Rotterdam School of Management
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Erasmus Platform for Sustainable Value Creation

An integrated strategic asset allocation framework

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An integrated strategic asset allocation framework[1]

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NON-TECHNICAL SUMMARY
This working paper provides an integrated strategic asset allocation (SAA) framework. This framework which provides a basis for institutional investments to integrate sustainability related considerations in the important first steps of SAA, where they determine in which asset classes to invest in. The framework integrates transitions, such as the energy transition and the food system transition, into macro-economic expectations that are the basis of SAA. These transitions have transformational effects on the economy, and take place through a process of build-up of new companies and views and breakdown of old regimes over time. The end goal is to achieve a sustainable economy. This view provides a basis for a broader understanding of the risk, return and impact of the investments made. Impact are the effects of company's activities on individual stakeholders, society, and the environment.

Responding to critiques on current measurement of sustainability, we compare companies' actual impacts against system thresholds of a sustainable economy. This measurement leads to the novel insight of this paper: investments' impacts are endogenous to investor decisions, as the impact indicates how investments can accelerate (or slow down) transitions. This implies that investors can better mitigate systemic risks and influence the stage of transitions. Building on the framework, we provide propositions that serve as the basis for future empirical research. Integrated SAA is an important way forward for institutional investors, as it allows them to strategically measure and manage the real-world impacts of their investment portfolio. It enables institutional investors to mitigate transition risk and to steer on the degree to which their investments' impacts facilitate or hamper transitions.

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ABSTRACT
Environmental and societal challenges are not addressed in strategic asset allocation, hampering investors to steer their investments towards a sustainable economy. This article develops an integrated strategic asset allocation (SAA) framework. In the framework, transitions are integrated in macro-economic analysis and investments' social and environmental impacts are measured and integrated in risk-return. Investors can perform risk-return-impact calculations for the investment portfolio. Responding to critiques on current impact measurement, we compare companies' actual impacts against system thresholds of a sustainable economy.

This measurement leads to the novel insight of this paper: investments' impacts are endogenous to investor decisions, as the impact indicates how investments can accelerate (or slow down) transitions. This implies that investors can better mitigate systemic risks and influence the stage of transitions. Building on the framework, we provide propositions that serve as the basis for future empirical research. Integrated SAA is an important way forward for institutional investors, as it allows them to strategically measure and manage the real-world impacts of their investment portfolio.

JEL codes: E27, G11, G17, Q01

Key words: Strategic asset allocation, investment policy, impact measurement, transition, scenario analysis

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) and see impact as a category rather than as a criterium to optimise (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.

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)[2].

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; Pedersen, 2021; Steuer & Utz, 2023) or by adding climate risk assessments (e.g. Bender et al., 2019, Cosemans et al., 2022, 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; Bjørn et al., 2020). Climate risk assessments provide an initial step, but are limited to climate change related effects.

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

[2] 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 (World Economic Forum, 2023). Although they identify several economic risks, these were considered less severe than the top 10.

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 (Roor & Maas, 2024). Busch et al. (2021) state that a "substantial re-orientation toward impacts in financial markets" (2021, p.33) is needed. Furthermore, comparing impacts to system thresholds is suitable, as it provides insights on how companies are positioned towards ongoing transitions (Bjørn 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. THE INTEGRATED STRATEGIC ASSET ALLOCATION FRAMEWORK

We address the identified research gap by introducing an integrated strategic asset allocation framework (Exhibit 1 and 2). 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. Exhibit 2 compares the conventional strategic asset allocation, in line with Koedijk et al. (2018), Van Dam et al. (2022) and 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.

EXHIBIT 1. Integrated strategic asset allocation framework

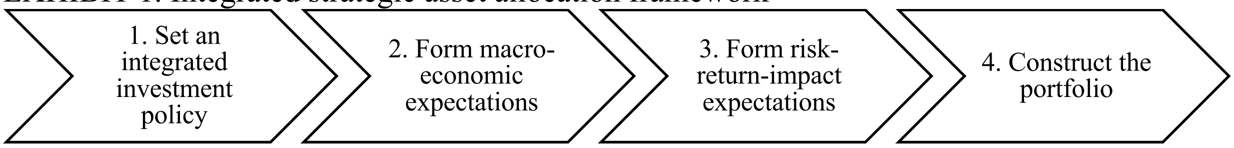


EXHIBIT 2. Conventional strategic asset allocation (SAA) and integrated SAA (by authors)

	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

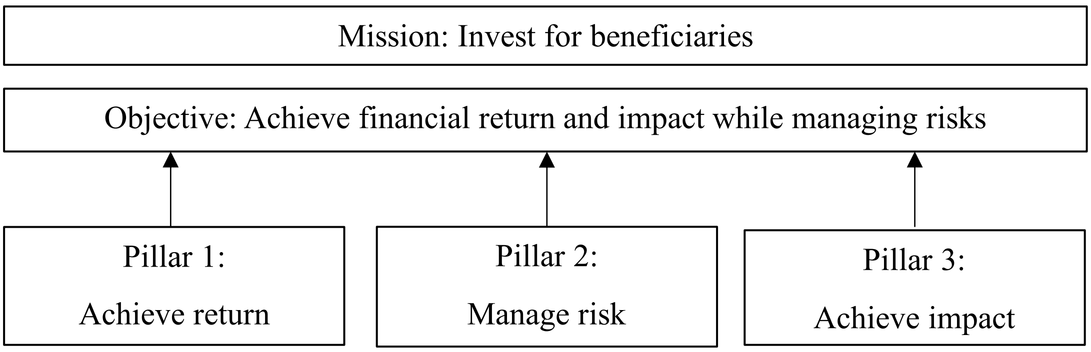
We elaborate on each of the four steps of integrated SAA in the next paragraphs.

Step 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 (Exhibit 3). 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).

EXHIBIT 3. 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). Exhibit 4 provides examples of investment beliefs.

EXHIBIT 4. 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 Exhibit 4 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.

Step 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[3] (e.g. Cosemans et al., 2022; Fang et al., 2019b; 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 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

[3] 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 (Reinders et al., 2023).

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.

Step 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 (Roor & Maas, 2024). We call the threshold a system threshold S_i (which can be allocated to geographies and sectors; see Exhibit 8 in the appendix)[4]. 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 Exhibit 5. 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 Exhibit 6: 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

[4] 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.

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 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 Exhibit 8). 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.

EXHIBIT 5. Visualisation impact alignment

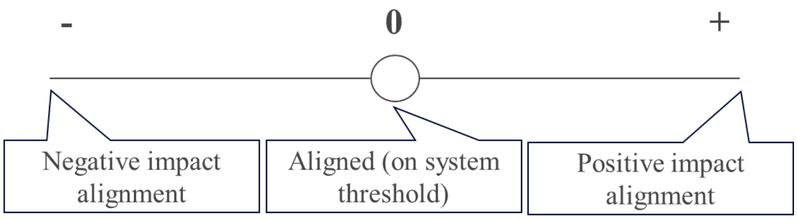


EXHIBIT 6. Examples impact alignment

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.

Note: 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

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

, which aggregates the IA calculated in eq. 2. In the example of Exhibit 6, 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

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

, 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 the Supplement material. 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.

Step 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., 2020a).

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. Exhibit 7 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. Exhibit 7 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.

EXHIBIT 7. 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., 2020a). 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 Exhibit 7)) 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 Exhibit 7, 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 field building activities to influence other investors, companies and regulatory changes (Kölbel et al., 2020b; Marti et al., 2023). Marti et al. (2023) describe field building as a way in which shareholders try to influence companies by influencing the fields in which the 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.

4. PROPOSITIONS FOR RISK-RETURN-IMPACT 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. (2021), 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 (Lee et al., 2020) or show insensitivity to the size of the realised impact (Heeb et al., 2023). 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 (Roor & Maas, 2024). 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. (2021, 2022) 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. (2023b) 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

$$R_i = \alpha_i + \beta_i^{RMRF} \cdot RMRF + \beta_i^{SMB} \cdot SMB + \beta_i^{HML} \cdot HML + \beta_i^{UMD} \cdot UMD + \beta_i^{NIA} \cdot NIA + \beta_i^{PIA} \cdot PIA + \varepsilon_i \quad (10)$$

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) and Garel et al. (2023). 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.

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, 2024; 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 (2024) 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), Pedersen et al. (2021) and 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 the appendix). 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.

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.

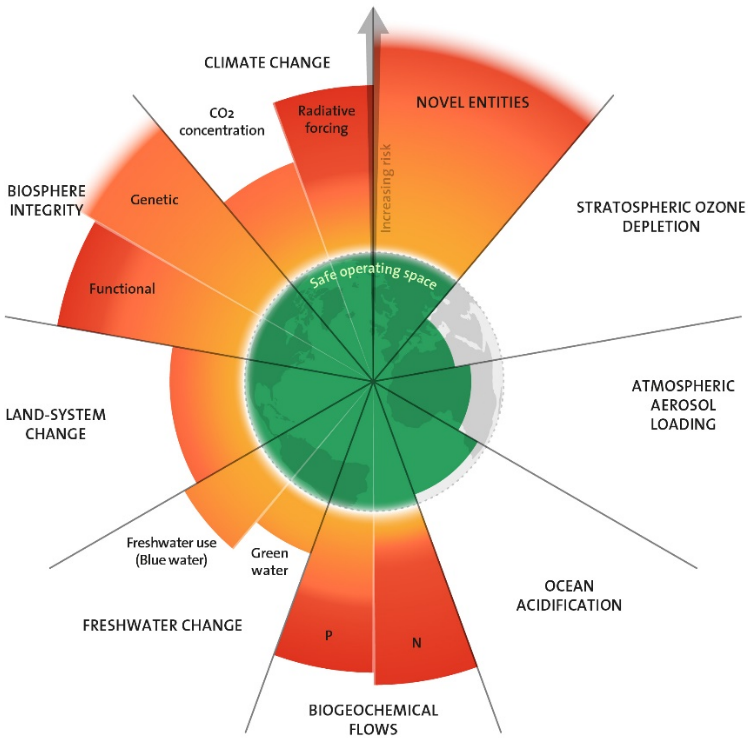
Institutional investors can use this novel approach as a basis for integrated SAA. It allows for a holistic approach through which investment beliefs and investment policy can be implemented. Through this, investors can strategically measure and manage the real-world impacts of their investment portfolio.

APPENDIX

Environmental system thresholds

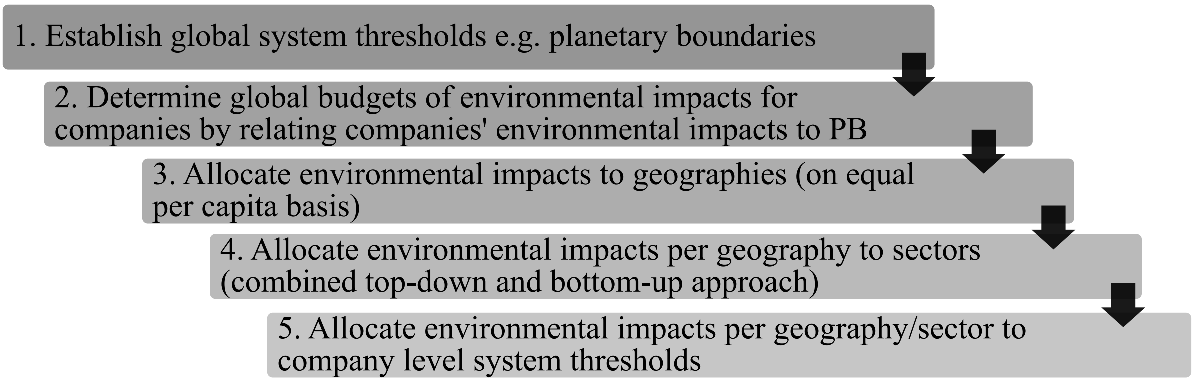
For environmental system thresholds, many scholars take the planetary boundaries by Steffen et al. (2015), as last updated by (Richardson et al., 2023), as the basis (see Exhibit 7). The planetary boundaries show the urgency of not only climate change and biosphere integrity (measured by biodiversity 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. Exhibit 8 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 Bjørn et al. (2020), Chen et al. (2021) and Ryberg et al. (2020).

EXHIBIT 7. 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.

EXHIBIT 8. 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[5] and IPBES[6] 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).

Social system thresholds

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

[5] The Intergovernmental Panel on Climate Change

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

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. Exhibit 9 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.

EXHIBIT 9. 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

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