0.195	0.357	0.619	0.938
Market beta	2,531,500	0.808	0.118	0.583	0.617	0.729	0.784	0.869	1.019	1.224
Market beta (within firm)	2,531,500	-0.000	0.117	-0.221	-0.187	-0.076	-0.021	0.060	0.208	0.417
Idiosyncratic Volatility (in %)	2,865,209	32.871	16.894	9.509	9.509	22.005	33.896	35.328	85.543	85.543
Momentum (in %)	2,385,676	10.239	38.586	-90.111	-49.157	-12.396	7.165	29.843	80.177	135.039

Appendix A5.II Sample distribution Panel A – Sample distribution by country of incorporation

Country	Obs.	Percentage	Cum. %
USA	278,910	27.63	27.63
JPN	138,127	13.68	41.31
CHN	87,630	8.68	49.99
GBR	42,609	4.22	54.21
TWN	41,370	4.10	58.31
IND	40,542	4.02	62.33
KOR	39,659	3.93	66.25
CAN	37,427	3.71	69.96
AUS	29,996	2.97	72.93
SWE	23,420	2.32	75.25
DEU	21,935	2.17	77.43
FRA	18,982	1.88	79.31
CHE	14,692	1.46	80.76
MYS	13,995	1.39	82.15
HKG	11,527	1.14	83.29
BRA	11,269	1.12	84.41
THA	10,817	1.07	85.48
SGP	10,498	1.04	86.52
IDN	10,179	1.01	87.53
ITA	9,769	0.97	88.49
ZAF	9,655	0.96	89.45
NLD	9,400	0.93	90.38
TUR	8,557	0.85	91.23
ESP	8,503	0.84	92.07
NOR	6,814	0.67	92.75
FIN	6,259	0.62	93.37
MEX	6,116	0.61	93.97
BEL	5,681	0.56	94.53
PHL	5,649	0.56	95.09
DNK	5,422	0.54	95.63
IRL	5,318	0.53	96.16
SAU	4,977	0.49	96.65
POL	4,811	0.48	97.13
NZL	4,573	0.45	97.58
AUT	4,393	0.44	98.01
CHL	3,956	0.39	98.41
ARE	3,067	0.30	98.71
GRC	2,438	0.24	98.95
QAT	2,353	0.23	99.18
PRT	1,711	0.17	99.35
COL	1,639	0.16	99.52
KWT	1,581	0.16	99.67
EGY	1,412	0.14	99.81
PER	870	0.09	99.90
HUN	715	0.07	99.97
CZE	331	0.03	100.00
Total	**1,009,554**	**100**	

Panel B – Sample distribution over time

Year	Obs.	Percentage	Cum. %
2010	13,813	1.37	1.37
2011	18,130	1.80	3.16
2012	25,015	2.48	5.64
2013	29,449	2.92	8.56
2014	32,289	3.20	11.76
2015	35,270	3.49	15.25
2016	38,027	3.77	19.02
2017	50,513	5.00	24.02
2018	60,569	6.00	30.02
2019	85,297	8.45	38.47
2020	92,959	9.21	47.68
2021	108,732	10.77	58.45
2022	118,130	11.70	70.15
2023	131,152	12.99	83.14
2024	170,209	16.86	100.00
Total obs.	**1,009,554**	**100**	

Panel C – Sample distribution by GICS sectors

GICS Sector	Obs.	Percentage	Cum. %
Industrials	182,517	18.83	18.83
Financials	135,573	13.98	32.81
Consumer Discretionary	117,123	12.08	44.89
Information Technology	105,889	10.92	55.81
Materials	96,734	9.98	65.79
Health Care	94,562	9.75	75.54
Real Estate	64,447	6.65	82.19
Consumer Staples	52,586	5.42	87.62
Communication Services	44,928	4.63	92.25
Energy	38,624	3.98	96.23
Utilities	36,517	3.77	100.00
Total obs.	**969,500**	**100**	

GICS Sector	Obs.	Percentage	Cum. %
Industrials	182,517	18.83	18.83
Financials	135,573	13.98	32.81
Consumer Discretionary	117,123	12.08	44.89
Information Technology	105,889	10.92	55.81
Materials	96,734	9.98	65.79
Health Care	94,562	9.75	75.54
Real Estate	64,447	6.65	82.19
Consumer Staples	52,586	5.42	87.62
Communication Services	44,928	4.63	92.25
Energy	38,624	3.98	96.23
Utilities	36,517	3.77	100.00
Total obs.	**969,500**	**100**	

The distribution in sectors of the total dataset is in line with the sector breakdown in observations on a monthly basis (compared to last month of data, December 2024).

6. Synthesis

This chapter reflects on the conclusions of preceding chapters by reflecting on the societal debate, providing three ways forward for both measuring and managing investments' impacts. I close by with this dissertation's contributions and areas for future research.

6.1 Reflections on achieving a sustainable economy

The following sections provide ways forward for impact measurement and management. If all these ways forward are executed, would the end goal of a sustainable economy be reached? This section sheds light on four relevant notions on achieving sustainable economy.

First of all, this dissertation examines the 'how' investors can measure and manage impact. Investors can use that to execute their sustainability strategy and objectives. But the ambition level of their strategy and objectives in the end determines in what way investors steer and improve investment impacts in their investment portfolio. In recent years, societal developments lead sustainable investing to develop differently in different geographies. On the one hand, in the United States the tide has turned: investors leave Net Zero and Climate Action 100+ collaborations, BlackRock backed only 4 percent of sustainability resolutions in 2024 (against 40 percent in 2021) and the Trump presidency has an explicit anti-sustainability agenda (FT, 2025b, 2025a). On the other hand, while in Europe and the United Kingdom there is some pushback on sustainable investing, these investment approaches continue to grow and develop, with a focus on combatting greenwashing and growing the real-world impact of sustainable investment approaches (FT, 2025b). In the Netherlands, several pension funds significantly increased their allocation to impact investments, although the investments in emerging markets remains limited (Netherlands Advisory Board on impact investing, 2025).

Second, this dissertation emphasises the need for sustainable investing to contribute to the end goal of a sustainable economy, achieving both environmental and social objectives. Research however shows that as economies in countries develop, their social objectives are increasingly met, but often at the expense of the environment, exceeding and thus harming environmental thresholds (Fang, 2022; Fanning et al., 2022). When determining the achievement of social objectives and respecting environmental thresholds per country, this dynamic appears to be quite persistent, with only a few countries able to achieve both (Fang, 2022). In other words, not all SDGs can be realized at the same time, because economic development comes at the expense of nature and the environment. Looking at the dynamics between countries, economic development in developed economies depends on production – and related environmental issues – in emerging economies (United Nations, 2019). The global demand for resources outpaces population growth (United Nations, 2025). The Jevons paradox shows that increases in energy efficiency in economies often leads to more emissions, rather than less (Alcott, 2005). These insights lead to sobering expectations on achieving a sustainable economy, and the potential role of sustainable investing.

Third, the recent societal developments in sustainable investing and the challenge of achieving a sustainable economy, highlight the role of governments. They have the role to establish the limits in which companies and investors can operate. Research shows that without these limits, economies almost always develop at the expense of people and the environment. With proper limits – through regulation and taxation – companies can competitively deliver products and services while treating employees and stakeholders fairly, while implementing responsible business operations. But as governments fail to do so, other actors are called on to take their own responsibility: companies, consumers, investors (Edmans, 2023).

Fourth, companies are influenced by so much more than what investors do. The question arises whether investors have the influence attributed to them. This dissertation shows three main investor impact mechanisms: capital allocation, stewardship and system-level influence. By differentiating between company and investor

impact, realistic expectations can be formed on investors' influence on companies. Investor strategies can be informed by the preferences of the beneficiaries, and once sustainable investing strategies are set, the investment chain needs to be aligned to execute these properly. Adequate impact measurement provides the objective view of investment impacts that investors need to effectively use the investor impact mechanisms. This research shows the ways in which the impacts can be measured and be managed. The next section puts forth three ways in which impact measurement and management can be advanced.

These are four important notions on how investors' management of impacts cannot on its own achieve a sustainable economy. But what can be achieved is that impacts considered 'external' by certain economic models are brought back and made integral to decision-making again. The notion of 'externality' refers to the concept that social and environmental impacts that occur outside of market transitions are external to market actors (Coase, 2013). But social and environmental impacts are integral to economic systems; and economic activities are embedded in social and environmental systems (Meadows et al., 1972; Raworth, 2017). In a narrow focus on asset prices and asset classes, the real economy dynamics and effects on people and the environment can get lost. By broadening the perspective to include impacts and transitions, the picture becomes complete again. The actual system risks can be better assessed. And people's considerations in caring for people and the environment is part of decision-making once again.

6.2 Ways forward in investments' impacts measurement

1. Measure company impacts by comparing to absolute thresholds

Conventional impact measurement shows the positive or negative impacts that companies have, but lack a comparison to a threshold. Investment analyses usually do not account for the fact that raw materials are limited and that emissions to soil, water and air have consequences for the economy at large. Today's product prices do not account for the many negative social effects in value chains. It is therefore important, as elaborated on in chapter 3, to measure impact by comparing it to an absolute threshold. These thresholds can be based on scientific knowledge for environmental thresholds and normative frameworks for social impacts. Examples for both are given in Chapter 3. Several frameworks propose both relative and absolute measures, but state that absolute thresholds are the direction for further development (Busch et al, 2025; IMP, 2025).

Although it is a challenge to set absolute thresholds, several frameworks propose these thresholds (Busch et al., 2025; IMP, 2025). Setting science-based thresholds for carbon emissions is already common practice; executed by initiatives such as the Science-Based Targets Network (SBTN, 2025), Transition Pathway Initiative (TPI, 2025) and Carbon Risk Real Estate Monitor (CRREM, 2025). In European regulation (EU Taxonomy) both negative and positive thresholds are set on a range of environmental impacts, obliging companies to report on these. On negative social impacts, thresholds can be set on internationally accepted expectations for companies as set out in the United Nations Guiding Principles on Business and Human Rights (United Nations, 2011) and Organisation for Economic Cooperation and Development Guidelines for Multinational Enterprises (OECD, 2011). Positive and negative social impacts can be identified as contributions to one of the 169 underlying targets of the SDGs, although direct company contributions may only be possible to a limited number of targets. This challenge is also identified by Busch et al. (2025), which in their review of absolute sustainability thresholds conclude that social thresholds are conceptually less developed than environmental thresholds, and a clear way of translating macro-issues into company level indicators is lacking.

In setting these thresholds, multinational companies can compare their impacts using global thresholds while small companies can use localized embedded thresholds. Recent work by Marijnissen, Schoenmaker & Schramade (2025) calculate both positive and negative impacts for 34 companies listed in the Amsterdam Stock Exchange, building on the proposed impact alignment measure (Chapter 3) and show the integrated value for these firms.

2. Differentiate between company impact and investor impact

In the field of impact measurement, impacts are often reported without an understanding of their significance or development over time (Busch et al., 2024). Certain investors report company impact improvements as their own impacts, without acknowledging their position towards this firm and the fact that a broad range of stakeholders influence the firm. In certain articles on whether sustainable investment 'matters', the authors only look at impact on asset prices, and if that seems to be limited, conclude that investor actions does not have effect. These are all examples in which confusing and sometimes even misleading statements are made in the field of impact measurement and reporting.

To clarify the contribution by investors as well as the arguments used, it is important to clearly differentiate between company impact and investor impact (as described in Section 1.1.3). For example, an investor can report companies' impacts in its annual report, but it is important to accompany this with the size of the investment as part of the company's total assets (capital allocation role) or by providing evidence on how these improved impacts relate to the investor's engagement efforts (stewardship role) (Busch et al., 2024). In describing transition pathways and impact targets, investors can describe their contribution to the societal debate in this regard (system-level influence role). In reporting, investors may aim to show that their impact is additional or they may try to attribute impact to themselves. Substantiating these claims sufficiently requires advanced methods and leads to a focus on proving impact rather than improving impact. Furthermore, these practices often ignore the fact a company decision making context is influenced by a wide range of stakeholders and considerations. I propose therefore, in line with Busch et al. (2024), to view these efforts as contributions rather than additional or attributed to them. Through a clear distinction between company and investor impact, investors do not over nor underclaim their contributions to improve investment impacts and can steer direction to useful actions.

3. Converge towards the most important impacts

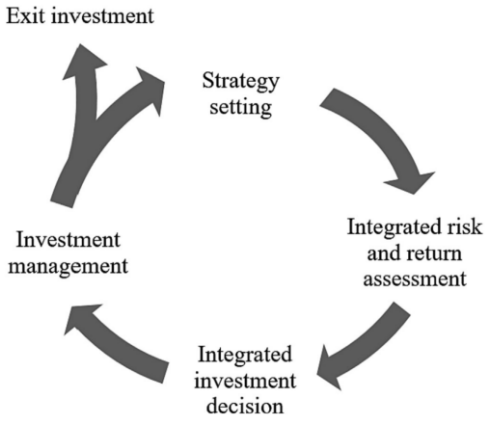
Considering the many environmental and social topics, there is a wide range of impacts that can be measured and reported by companies. But a multitude of reported impacts cannot be understood and valued by investors. Impact measurement diverge in approaches and proposed metrics, which makes it complicated for investors to select the most relevant impacts (Ferreiro et al., 2025; Perrini et al., 2020). For investors to steer on positive and negative impacts, they need to be able to assess the most important impacts measured against absolute thresholds, and to compare these between different portfolio companies.

There is therefore a convergence needed towards the most important impacts. This convergence has been pleaded for by both academia and practitioners for a long time. Harmonization efforts on a global scale have taken place. The IFRS Foundation issued the IFRS S1 General standard and the IFRS S2 Climate-related disclosures standard (IFRS Foundation, 2024). Connected to the General standard are the SASB Standards, which identify for 77 industries which are the most relevant sustainability-related risk and opportunities (IFRS Foundation, 2025). For the most pressing issue, climate change, a separate standard is introduced. The focus of the IFRS Foundation however, is more on risks and opportunities originating from dependencies than on impacts (see Figure 1.1). In Europe, a substantive sustainability agenda lead to several sustainability reporting requirements. The most important being the Corporate Sustainability Directive (CSRD), which was originally mandatory for over 50.000 European firms. The CSRD does require companies to identify both material risks and opportunities, as well as impacts. In spring 2025, the European Commission announced to decrease the regulatory framework both in scope of companies, scope of reporting requirements as well as a delay in reporting timelines (European Union, 2025). It was announced that the sector-specific standards which were already in development, were to be withdrawn completely. The convergence towards most important impact is an ongoing development. Investors can use stewardship role and system-level influence to pressure companies towards reporting the most important impacts.

6.3 Way forward in investments' impacts management

With an accurate understanding of investments' impacts, investors can manage these impacts throughout the integrated investment process (see Figure 6.1). This section provides three ways forward for managing investment impacts throughout this process.

Figure 6.1 – Integrated investment process (adapted from GIIN, 2020)



1. Develop impact decision-making tools for institutional investors

The literature review (chapter 2) shows that although the need for impact steering is described by several authors, there is limited research on how to make these decisions. Several authors propose decision-making models such as a multi-criteria decision-making (MCDM) process (Kumar et al., 2020; Rania et al., 2020), a hybrid decision-making model (Ou, 2016) or a decision support system (Calvo et al., 2015). But most of these lack an empirical perspective on how these models are operationalised and used in investment practice. It is therefore important to examine the investment decision-making practice and develop decision-making tools that institutional investors can use to take integrated decisions (Calvo et al., 2015). These decisions are focused on achieving their main objective: achieve financial return and impact while managing risks (see Section 3.3.1).

In the strategy setting phase, more specifically in the strategic asset allocation process, decisions can be guided by the targets that an investor sets on the portfolio level for investor and company impact. These targets allow an investor to be explicit on the positive impact they aim for as well as negative impacts they want to lower, avoid or exclude. An investor can differentiate between investor and company impact targets, acknowledging that at times investors are influential and at times they have limited influence on the impact of companies. Ideally, targets are related to absolute thresholds and argued from how they contribute to ongoing transitions. Discussing impact targets also leads to some necessary discussions: What data related to the impact target is available? How will impact information be recorded, monitored and acted on? Where can this impact be realised in the portfolio? (Mansell et al., 2020).

This dissertation provides suggestions for decision-making tools on where to realise impact in the portfolio (Chapter 3). Each asset class, sector and geography provides different potential to achieve return, improve the risk profile, to lower negative impact or to achieve impact (and sustainability) targets. Notably, only a limited proportion of institutional investment is currently done in geographies with the largest positive impact potential; in countries that face a financing gap for addressing challenging e.g. high poverty rates and environmental challenges. The impact potential per asset class can be incorporated in the asset allocation advice. Insights on impact potential can be provided in overviews, simplified objective functions and/or visualised in figures. Section 3.3.4 provides an illustrative example of expected risk-return-impact for an investment portfolio. These overviews provide a basis to discuss what objective can be best achieved where, and expectations can be set on how to realize the impact target throughout the portfolio. Understanding impact (potential) also provides

a solid ground for determining which investor impact role to employ where, e.g. capital allocation, stewardship and system-level influence.

In the integrated risk and return assessment and investment management phase, the focus is more on managing impact on the investment level. Section 2.4.8 provides a portfolio example where investments are plotted based on different levels of financial, social and environmental return (in line with Aggarwala and Frasch (2017) and Lee et al. (2020). This portfolio view provides a basis for integrated investment decisions and investment management. If two or three impact targets are set, separate figures provide useful insights to decision-makers. While the portfolio plotting provides a static view, recent models such as Schramade et al. (2022) introduce a more dynamic view, allowing for decision-making based on integrated value. Gasser et al. (2017) and Blitz et al. (2024) visualise portfolios in a 3D-model, in which risk, return and real-world impact form the three axes. This underscores that financial return and impact are intrinsically connected through the value-creating potential of the business model. In the potential tension of having dual objectives (financial and impact), novel governance structures, such as embedding impact performance in investors' remuneration, can align interests along the investment value chain (Dordi et al., 2023). In looking to improve impact over time, impact scaling is an interesting perspective, as it conceptualises improving impact as not only enlarging the investee (capacity scaling) but also the quality and depth of impact (up and deep scaling) (see Section 2.5).

In general, the challenge remains to evaluate whether the intended impacts are in fact realised by the invested companies and projects. This ‘closing of the loop’ (see Figure 6.1) is common for financial information, but often lacking for social and environmental impacts. While (impact) investment approaches often has a ex-ante strategy on how to realise positive impact, or mitigate negative impact, the ex-post evaluation is not part of the processes yet. This evaluation is essential in the investment management phase, as a basis for determining investor actions. Based on realised impacts, investors can choose to allocate capital differently (increase or lower positions, divest, invest in other positions), execute its stewardship role and have system-level influence.

2. Use transition pathways to determine investor actions

Managing impacts can be further enhanced by developing transition pathways and based on insights, determine investor actions. In this dissertation, integrating transitions in strategic asset allocation is raised as an important step to take (Chapter 3) and the following chapter shows emerging practices (Chapter 4). Through transition pathways, investors can understand how transitions affect the investment portfolio, and how investment impacts affect transitions. Investment impacts are thus endogenous to investor decisions because the impact indicates how investments can accelerate (or slow down) transitions (Chapter 3). A pragmatic approach for an institutional investor can be to select two or three transitions that matter most, either because it anticipates the largest risks and opportunities in these or because it wants to impact these transitions positively. These pathways provide insights for further positioning of the portfolio: what are the investments at risk, investment opportunities and potential no- or least-regret actions or real options to take. As transitions affect sectors and geographies rather than asset classes, arguing from the real economy impact of transitions provides insights to investments. What the financing structure of these investment are, then provides further insights into how this affects the investor.

Developing a transition pathway for the energy transition and the physical consequences of climate change are usually considered first. These pathways supplement quantitative insights, which for climate change currently underestimate effects on the investment portfolio (Chapter 4; Reinders et al., 2023). Several investors have an ambition to invest in line with the Paris Agreement on mitigating climate change effects; initiatives such as Transition Pathway Initiative (2024) and Carbon Risk Real Estate Monitor (CRREM, 2025) allow for monitoring of the portfolio on this pathway. By now, it is clear that physical consequences of climate change affect certain sectors and geographies more than others. Therefore, a transition pathway where sectors and geographies are central makes most sense. These insights provide a basis for taking action in the investor impact roles. First, in allocating capital: potential divestment of risky positions, increase positions in climate resilient companies or those benefiting from the energy transitions. Second, in stewardship, for example by engaging some portfolio companies which lower emissions insufficiently, and are thus behind in alignment to the Paris Agreement. Third, the transition pathway shows that economies are insufficiently transitioning to reach the Paris Agreement. This insight can lead to action in system-level influence. For example, investors called on governments for several years already to take adequate measures to mitigate climate change. The ‘Global Investor Statement to Governments on the Climate Crisis’ of 2024 was signed by 650 investors representing USD 33 trillion in assets under management (UNEP FI, 2025). It specifically calls on governments to implement sectoral strategies for high-emitting sectors, and so address nature, water and biodiversity related challenges that are intertwined with climate change, and to facilitate private investment to emerging markets.

Another transition – ageing and other demographic developments – lead, together with other developments, to a shortage in housing in the Netherlands. Three of the largest pension funds in the Netherlands aim to contribute to affordable housing through capital allocation. ABP (2025) committed to making 10 billion impact investments in Netherlands in for example affordable rental houses. As part of the investments done by PFZW on behalf of health care workers, the Attens Mortgage label was set up 10 years ago. The mortgage label considers more types of income (e.g. from irregular work, income that doctors and nurses earn during educational trajectories) in the maximum allowed mortgage amount. This increases opportunities for health care workers to enter the Dutch housing market (PGGM, 2025). By July 2025, 25.000 mortgages were given out with the portfolio now over 6 billion euro.

3. Build on different capacities by employing the three cognitive frames

This dissertation provides a framework on how cognitive frames interact in collaborations for sustainability integration (Chapter 4.5). This way forward indicates how these insights can be used in collaborations for sustainability integration. First of all, it is important to acknowledge that peoples actions are driven by how they understand and structure information. Table 6.1 provides an overview per cognitive frame. As the cognitive content shows that people view sustainability objectives differently, it is important to clarify how these relate and what is accepted as the joint understanding (or agree-to-disagree) in collaboration. As people differ in how they view for example climate change effects and investor impact, collaborations can be strengthened by discussing and clarifying how these are understood, as a theoretical basis for sustainability integration. Depending on the organizational strategy, organizations take a position in these topics, or they are more left to personal sensemaking, but in all cases these views matter to sustainability integration.

Table 6.1 – Overview cognitive frames: content, structure and stance

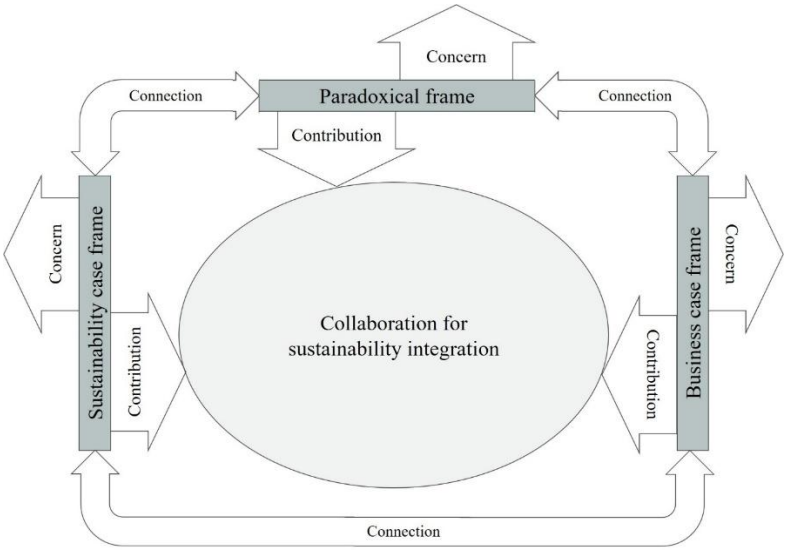
	Cognitive content	**Cognitive structure**	**Stance**
Business case frame	Only integrate sustainability insofar it aligns with financial objective	Low degree of complexity	Pragmatic stance
Paradoxical frame	Juxtaposition of financial and sustainability objectives, even if contradictory	High degree of complexity	Prudent stance
Sustainability case frame	Convinced that financial and sustainability objectives can be jointly achieved	Medium degree of complexity	Proactive stance

Second, the presented framework (Figure 6.2 and Table 6.2) shows that people take different stances, leading to difference contributions, concerns and connections to other frames. People using a business case frame only integrate sustainability insofar it aligns with the financial objective, and are thus concerned when sustainability motivated decisions are taken. They contribute by using finance logic and emphasising the need for academic evidence. The business case frame can critically assess proposals, and comes with incremental proposals based on current practices, which might serve as initial steps or even as a basis for more radical proposals. People using a paradoxical frame want to integrate impact, but are held back by seeing all the different considerations, paradoxes and perspectives at the same time. Their key concern is that investors act too quickly or incorrectly, due to uncertainties and complexities. People using the sustainability case frame propose innovative solutions, bring an integrated risk-return-impact narrative and bring forth insights of different fields of expertise. They key concern is that investors act too late and get stuck in ‘old thinking’.

Table 6.2 – Stance elaborated: Contribution, concern and connection in sustainability integration

	Contribution	**Concern**	**Connection to other frames**
Business case frame	Uses finance logic, need for academic evidence	Potential financial consequences of acting based on sustainability	Include more considerations, paradoxes and perspectives
Paradoxical frame	Bring forth different considerations, paradoxes and perspectives	Acting too quickly or incorrectly, due to uncertainties and complexities	Connect the other two frames through structuring relevant considerations
Sustainability case frame	Proposes solutions, integrated narrative, broadens fields of expertise	Acting too late, stuck in ‘old thinking’	Acknowledge paradoxes and potential consequences of sustainability decisions

Figure 6.2 – Framework cognitive frames interaction in sustainability integration collaboration



People of all three cognitive frames can connect to people using the other frames. The business case frame can include more considerations, paradoxes and perspectives. The paradoxical frame can structure relevant considerations and thus integrate the considerations and concerns to the discussions. When the sustainability case frame acknowledges existing paradoxes as well as potential adverse financial consequences of sustainability motivated decisions, a joint understanding emerges in which all relevant considerations are actively discussed. This joint understanding forms an important basis for further integration. This integration can be structured in iterative cycles (of interim decision-making), in which concerns can be actively addressed while steps are being taken. Figure 6.2 also sheds light on potential risks. When the concerns of people using a business case frame are not discussed explicitly, they might leave the table, either physically, by acting passively or taking opposing positions. When innovative approaches are implemented, concerns can be addressed by actively monitoring them, or by implementing the innovative approach initially alongside the conventional approach.

When looking from an organisational perspective, it is important for investors aiming to integrate impact to not only consider organisational or process changes, but also the cognitive frames that employees use. Especially when a lack of shared understanding is anticipated, it is worthwhile taking the time to share people's beliefs and understanding, which is the basis for how people will act later on in the process. In this process of learning, Osagie et al. (2022) identify three key characteristics: leadership for change (people motivated to learn and embrace change), system connection (being open to adjust practices based on community needs) and group learning. The latter can be especially relevant to discuss emerging insights and advance a shared understanding and language in impact integration (Loorbach et al., 2020).

6.4 Contribution and future research

Many academic papers on impact measurement conclude with a call to investors to use measurement to steer on impact, but there is less research on how investors actually steer on impact (Chapter 2). This dissertation focuses on measuring and managing impact through theoretical and empirical research. It contributes to the academic literature in several ways. First, it provides insights in the current stance in academic literature on impact measurement and emerging practices (Chapter 2). Second, it provides a framework for how transitions and impact measurement can be integrated in strategic asset allocation (Chapter 3). Building on this framework, Chapter 4 provides empirical insights in how a large asset manager is implementing integrated SAA practices. Third, it presents a framework for cognitive frame interactions in sustainability integration collaborations. Section 6.3 generalises the findings of Chapter 4, providing an overview of three cognitive frames that investment professionals employ. Lastly, this dissertation provides empirical insights into one of the emerging impact measurement methods, SDG contributions. Through a large global sample, the findings in Chapter 5 show that SDG contributions matter to asset prices. Negative SDG contributions seem to play a larger role than positive SDG contributions, and the effects differ across regions and sectors.

There are several avenues for future academic research. The main area for future research is how investors managing impact employ their three investor impact roles: capital allocation, stewardship and system-level influence. This dissertation provides theoretical and empirical insights into managing impact, and future research could examine which investor impact roles execute based on these practices. This can be examined through a range of research methods, among others inductive case studies, asset pricing research, experiments with investment professionals. The basis for investor impact actions is the evaluation on whether impacts are realised, another avenue for future research. The integrated SAA framework (Chapter 3) lays a theoretical basis suitable for future research and investment practice. The presented framework in Chapter 4 provides a theoretical basis for understanding and strengthening cognitive frames interactions in sustainability integration in organizations. The relation between excess returns and SDG contributions needs further empirical evidence, as Chapter 5 provides early evidence for the risk channel, employing the Robeco SDG contributions data. As shown in this dissertation, a range of different research methods is needed to adequately research investors' impact management and investor impact actions.

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Summary

This dissertation examines how institutional investors manage the environmental and social impacts of their investment portfolios, using four research methods. It demonstrates that multidisciplinary research can generate novel insights, contributing both to academic debate and to investment practice.

A systematic literature review shows that, while measuring impact receives considerable attention in the academic literature, there is relatively little research on how institutional investors integrate impact into their investment processes. Measuring impact to demonstrate accountability differs from measuring to improve outcomes. Measuring to demonstrate accountability mainly relates to legitimacy and stakeholder expectations, whereas measuring to improve relates to understanding impact and integrating it into decision-making. The review highlights the need for research on operationalising impact throughout the investment process.

The conceptual study introduces the Integrated Strategic Asset Allocation (SAA) framework, which enables investors to consider not only risk and return, but also long-term societal and environmental transitions and the impact of their investments. A key insight is that investment impact is partly determined by investors themselves, as their decisions can accelerate or slow down societal transitions. Propositions derived from this framework inform future empirical research.

The grounded theory study examines the cognitive frames interactions in integrating sustainability in investment practice. Based on interviews and observations, three cognitive frames are identified: the business case frame, the paradoxical frame, and the sustainability case frame. These frames influence how professionals interpret and act on sustainability. Differences in frames explain why discussions about sustainable investing are often polarized. At the same time, in collaborating the frames can be complementary: combining their strengths can help investors more effectively advance sustainable investment practices. The framework presented in this chapter provides a basis for understanding and strengthening these collaborations.

Quantitative research investigates the relationship between investment returns and contributions to the United Nations Sustainable Development Goals (SDGs). The main results show a negative relation between excess returns and SDG contributions of –0.62% to –0.82% on an annual basis. The results furthermore indicate that the relation is stronger for negative SDG contributions than for positive SDG contributions. While designed to measure positive SDG contributions, investors in practice focus more on negative contributions. Negative SDG contributions appear to signal companies' unpreparedness for societal transitions, effectively functioning as a risk indicator.

The final chapter synthesizes the findings and provides guidance for future research and practice. For measuring impact, it is important to distinguish between company impact and investor impact, and to evaluate company impacts against absolute planetary and social boundaries. For managing impact, investors can benefit from decision-making tools that explicitly integrate impact, the use of transition pathways, and the application of the three cognitive frames. Together, these insights provide a practical and theoretical foundation for better measuring and managing the impacts of institutional investments.

Summary in Dutch (Nederlandse samenvatting)

Dit proefschrift onderzoekt hoe institutionele beleggers de milieu- en sociale impact van hun beleggingsportefeuilles managen, met behulp van vier onderzoeksmethoden. Het laat zien dat multidisciplinair onderzoek nieuwe inzichten kan opleveren die zowel de academische discussie als de beleggingspraktijk verrijken.

Een systematische literatuurstudie laat zien dat, hoewel het meten van impact in de literatuur veel aandacht krijgt, er relatief weinig onderzoek is naar hoe institutionele beleggers impact daadwerkelijk integreren in hun beleggingsprocessen. Impact meten om verantwoording af te leggen verschilt van meten om te verbeteren. Meten om verantwoording af te leggen heeft vooral te maken met legitimiteit en verwachtingen van stakeholders, terwijl meten om te verbeteren betrekking heeft op het begrijpen van impact en het integreren daarvan in besluitvorming. De studie benadrukt de behoefte aan onderzoek naar het operationeel maken van impact binnen het volledige beleggingsproces.

De conceptuele studie introduceert het geïntegreerde raamwerk voor Strategische Asset Allocatie (SAA), waarmee beleggers niet alleen risico en rendement, maar ook langetermijn milieu en sociale transities en de impact van hun beleggingen kunnen meenemen. Een belangrijk inzicht is dat de impact van beleggingen deels wordt bepaald door de keuzes van beleggers zelf, aangezien hun beslissingen maatschappelijke transities kunnen versnellen of vertragen. Vanuit dit raamwerk worden proposities opgesteld die toekomstige empirische studies kunnen testen.

Het ‘grounded theory’ onderzoek bestudeert interacties tussen cognitieve denkkaders in duurzaamheidsintegratie in de beleggingspraktijk. Op basis van interviews en observaties worden drie cognitieve denkkaders geïdentificeerd: het business case-frame, het paradoxale frame en het duurzaamheidscase frame. Deze frames beïnvloeden hoe professionals duurzaamheid interpreteren en erop handelen. Verschillen in frames verklaren waarom discussies over duurzaam beleggen vaak gepolariseerd zijn. Tegelijkertijd kunnen de frames in samenwerking complementair zijn: het combineren van hun sterke punten kan beleggers helpen duurzaamheid effectiever in hun praktijk te integreren. Het raamwerk wat in dit hoofdstuk wordt gepresenteerd legt een basis voor het begrijpen en versterken van deze samenwerkingen.

Het kwantitatieve onderzoek analyseert de relatie tussen beleggingsrendement en bijdragen aan de Sustainable Development Goals (SDG’s) van de Verenigde Naties. De resultaten laten een negatieve relatie tussen excess returns en SDG-bijdragen zien van –0.62% tot –0.82% op jaarlijkse basis. De resultaten laten ook zien dat de relatie sterker is voor negatieve SDG-bijdragen dan voor positieve SDG-bijdragen. Hoewel de data is ontwikkeld om positieve bijdragen te meten, richten beleggers zich in de praktijk vooral op negatieve bijdragen. Negatieve SDG-bijdragen wijzen op bedrijven die onvoldoende zijn voorbereid op maatschappelijke transities en functioneren daarmee als een risicomaatstaf.

Het laatste hoofdstuk brengt de bevindingen samen en formuleert handvatten voor toekomstig onderzoek en de praktijk. Voor het meten van impact is het van belang onderscheid te maken tussen de impact van bedrijven en die van beleggers, en bedrijfsimpact te beoordelen ten opzichte van absolute planetaire en sociale grenzen. Voor het sturen op impact is het nuttig dat beleggers gebruikmaken van besluitvormingsinstrumenten die impact expliciet integreren, transitiepaden volgen en meerdere denkkaders toepassen. Gezamenlijk bieden deze inzichten een theoretische en praktische basis om de impact van institutionele beleggingen beter te meten en effectiever te sturen.

About the Author

Annebeth Roor-Wubs is born on April 6, 1994 in Wageningen, Netherlands. In 2012, she obtained a Bachelor of Science (BSc) in Public Administration & Organisational Science from Utrecht University alongside several sources of the bachelor degree Economics & Business Economics. She obtained two Masters of Science (MSc) in Financial Management from Utrecht University and Global Business and Sustainability at Rotterdam School of Management, Erasmus University Rotterdam. During the latter master program, she did empirical research on two SDG investment funds. This sparked her interest for sustainable investing and lead to the start of a PhD trajectory in finance at Rotterdam School of Management in September 2020. As a parttime PhD candidate, she conducted research while working at EY and in Nepal.

Annebeth's professional experience lays mostly in corporate sustainability and sustainable investing. While working for EY Climate Change and Sustainability Services (2018-2024), she supported Dutch financial institutions on sustainability strategy (e.g. climate transition pathways, biodiversity) and the implementation of European sustainability legislation, such as Sustainable Finance Disclosure Regulation (SFDR), EU Taxonomy and Corporate Sustainability Reporting Directive (CSRD). She is actively involved for the ChristenUnie (political party), first in parliament (2016-2017) and later on local level (Utrecht) as chair of the party (2019-2022). Since 2024, she started working as a freelance advisor and researcher in Netherlands and Nepal. Since 2025, she lives and works in Nepal for the foundation Werk in Nepal, which support farmers to start growing coffee through the Nepali coffee company Charge Nepal. This coffee is sold to the Nepali and Dutch market (as 80 Days Coffee).

Education

- PhD in Finance, 2020 – 2026
  Rotterdam School of Management, Erasmus University Rotterdam
- MSc in Global Business & Sustainability, 2018 – 2019
  Rotterdam School of Management, Erasmus University Rotterdam
- MSc in Financial Management, 2016 – 2018
  Utrecht University
- BSc in Governance and Organisational Science, courses in BSc Economics and Business Economics, 2012 – 2015
  Utrecht University

Professional experience

- Accelerator jobs Nepal, 2025 – present
  Foundation Werk in Nepal, Nepal/Netherlands
- Freelance sustainable investing specialist, 2024 – present
  Sustainable Finance Consulting, Netherlands/Nepal
- Consultant sustainable investing, 2018 – 2024
  EY, Netherlands
- Intern and policy advisor, 2016 – 2017
  ChristenUnie in parliament, Netherlands

Portfolio

Papers

- Roor, A. & Maas, K. (2024). Do impact investors live up to their promise? A systematic literature review on (im) proving investments' impacts. *Business Strategy and the Environment*, *33*(4), 3707-3732.
- Roor, A., Schoenmaker, D. & Maas, K. (2025). Integrating Transitions and Impact Measurement in Strategic Asset Allocation. *Journal of Portfolio Management*, August, 1-26.
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- Roor, A. (2026). Do SDG contributions matter to asset prices? First evidence

Working papers

- Roor, A. (2019). SDG investing in practice. *Erasmus Platform for Sustainable Value Creation working paper.*
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- Roor, A., Bosma, D. & Schoenmaker, D. (2025). Principles for Investing in Nature as an Asset Class. *Erasmus Platform for Sustainable Value Creation working paper.*
- Co-author to the Integrating Impact Handbook (2026). *Sustainable Finance Platform.*
- Roor, A., Van Dam, J. & Knijp, G. (2026). SPIL Knowledge Paper 9: A robust policy approach in uncertain times. Pension fund board choices on security and resilience. *Sustainable Pension Investments Lab*

Conferences

- EGOS, 2022
- Oxford Sustainable Finance Summit, 2022
- IABS, 2023
- EURAM, 2023

Teaching

- Bachelor course Finance for positive change, 2022
- Executive course Sustainable Finance, Erasmus University, 2023, 2024, 2026

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Scmidt, A., *How Can Incumbents Innovate? A study on the microfoundations of absorptive capacity*, Promotors: Prof. dr. T.J.M. Mom, Prof. dr. H.W. Volberda

This dissertation examines how institutional investors manage the environmental and social impacts of their investment portfolios using four research methods. The literature review shows that although improving impact is widely discussed, there is still little research on how this can be implemented in investment practice. The conceptual study introduces an Integrated Strategic Asset Allocation framework, which enables investors to allocate assets based on expected risk, return and impact. It highlights that investment impact depends partly on investors' decisions, as investments can either accelerate or slow down economic and societal transitions. The qualitative research identifies three cognitive frames used by investment professionals: the business case frame, the paradoxical frame, and the sustainability case frame. Each frame offers a distinct perspective on sustainability, demonstrating their collective importance in advancing investment practice. The quantitative analysis shows that investments with higher negative SDG contributions tend to have higher excess returns, suggesting that SDG contributions may capture transition risk. Finally, the synthesis proposes ways to improve how investment impacts are measured and managed.

Annebeth Roor-Wubs researches the societal and environmental impact of companies and investors. As a parttime PhD candidate, she wrote this dissertation while working as sustainability consultant for financial institutions, and after that while supporting farmers to start growing coffee in Nepal.

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ERIM Part-Time PhD

Rotterdam School of Management

Erasmus Research Institute of Management
Erasmus University Rotterdam
Burgemeester Oudlaan 50
Mandeville (T) Building
3062 PA Rotterdam, The Netherlands

P.O. Box 1738
3000 DR Rotterdam, The Netherlands
T +31 10 408 1182
E info@erim.eur.nl
W www.erim.eur.nl