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The Promise Of Transformative Investment: Mapping The Field Of Sustainability Investing

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Abstract

This paper addresses the question: How can private finance be mobilized for sociotechnical sustainability transitions? In answering this question, maps the sustainability investment literature, which leads to four propositions: (1) The literature on sustainability investing coevolved with corporate social responsibility theory and with the practice and events of the field, revealing four distinctive waves of "sustainable investing"; (2) Each wave of sustainability investing triggers new investment strategies, while propelling preceding ones upwards ('tidal effect'); (3) Sustainability investing strategies can be classified into certain categories, namely: (a) approach (top down/ investment thesis or bottom up/ valuation); (b) orientation (mitigating negative externalities or inducing positive externalities); (c) return on investment (from zero to risk-adjusted); and (4) We may be witnessing the emergence of a fifth wave of sustainability investing triggered by new research and practices on "impact investing". We discuss these propositions against sociotechnical sustainability transitions' theory.

Highlights

- Provides an overview of the evolution of the sustainability investing field of research and practice.
- Develops four propositions on how the sustainability investing field evolved.
- Discusses the propositions from a sociotechnical transition perspective.
- Calls for a bridging between the literature on sustainable investment and finance and sociotechnical transitions.

Keywords

sustainability investing, financing transformative change, sociotechnical transitions

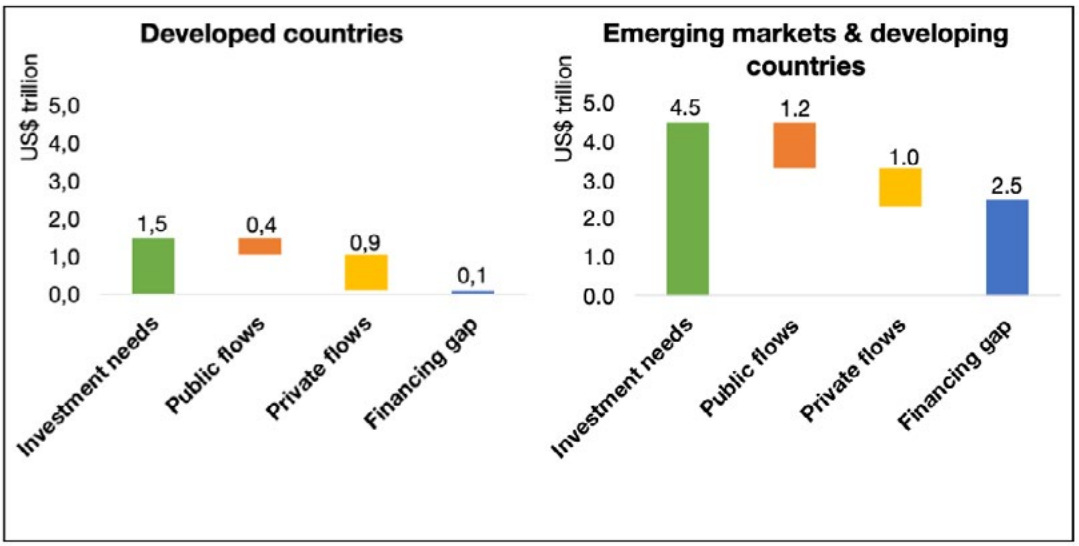
1. Introduction

This paper discusses sustainability investing strategies from a sociotechnical transition perspective, tackling the neglected topic of financing sustainability transitions. Mobilizing finance is key to promoting the "connected and sustained fundamental transformations" of sociotechnical systems that are needed for the emergence and acceleration of a "Deep Transition" (Schot and Kanger, 2018), away from the socially unequal and environmentally destructive directionality of the current "techno-economic paradigm" (Perez, 2010). Because any changes (and most innovations) that lead to a sociotechnical transition will require funding, addressing this gap in the sociotechnical transitions research field seems both timely and urgent.

Estimating the financial needs for the transformative change in sociotechnical systems to achieve a deep transition to sustainability is a challenging exercise. The type of required transformations for various systems are highly contested, accordingly no agreement exists about desirable directions and, therefore, investments. Even if there were an agreement among various actors, the likely interconnections, overlapping, trade-offs and synergies still would make the analysis very complex: estimates of the "sustainability funding gap" should not be regarded as definitive but illustrative.

Using the United Nations 17 Sustainable Development Goals (SDGs) – which call for sustainable forms of production, consumption and distribution – as a proxy for those transformative directions and required system changes can indicate the amount needed (Figure 1): the United Nations Conference on Trade and Development (UNCTAD) estimates the financial needs for achieving the SDGs at USD 5-7.5 trillion ***per year***, with emerging markets and developing countries requiring investments of USD 3.3-4.5 trillion per year[1] (UNCTAD, 2014). In those developing economies, the financial gap – considering the availability of international and domestic public and private finance for "SDG sectors"[2] – stands at USD 2.5 trillion per year.

Figure 1: SDG annual investment gap



Source: Based on UNCTAD (2014)

While estimates vary depending on underlying assumptions and methodologies[3], the message is clear: the financial needs for promoting sustainability transitions are huge.[4] Meeting those needs will not only require a very substantial increase in the levels of both public and private investments across the globe, but also more focus from investors on sustainability transitions. What might lead to this change and what barriers impede increases in the level of and nature of sustainability transition investments worldwide? These questions have been addressed only marginally in the sociotechnical (sustainability) transitions field.

The number of peer-reviewed articles dealing with finance ***within*** the field of sociotechnical transitions is relatively small. Adopting a modified search string based on Markard ***et al.*** (2012) to identify in the ***Scopus*** database peer reviewed articles that discussed sociotechnical transitions results in 3,494 hits. Yet, those whose core focus is finance[5] amount to 96 (2.7%) only[6]. Comparing these results with the number of articles dealing with other regimes such as energy (631) or transport/mobility (521) reveals the little attention that the financial regime receives in the sociotechnical transitions research field.[7]

To address this gap, the most recent agenda for sustainability transitions research (Köhler ***et al.***, 2019) includes "the role of finance capital" (***sic***) as a future research direction, calling for particular attention to the issues of economic crisis, long-term growth and financial regulation. However, the agenda suggests that finance should be investigated as a topic within the theme "Businesses and industries in sustainability transitions" – instead of as a theme of its own. This conflation between finance and business overshadows important finance-related topics for transitions research, for instance, the distinction between public and private finance and whether the former crowds in or out the latter (David ***et al.***, 2000), issues of financialization and the imperative of "maximizing shareholder value" (Lazonick, 2013; Lazonick and O'Sullivan, 2000), the emergence and diffusion of financial innovations, access to financial products and services, and the role of financial actors and their strategies in

promoting or preventing sustainability transitions – just to mention a few. We argue that finance is too important for sociotechnical transitions to sustainability to be relegated as a secondary topic of research.

Research on finance in sustainability transitions did accelerate since the publication of the latest sustainability transitions research agenda (a pre-print version came out in 2017). Of the 96 articles with a core focus on this theme, 62 were published since 2017. Among those published in the last decade, we briefly discuss those that we understand to deal (directly or indirectly) with the research question this paper seeks to address: How can private finance be mobilized for a series of sociotechnical sustainability transitions? This question later leads us to an investigation into what types of investing strategies to promote transformative change or sustainability transitions already exist, whether they are fit for the task from a sustainability transitions perspective, and what new forms of funding (its characteristics) are needed.

Half of the articles that we consider relevant to our research question discusses barriers to green or low-carbon investment/finance (e.g. Bolton and Foxon, 2015; Hafner ***et al.***, 2020; Jacobsson and Jacobsson, 2012; Polzin, 2017). Short-termism and financialization are identified as prominent barriers (Jacobsson and Jacobsson, 2012; Hafner ***et al.***, 2020), but other issues considered include technological and political uncertainty, compounded by complex system dynamics (Bolton and Foxon, 2015; Polzin, 2017). While Jacobsson and Jacobsson (2012) and Polzin (2017) suggest that public finance is a potential solution to closing the green finance gap, Bolton and Foxon (2015) and Hafner ***et al.*** (2020) suggest looking at the emerging landscape of private sustainable investment (a suggestion we follow in this paper).

The other half of the articles each have a more unique focus. For example, Urban and Wojcik (2019) analysed the practices of a large pension fund and concluded there was no evidence that such institution was avoiding investments in unsustainable companies. They called for more research on sustainability investing practices by private institutions, beyond the use of Environment, Sustainability and Governance (ESG) metrics[8]. Another study that employed a quantitative approach is by Deleidi, Mazzucato and Semieniuk (2020), who sought to estimate whether public investments in renewable energy technologies crowd in or out private investments. Their estimates show that direct public investment has a positive effect in mobilizing private investment, an effect that is higher than other policy instruments such feed-in tariffs, taxes and renewable portfolio standards. They therefore highlight the important complementarity of public and private finance in supporting the sustainability transition.

Naidoo (2020) offers a review of finance in the sustainability transitions literature. Her conceptual contribution, utilizing concepts from the sustainability transitions field, is to identify design features for a financial system that promotes sustainability transitions. The author claims that the concept of 'directionality' embedded in financing decisions is of particular importance and should substitute for financial 'neutrality' (i.e. finance that is indifferent to sustainability outcomes). She also calls for new financial system features, such as a more explicit and politically-derived mandate for financial sector performance (which would include sustainability goals) and structural reforms in the system that broaden performance targets and reduce short-term orientation. These are examples of demands that a sociotechnical transition process poses on the financial system.

Geddes and Smith (2020) also mobilize concepts from the sustainability transitions field – the Multi-Level Perspective (MLP) (Geels, 2002) and transition dynamics derived from it – to study the actions by State Investment Banks (SIBs, also known as National Development Banks) in the sustainability investing landscape. Their starting argument is that the financial sector is a sociotechnical regime[9] of its own, operating with distinctive rules or heuristics that define its nature as a regime and that is interacting with all other regimes. While their conclusions confirm previous MLP findings –

e.g. that technological niches tend to conform to the financial regime, with occasional secondary transformation of the regime by developments in niches – the fact that the authors consider finance a separate sociotechnical regime and not as an element or dimension of other sociotechnical regimes stands out from most conceptualizations in the field employing the MLP.

This is also the approach adopted by Loorbach ***et al.*** (2020), who consider the current financial system as unsustainable: "a complex regime of institutions, organisations, regulations, practices and cultures that has become focused on transforming ecological and human capital into financial capital as efficiently as possible. It produces economic benefits and financial growth for relatively small groups of people and institutions, while externalising significant costs and risks that are borne by society and nature." (p.11) Due to extreme quantification and specialization, the authors argue, the financial regime became detached from the real economy and thus focused on "value extraction" rather than "value creation" (Mazzucato, 2018), with a general denial of responsibility or ethical considerations concerning the negative impact of financial practices (such as tax evasion to maximize profits or the provision of funding for the fossil, extractive and carbon-intensive industries).

Loorbach ***et al.*** (2020) recognize, however, that there are signs of destabilization in the dominant financial regime, due to societal pressures and innovative niche practices: "Examples are mission-driven banks, impact investing strategies, digital financial technologies, alternative accounting, local economies, and so on." (p. 14) Some sustainability investment strategies could contribute to incremental change and adaptation of the current financial regime, like the integration of environmental and social criteria in valuation model ("ESG integration") or the issuance of "green bonds" (to fund sustainability projects), while other would represent more radical departures of current practices, like fintech-based portfolios based on sustainable business models or purpose-driven financial institutions. To effectively promote a transition to sustainability, Loorbach ***et al.*** (2020) propose that a new financial regime should be based in new guiding rules: (1) ***from financial to integrated value***, which combine financial, social and environmental returns, as a basis for investment decisions; (2) ***relationship finance***, based on a direct link and dialogue between financiers (be them bankers or asset managers/owners) and companies; and (3) capital allocation based on ***long term societal value***.

This paper takes stock of the findings and suggestions for future research from these selected contributions and the call for an examination of the emerging landscape of private sustainable investment and the required characteristics for sustainability finance. We thus address one of the four levels (or facets) of the financial system transition to sustainability proposed by Loorbach ***et al.*** (2020): ***financing sustainability transitions***, to ensure the transformation of other sociotechnical regimes (e.g. food, mobility, energy.[10] To do so, we look away from the sustainability transitions field and survey the sustainable investment literature to create a map of the field, based on which we derive four propositions that indicate where we are on the map. We then reflect on these propositions drawing on a sociotechnical sustainability transitions' "theory of change".

The next section briefly outlines our methodology and methods. In section 3, the academic and practitioner literature on sustainability investment[11] is examined qualitatively and historically to characterise four waves in sustainability investment theory and practice and to propose an interpretation and analytical categorisation of its evolution. This is our first map of the field. In section 4, the academic literature is further examined with the aid of network analysis to create a semantic network that aid in the identification of specific themes, creating a second map that complements the analysis of section 3. Section 5 discusses the findings considering the sustainability transitions literature, while section 6 provides concluding remarks and speculates about a ***transformative investment*** framework.

2. Methodology

This paper seeks to contribute to the research of field sociotechnical transitions to sustainability, by making an initial bridge with the field of sustainable investing. Its focus is on how to mobilize private finance for sustainability transitions, scoping the types of sustainability investing strategies, reflecting on their appropriateness to the task (from a sociotechnical transition theory perspective) and on whether new forms of investing are needed. To this end, we combine qualitative and quantitative methods.

In section 3, we synthesize secondary accounts of the evolution of the sustainability investing research field. The specific methodology for this section is based on the analysis of (academic and practitioner) studies that provide a review of the field supplemented with desk research drawing on a snowballing technique (searching for subjects and developments mentioned in these accounts). It also drew on the review of the CSR literature from of one of the authors' PhD research project [reference omitted]. This narrative overview of the field is not meant as a systematic review but as a first approximation that allows us to identify different eras (or "waves") of sustainability investing, their most relevant topics and prominent investing strategies. We use this first "map" to derive the keywords we use to sample the literature and create a semantic network (section 4 – see below). The papers for section 3 were selected due to their scope (reviews and historical accounts of the field) and high citation count[12].

The second method for mapping the literature on sustainability investing (presented in section 4) is based on network analysis, and, more specifically, on the analysis of semantic networks between academic articles. This method allows for the identification of key themes and issues that may escape an initial investigation based on highly cited and review papers. It involved steps A-E below, which we followed to produce a sample of the broader literature on sustainable investment and finance. Again, we do not claim to be doing a ***systematic review*** of the sustainable finance research field: we survey a representative sample of the sustainability investing literature that we will discuss from a sociotechnical transition perspective. Our aim is to contribute to the field of socio-technical transitions to sustainability, and thus provide an initial "bridge" between the two fields.

A) Identification and refinement of search terms*:* this was done based on the analysis of highly cited and review papers (coupled with the analysis of documents by practitioners), i.e. the results from section 3. Establishing a search syntax is necessary for avoiding 'false negatives' (exclusion of topic-relevant papers) and 'false positives' (inclusion of topic-irrelevant papers). After many iterations, a search syntax was chosen. Given our research questions, we chose to use as keywords the types of sustainability investing strategies found in the secondary literature reviewed in section 3. We use a broad and simple syntax[13] and did not use other keywords that could be associated with each type of strategies (e.g. microfinance for impact investing; ESG indicators for ESG investing) because it could bias the results and therefore the resulting network. The search was done in the ***Web of Science*** database, resulting in 369 documents (we make the full list available as supplementary material to this article). As a narrow search syntax was used, it is important to note that this represents only a niche sample of the literature. Furthermore, neither the wildcard character '*' (as in "ethical* invest" which would have captured "ethically invest") nor expressions with "investment" were used – when the syntax was expanded this way, the search resulted in almost 2,000 documents. While these decisions may seem arbitrary, most of these 2000 papers were focused on corporate social responsibility issues other than sustainability investing, which is the core focus of this paper.

B) Exporting results: the full record of the 369 results were exported to ***Gephi***, an open-source network analysis and visualization software package.

C) Screening results: after importing records to ***Gephi***, the titles and abstracts of those 369 documents were screened to identify irrelevant papers or papers in languages other than English[14] (only one paper was removed, because it was not related to the subject of sustainability investing).

D) **Building the semantic network:** with the aid of a Gephi plug-in developed by the Brazilian ***Centre of Strategic Studies and Management*** (CGEE), a semantic (bibliographic) network was created. The network links two papers if they display semantic proximity, which is calculated based on a matrix (vector-space representation) of word co-occurrences in the title and abstracts of the documents[15]. Similarity was inferred by using the standard technique of calculating the cosine similarity of the vector-space representation of two document abstracts/titles (Rahutomo ***et al.***, 2012). The plugin and package calculates this as well as other indicators of this bibliographic network, such as the degree centrality of each node (how many other nodes a given node is linked to) and modularity class, designed to measure the strength of division of a network into modules (a 'class' or 'cluster' cosine similar documents). The bibliographic network that was created resulted in 354 nodes (the plugin discarded 15 data points due to lack of information), 685 edges and 93 modular classes. From those classes, 27 had at least 2 nodes (the other 66 classes were made up of only one node, i.e. each of these papers did not present enough similarity with others, given the conservative similarity cut-off parameter used).

E) **Analysing the bibliographic network:** the analysis sought to identify what connects a paper to another to form a cluster. This was done through an examination, for each cluster, of: (a) authors, organizations and countries, to access whether a class is characterized by the dominance of single author, organization or country; (b) Web of Science (WoS) categories; (c) first year when a document in the cluster was published and year when more papers in the cluster were published; (d) ***wordcloud*** of keywords; (e) identification of the two papers with the highest degree centrality; and (f) identification of the two most cited papers in the class. The examination of (a) is made to avoid spurious clustering, while the triangulation of (c), (d), (e) and (f) is what allowed for the identification of the theme(s) that characterizes each cluster in the network.[16] Annex I provides information about each modular class in terms of these indicators, and should be used to help with the interpretation of the semantic network. The complete list of articles (supplementary material) indicate the cluster to which each article was assigned (in step B).

We use these methods and procedures (analysis of the number of academic articles over time and semantic network analysis) to verify whether our initial map based on secondary accounts (section 3) could be confirmed by the analysis of a representative sample of articles looking at sustainability investing strategy. The results from both analyses led to the formulation of analytical propositions. The identification and analysis of the different types of sustainability investing strategies resulted in the proposal of a typology of such strategies, which informed our reflection on the appropriateness of such strategies for sociotechnical sustainability transitions. In section 5, we discuss these propositions and, in particular, the types of sustainability investing strategies in relation to sociotechnical transition theory.

3. The coevolution of the Business & Society field and the literature on sustainability investment practices

3.1. Chronology

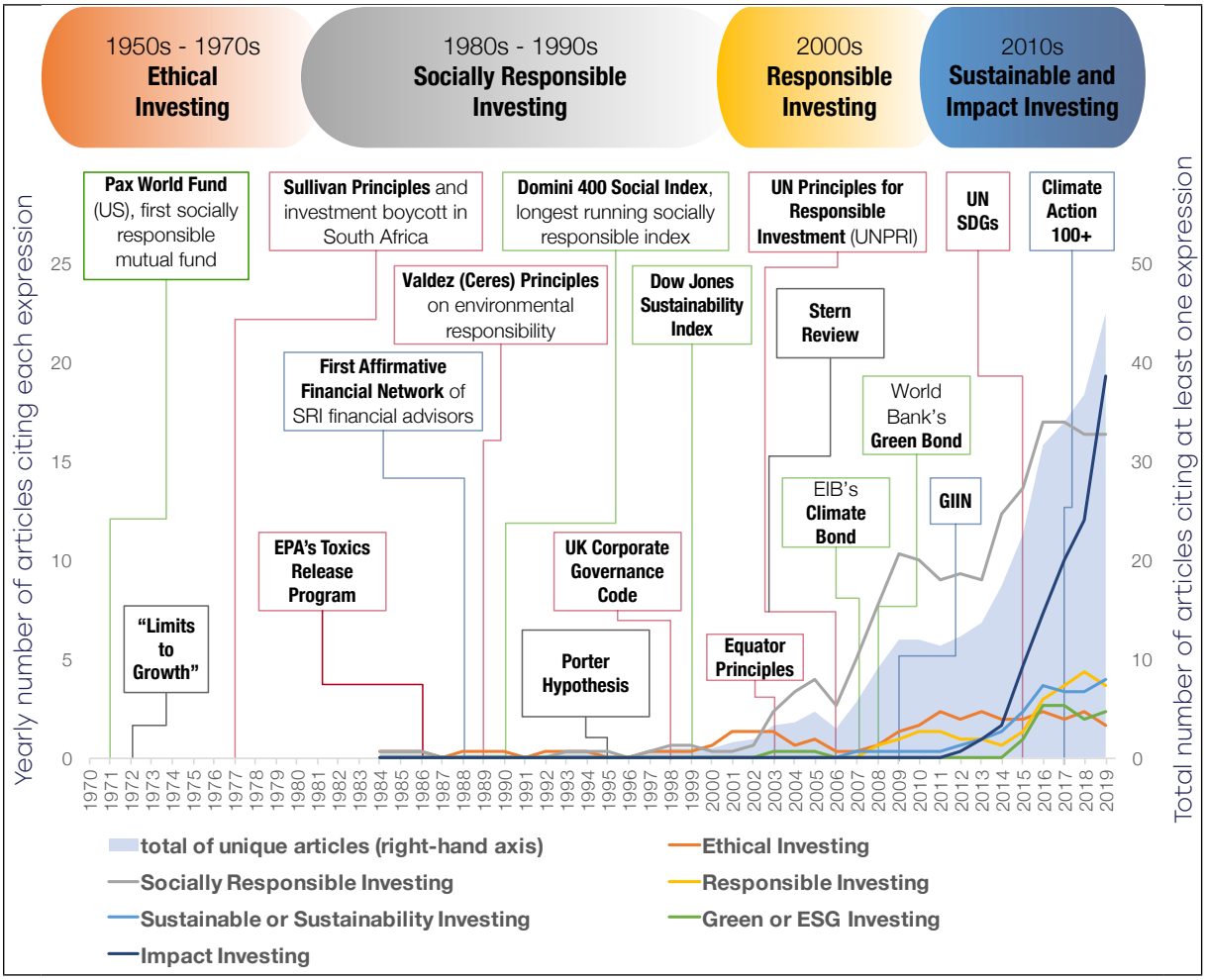
The terms used to refer to investment practices that integrate a consideration of moral values or environmental, social and governance (ESG) issues has varied over time. Eccles and Viviers (2011) identifies the most common terms[17] as:

- *Ethical Investment*;
- *Social Investment*;
- *Socially Responsible Investment*;
- *Responsible Investment*; and
- *Sustainability/Sustainable Investment.*

The number of terms referring to investment practices considering issues beyond financial return is vast, raising questions such as: are they all the same concept? And do they all deal with or refer

to the same kind of investment practices? The short answer to both questions is: 'no'. A review of the evolution of the literature explains why this is so. The literature looking at sustainability investing practices originates in the Business & Society field[18] of the 1950s, and is related to how both theory and practice evolved. Figure 2 depicts the result of our synthesis: a co-evolutionary process through which key events influenced the field and the usage of key terms in peer-reviewed articles.

Figure 2: Sustainability investing, the evolution of the field (number of articles per year, 3-year moving average and key events)



Note: The y-axis for the series for each of the six terms is on the left; the y-axis for the total number of articles citing at least one term is on the right. The light blue shaded area representing the yearly total of unique articles is less than the sum of the six data points in a given year, because a single article may use more than one term.
Source: Author's construction based on Deutsche Bank Group (2012); Eccles and Viviers (2011); Touchstone Investments (2020); UNPRI (2020); Vezér et al. (2017); [reference omitted].

This figure was constructed through the same search strategy (syntax) that we use for the semantic network, but we also searched for each sustainable investing strategy individually (as indicated in the labels of the figure – see also footnote 14) to check whether the focus of academic research on different types of strategy changed over time. One limitation of our restrictive approach (see the methodology section) is that it only captured articles published from 1970s onwards. However, the history of sustainable investing (broadly speaking) is thousands of years old, if one considers the alignment of financial practices with the religious values of Judaism, Methodism and Quakerism (Busch *et al.* 2021).

Two further observations about this figure are warranted: first, it shows the events that we discuss in the overview (narrative account) due to its apparent influence on the evolution of the field; second, decadal headings are based not only on the usage of terms in journals, but, more importantly, on our analytical overview of the field. While the figure may give the impression that the four periods

are well-structured along specific decades, in fact, the periods overlap. Our narrative overview will particularly emphasize how certain developments had lasting effects, strategies remained in use, and debates continue.

The publication of ***Social Responsibilities of the Businessman*** by Bowen (1953) grounded the concept of 'social responsibilities' on moral philosophy and ethics (Carroll, 1999). The focus on the ethical behaviour of the individual (i.e. the 'businessman' or the investor) gave rise to the philanthropic investment movement and to the first term used to refer to sustainable investment practices: ***ethical investing***. In the first wave of sustainability investing, the focus was on how to avoid investments in firms or activities that are deemed unethical – investors therefore held a ***deontological*** ethical position[19] towards their investments (Chatterji ***et al.***, 2009; Eccles and Viviers, 2011).

In the 1960s, the level of analysis began to move upwards, from the individual to the firm, with Davis (1960), who drew on the concept of power from political sciences to reformulate the moralistic rationale for social responsibilities into an 'Iron Law of Responsibility': business' social responsibilities should be proportional to its social power, otherwise it risked losing this very same power as well as social legitimacy (Davis, 1960, 1973)[20]. This was the inception of the concept of ***Corporate Social Responsibility*** (CSR), which is intimately associated with the concept of sustainable investing (Busch ***et al.***, 2016).

Normative views of social responsibilities of businesses were challenged by some economists, amongst whom the most famous was Milton Friedman (Kusunoki, 2016). In his book ***Capitalism and Freedom***, Friedman (1962) argued that the 'social responsibility of business' was to 'increase its profits' (as he later phrased it in a 1970 article) and contended that responsibilities other than that would impose a costly burden on shareholders. Therefore, according to Friedman, corporations had the strict economic responsibility to profit and pay dividends to its shareholders – to ***maximize shareholder value*** (MSV).[21] The flipside of this critique was that asset and portfolio managers who engaged in ethical investment practices, by selecting companies with higher levels of social performance, would be breaching their fiduciary duty, as those companies were deploying capital to address issues other than maximizing shareholder value.

Given this intellectual controversy (whether a firm have a social or environmental responsibility or only a profit maximization responsibility), in the 1970s scholars offered a more instrumental and pragmatic approach to corporate social responsibility (Carroll, 1999; Lee, 2008). Three main strands of research developed in that decade: one evolved into what is known as the 'Business Case for Corporate Social Responsibility' (that CSR contributed positively to a firm's financial performance), the second developed the idea of 'Corporate Social Responsiveness' (that firms had an obligation to respond to their ***stakeholders*** and not only to shareholders), and the third refocused the debate on the notion of 'Corporate Public Responsibility' (that firms were responsible for solving not all problems but those they have cause or related to their interests). It is the first strand that is more relevant for the literature on ESG-related investment practices.

Several authors attempted to demonstrate a "business case" for Corporate Social Responsibility by showing an empirical correlation between CSR and Corporate Financial Performance (CFP). If such correlation could be established, i.e. if the market rewarded socially responsible firms (e.g. through access to lower cost of capital or increased equity value), then engaging in socially responsible activities would be in the shareholders' interest. This research represented an instrumental approach to CSR; being responsible would be a means to the end of maximizing profits. Years later, the formulation of what came to be known as the "Porter Hypothesis" (Porter, 1991; Porter and Van der Linde, 1995a, b) – that environmental regulations do not hinder but often enhance competitive advantage – was a milestone in this stream of research, signalling the possibility of a win-win-win – or triple bottom-line (Busch ***et al.***, 2016) – situation (whereby shareholders, society and the environment 'profit'). While early

studies "tried to find the relationship between CSR and CFP without explaining the relationship" (Lee, 2008, p. 56), the Porter Hypothesis provided a causal reasoning for the link, and this line of research evolved theoretically and empirically in the following decades.

While theoretically researchers tried to demonstrate the rationales behind the 'business case' (Carroll and Shabana, 2010), empirically, proving that CSR and CFP were linked remained elusive in the beginning, particularly because of difficulties in ***measuring*** and ***comparing*** socio-environmental performance (Wood, 2010). Indeed, measuring corporate environmental, social and governance performance became a main focus of the field in the 1980s, with a continuing stream of contributions (to present days) and practical developments including the emergence of ESG-performance disclosure standards, ESG-rating agencies and ESG-data providers (Busch ***et al.***, 2021).

From the sustainability investing practice perspective, demonstrating the correlation between superior corporate ESG-performance and superior corporate ***financial*** performance was of paramount importance. If this link could be established, then ethical investing would be justified from a fiduciary duty[22] perspective. Ethical investing had received an impetus in 1971 with the launch of the ***Pax World Fund*** in the US, the first and longest running ethical mutual fund, which pledge not to invest in weapons production, in part a response to the anti-Vietnam War movement (Deutsche Bank Group, 2012). Another impetus also came in 1977 in the form of the ***Sullivan Principles*** (named after Rev. Leon Sullivan, at the time a member of the General Motors board). The Sullivan Principles were standards that were meant to challenge key features of apartheid for companies operating in South Africa. The adoption of the Principles meant that the complying company would transgress some rules of apartheid, e.g. 'non-segregation of the races in all eating, comfort, and work facilities' – creating a type of corporate 'civil disobedience'. The Sullivan Principles were more a governance reform than a divestment strategy, although the difficulty of complying no doubt became an impetus to divestment.

In those early decades, the practice of ethical investing was indeed mainly based on an exclusionary approach, in that certain firms or sectors were screened out of portfolios based on religious or moral grounds. And that was a problem, because a direct link between the investment practice of ***negative screening*** (also known as ***values-driven*** investment screening) by ethical mutual funds, on the one hand, and superior risk-adjusted performance of those funds, on the other, could not be established. Initial results were mixed or neutral at best, depending on the level of negative screens used for portfolio selection (Barnett and Salomon, 2006; Geczy ***et al.***, 2005).

Thus, like the Business & Society field, in the late-1970s the literature on sustainable investment ***practices*** moved towards a more pragmatic, instrumental and utilitarian ethical approach (Eccles and Viviers, 2011), whereby "financial arguments win [have precedence] over environmental or social considerations" (Busch ***et al.***, 2021: 33). To mark the move away from its religious and moral foundations, a new term was coined: ***socially responsible investing***. The key distinguishing feature of this new investment practice was the "combination of social and environmental goals with financial objectives of achieving a return on invested capital approaching that of the market" (Sparkes, 2001). In practice, that meant that a certain level of trade-off between corporate ESG- and financial-performance when making investment decisions was expected, particularly because portfolio selection was still centred on negative screening strategies (Deutsche Bank Group, 2012). It also meant that the ethical stance of investors moved from a deontological to a more utilitarian position (Eccles and Viviers, 2011).

Developments from the late 1980s and 1990s resulted in a new reframing of sustainable investing practices: (a) the recognition of the impact of certain environmental disasters on firm value (e.g. Exxon Valdez oil spill); (b) the surge in environmental disclosures (both by official sources, such as the US Environmental Protection Agency (EPA), and firms); and (c) the emergence of new practices – namely, shareholder activism and positive (or norm-based) screening.

Those developments meant first and foremost that ESG-related issues were assumed to be of ***material*** importance to corporate – and investment – financial performance. Several studies finally managed to demonstrate this materiality, using standardized environmental disclosure information, which boomed at the time (a key development was the US EPA's ***Toxics Release Program***, which started to disclose corporate pollution information in 1986). A meta-analysis of those studies by the Deutsche Bank Group (2012) showed "overwhelming academic evidence" that firms with superior ESG-performance faced lower cost of capital in terms of debt and equity as well as demonstrating both accounting-based and superior market performances. The business case for socially responsible investment ***seemed*** finally demonstrated. Yet, to this day there are conflicting evidence. While a systematic review article – employing different methodologies including meta-analysis – of more than 2000 studies examining the relationship between ESG- and financial performance found that 90% show at least a non-negative relation, with the majority finding a positive relation, when the authors analysed only a subset of those studies that looked at the performance of ESG portfolios, mutual funds and indices, the non-negative result diminished considerably (Friede ***et al.***, 2015). Similarly, Bruno ***et al.*** (2021) examined the performance of different ESG-investment strategies (accounting for exposure level, risks, and market momentum), and concluded that ESG considerations do not lead to superior performance (75% of a supposed outperformance would be due to traditional "quality" or growth factors). Therefore, the debate continues.

By the 1990s, however, the investing practices had shifted the focus from moral ***values*** to financial ***value***. Instead of negative screening investments, the new practice tried to ***positively*** screen investments, by including in the possible investment universe only those assets that displayed superior ESG-performance. Such practice comprised strategies like norm-based or index-screening, in which asset managers invest in companies that adhere to certain norms or a part of a sustainability-/ESG- market index. In 1990, ***Domini 400 Social Index*** was launched, since then becoming the longest running socially responsible stock index; in 1999, the most famous sustainability index was launched: the ***Dow Jones Sustainability Index***. Eccles and Viviers (2011) use the term ***responsible investment*** (without 'socially') to refer to this third wave of sustainability investing, which was popularized after the launch in 2006 of the UN's initiative ***Principles for Responsible Investment*** (UNPRI) and its widespread adoption.

The ***Principles for Responsible Investment*** were the result of a UN working group "to study the financial materiality of Environmental, Social and Governance (ESG) issues to securities valuation – a key finding being 'agreement [among analysts] that environmental, social and corporate governance issues affect long-term shareholder value… [and] in some cases those effects may be profound" (Deutsche Bank Group, 2012, p. 21). The UNPRI sought to formalize certain ESG-related standards, practices and goals.[23]

This was no minor turn in the evolution of the field, in that the ethical stance underlying the sustainability investment practices moved from a moral-based (deontological) ethics (based on a code of values) through a utilitarian/instrumentalist ethics (focused on minimizing ESG-risks) to an egoist ethics (focused on achieving superior return on investments) (Eccles and Viviers, 2011; see also the classification of investors that consider ESG- factors by Chatterji ***et al.***, 2009). This is why these authors define ***responsible investing*** as "investment practices that integrate a consideration of ESG issues with the primary purpose of delivering higher-risk-adjusted financial returns" (Eccles and Viviers, 2011). The underlying assumption of those practices is that ESG-issues are of material importance and it is possible to identify superior investment opportunities – those that offer more value to shareholders/investors – by analysing how the company scores in relation to ESG-factors (strategies used included "ESG-integration", the inclusion of ESG-factors in valuation models or best-in-class screening, to select a best-performing asset relatively to peers).

The scandals of Enron and Worldcom in the early 2000s (and the subsequent passage of the ***Sarbanes-Oxley Public Company Accounting Reform and Investor Protection Act*** in 2002) reinforced the trend of

responsible investment practices, putting a new emphasis on *governance* issues on top of environmental and social issues (the publication in 1998 of the *UK Governance Code* was part of this trend). Institutional investors and asset managers (and large asset owners known as *Universal Owners*) particularly pushed for this emphasis on governance. As Busch *et al.* (2021) observe, the governance dimension is quite different from the environmental and social ones and is associated with active types of "sustainable" investment strategies whereby shareholders pressure corporate executives and board directors for change (through active engagement and proxy voting). These *responsible investors* "typically exhibit active ownership, which entails shareholder engagement with the corporations they invest in, rather than just negative screening techniques" (Deutsche Bank Group, 2012, p. 21).

In the most recent years, a new term consolidated amongst practitioners to refer to investment practices that integrate ESG considerations into portfolio selection and management processes to achieve sustained competitive advantage and outperformance: *sustainable investing* (Deutsche Bank Group, 2012; Touchstone Investments, 2020; Busch *et al.* 2016). This reframing seems to have been stimulated by important sustainability- or climate-related developments, namely, the launch of the *Equator Principles* in 2003 by the International Finance Corporation (World Bank Group), an environmental and social risk management framework for financial institutions, and the *Stern Review* (Stern, 2006), which offered an estimate of the economic costs of climate change. These assessments were followed by financial instrument innovations to promote sustainability or mitigate climate-change, such as the European Investment Bank's *Climate Bonds*, in 2007, or the World Bank's *Green Bonds*, in 2008. It also gave rise to the strategy of thematic and cause-based investing.

In this forth wave of sustainability investing, the investment focus become less on avoiding unethical investments (as in the wave of ethical investing), minimizing ESG-risks (second wave) or capturing superior financial value associated with ESG-factors (third wave) and more on supporting or creating positive impacts to solve societal problems.[24] Impact investors therefore seem to return to a deontological ethical position coupled but now acting proactively and, sometimes, altruistically, even though utilitarian motives (e.g. avoiding ESG risks that could affect financial performance) also seem to persist particularly amongst asset managers who are bound to their fiduciary duties (cf. Eccles and Viviers, 2011 and Chatterji *et al.*, 2009).

This forth wave of sustainability investing comes with another round of instrument or strategy innovations, with a new focus: the practice of *impact investing* based the investment decision from 'ESG-inputs' to 'ESG-outputs' (actual impacts). The *Global Impact Investing Network* (GIIN), founded in 2009, defines impact investing as "investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return" (GIIN, 2020). To be sure, some forms of impact investing can be traced back to the previous decades (Benjamin *et al.*, 2004; Busch *et al.*, 2021), such or community investing, for disadvantaged localities (which received an impetus in the US with the Community Reinvestment Act of 1977) and microfinance (or microcredit), which seeks to provide access to finance and financial services to individuals (or small firms) who are adversely selected by other intermediaries.

Both *sustainable investing* and *impact investing* are terms increasingly adopted by academics (see Figure 2) and practitioners, indicating a new turn in the evolution of the field, towards more proactive, impact-oriented investment strategies. The announcement of the *Sustainable Development Goals* (SDGs) by the United Nations in 2015 can be seen as the part of this process – indeed, the SDGs are now often referenced in investors' statements concerning impact investing.

Based on the preceding analysis, we can advance the following proposition:

(1)

The literature on sustainable investing coevolved with corporate social responsibility theory and with the practice and events of the field, revealing four distinctive waves of "sustainability investing".

We deem important to discuss this proposition in light of the periodization offered by Busch ***et al.*** (2021). In our understanding, the identification of four waves is compatible with their view on the different "Sustainable Finance" eras: the first wave would correspond to what they call Sustainable Finance 1.0; the second and third waves would cover Sustinable Finance 2.0; and the fourth wave, Sustinable Finance 3.0. As we will argue, the results reported in section 4 also lead us to speculate about the emergence of a fifth wave of sustainability investing. Our analytical overview of the evolution of the field provide details to different aspects of these waves/eras. Table 1 provides a summary of our analytical chronology: the key terms used to refer to sustainability investment practices, indicating the period in which their use was more prominent; their ethical foundation; associated themes; and main investing (portfolio selection) strategies.

Table 1: Schematic summary of the sustainability investing literature and practice

	1950s-1970s	1980s-1990s	1990s-2000s	2000s-2010s
Key terms	Ethical investing	Socially responsible investing	Responsible investing	Sustainable and impact investing
Definition	Investments guided by moral values, ethical codes or religious beliefs.	Investments that combine socio-environmental goals with financial objectives to achieve a return on investment approaching that of the market.	Investments that integrate a consideration of ESG issues with the primary purpose of delivering higher-risk-adjusted financial returns.	Investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return.
Ethical position	Deontological	Utilitarian	Egoist and Utilitarian	Utilitarian and Deontological
Level of analysis	Businessmen	Shareholders and companies	Companies, corporate executives/ directors and asset managers	Asset managers, shareholders and impact investors
Themes (also associated to events)	Moral responsibilities of investors; Philanthropy; Environmental and social issues; Fiduciary duty and MSV	Relation between CSP and CFP; Performance of SRI funds; Measuring CSP; Shareholder activism	Materiality of ESG-factors; Governance issues; Standards for ESG-disclosure and data	Impact-oriented investing; Shareholder engagement
Investing strategies	Negative/ exclusionary screening; Philanthropy	Negative screening; Positive screening; Norm-based and index investing	ESG-integration (valuation); best-in-class screening; Active ownership and engagement; Proxy voting	Thematic and cause-based investing (incl. thematic bonds); Community investing; Microfinance; Venture philanthropy

Source: Author's construction.

Because of our interest on the types of investment strategies to promote sustainability, we here offer a brief definition of the most important categories (bottom row in Table 1). In line with Krosinsky (2017), who discusses the "seven tribes of sustainable investing"[25], in our overview we encountered seven sustainable investing strategies:

a) **Negative screening and exclusionary approaches:** a passive, binary choice, in that a company, sector/class of assets, or assets from a given country, is out of the investment universe or portfolio, depending on e.g. moral values or on pre-defined criteria.[26]

b) **Norm-based screening:** this strategy is related to external criteria as the standard for inclusion of an asset in the investment universe (e.g. being part of a sustainability index or adhering to certain norms and certifications). Other terms used in association to this strategy is passive (sustainability, social or ESG) index investing and ESG-indicator based (factor investing).

c) **Positive screening or best-in-class screening/ relative screening:** a pure positive screening strategy that is a passive, binary choice, in that a company or sector is in an investment universe or portfolio due to it being socially or environmentally responsible. ***Best-in-class or relative screening*** attributes weights to certain criteria in order to rank investment opportunities in different asset 'classes' or sectors.

d) **Full integration of ESG factors into individual stock valuation:** a long term, value investing strategy, in which ESG factors are computed into the valuation model (fundamental analysis), together with traditional financial and economic factors. The difficulty in this strategy is to obtain standardized high-quality data to allow for comparison between investment opportunities

e) **Thematic investing (sustainability themed, cause-based):** investments in companies, projects or assets related to a theme, usually linked to the development of sustainability. Include "thematic funds" that seek to address a given societal (ESG) challenge. It is a strategy that requires a screening procedure and certain investment products such as social or green bonds can be associated with this type of strategy.

f) **Active ownership and engagement:** in this active strategy, the investor or fund manager try to directly influence the management, strategy and business model of the company. Active ownership "deviates completely from the [other strategies] in that it is not about making investment decisions, but rather about how ownership is conducted. […] They do so by engaging in dialogue, filing resolutions, and using their voting rights at Annual General Meetings [AGM]." (Eccles and Viviers, 2011, p. 394) Other practices/terms associated with this strategy are: shareholder activism (when an activist buys a company's share with the sole objective to gain access to its AGM and e.g. stage a protest); engagement and voting; and proxy voting (whereby a fiduciary will cast a vote for other shareholders in shareholder meetings) and shareholder resolutions (Eurosif, 2016). Note that Eurosif (2012) does not consider engagement and voting on ***governance matters only*** as a type of sustainable investing strategy.

g) **Impact investing:** the focus of this strategy is to invest in assets that provide solutions to societal challenges, i.e. cause a 'positive impact'. While the focus may be on companies, it is increasingly on specific ***projects***, and may target several asset classes along the investment chain, such as cash equivalents, fixed income, venture capital and private equity. This strategy also requires high quality standardized data for impact measurement to access impact.[27] It differs from philanthropic support to projects, in that the investor is also expecting a risk-adjusted market return on capital, which may vary depending on the asset class. Other terms (or practices) associated with impact investing include microfinance/ microcredit, community investing and social business/entrepreneurship funds. Busch ***et al.*** (2021) propose two types of impact investment strategies: impact-aligned investments, which is backward-oriented as it considers already realized ESG-outputs; and impact-generating, which is forwards-oriented by considering future ESG-outputs.

3.2. Recent change in the sustainability investing landscape

Since 2012, every two years the Global Sustainable Investment Alliance[28] (GSIA) publishes a ***Global Sustainable Investment Review*** – the 2018 edition being the most recent one (Global Sustainable Investment Alliance, 2019). This report is based on results from the GSIA studies of regional sustainable investment markets (Europe, the United States, Japan, Canada, and Australia and New Zealand). Table 2 shows the growth of sustainable investing assets by region. While the largest market in 2018 is Europe (USD 14.1 trillion), followed by the USA (USD 12.0 trillion), the fastest growing markets are Australia/New Zealand (USD 734 billion) and Japan (USD 1.7 trillion).[29] Also, worth noting, the proportion of sustainable investment assets relative to total managed assets grew in every region from 2014-2018 except for Europe. This fact highlights the increasing adoption of ESG-related investment strategies by investors worldwide.

Table 2: Growth of sustainable investing assets by region in local currency 2014–2018

	2014	2016	2018	Growth per period		Compound Annual Growth Rate (CAGR) 2014-2018
				Growth 2014-2016	Growth 2016-2018	
Europe	€9,885	€11,045	€12,306	12%	11%	6%
United States	$6,572	$8,723	$11,995	33%	38%	16%
Canada (in CAD)	$1,011	$1,505	$2,132	49%	42%	21%
Australia/ New Zealand (in AUD)	$203	$707	$1,033	248%	46%	50%
Japan	¥ 840	¥ 57,056	¥231,952	6,692%	307%	308%

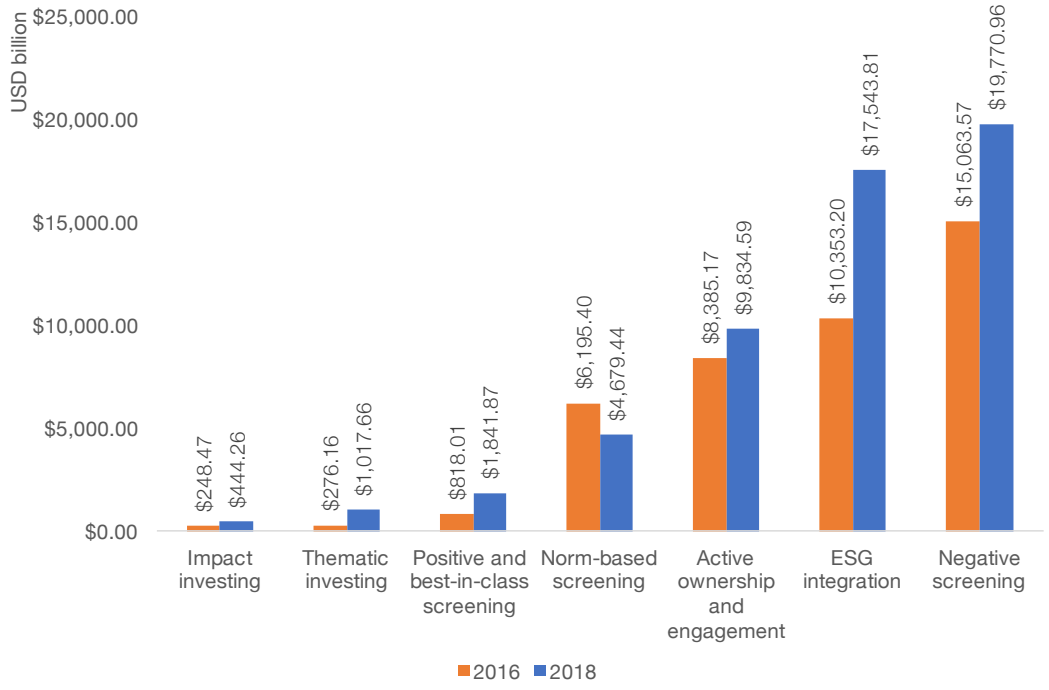
Note: Asset values are expressed in billions. All 2018 assets are as of 31 Dec 2017, except for Japan, whose assets are as of 31 Mar 2018.
Source: Global Sustainable Investment Alliance (2019, p. 8)

GSIA adopts a seven-fold classification of strategies for sustainable investing (similar to Eurosif's (2012) and Krosinsky's (2017)). Figure 3 shows how the assets managed under each of the strategies grew between 2016 and 2018.

The largest sustainable investment strategy globally continues to be negative or exclusionary screening […], with a combined $19.8 trillion in assets under management. This is followed by ESG integration, which has grown by 69 percent over the past two years, to $17.5 trillion in assets. Negative screening is the largest strategy in Europe, while ESG integration commands the majority of assets in the United States, Canada, Australia and New Zealand. Meanwhile, corporate engagement and shareholder action constitute the predominant strategy in Japan. (Global Sustainable Investment Alliance, 2019, p. 10)

From a very low level in 2016, the most rapidly ***growing*** strategy has been ***thematic investment*** (CAGR of 92%), followed by ***positive and best-in-class screening*** (CAGR of 50%). New investment strategies such as ***impact investing*** grew 34%, and so did ***ESG integration*** (30%) and ***Active ownership and engagement*** (8%). Interestingly, the oldest type of investing style, ***negative screening***, continued to grow at a CAGR of 15% between 2016 and 2018. The only strategy that saw a decline in the amount of assets under management was ***norm-based (index) screening*** (CAGR of -13%).

Figure 3: Global growth of sustainable investing strategies 2016–2018



Source: Based on data from the Global Sustainable Investment Alliance (2019, p. 10)

Long-term (prior to the 1990s) datasets on the size of different sustainability investing strategies globally over time are rare (or, to our best of knowledge, non-existent). The US SIF Foundation (2020) estimates the size of sustainable investing in the US market since 1995, separating strategies into two categories: ***ESG Incorporation*** (not necessarily ESG Integration but simply applying any ESG-related criteria for investment decision and portfolio selection) and ***Shareholder Advocacy*** (filling shareholders resolutions on ESG issues at publicly traded companies). Its data underscores the fast pace of increase in sustainable investments in the past decades: in 1995, it estimated assets of $639 billion which increased 25-fold (14% CAGR) up to 2020 when it reached more than $17 trillion[30], and "the most rapid growth has occurred since 2012" (US SIF Foundation, 2020: 1). In Europe, Eurosif has estimated the size of each of the seven sustainable investing strategies since its 2012 report (Eurosif, 2012). Between 2011 and 2018, all strategies presented a positive 6-year CAGR, with "Impact Investing" displaying the highest rate (52.2%, representing however the smallest strategy in assets of €108.6 billion in 2017), followed by "ESG Integration (22%[31], €4.2 trillion) "Sustainability Themed" (20.7%, €148.8 billion), "Engagement and Voting" (18.4%, €4.6 trillion), "Exclusions" (Negative Screening (17.6%, the largest strategy with assets of €9.5 trillion), Best-in-Class (12.9%, €585.7 billion), Norm-Based (6.7%, €3.1 trillion).

Despite methodological difficulties, different sources converge in the depiction of similar trends in the past two decades. While newer strategies such as thematic investing and impact investing show large growth rates (which would be expected if the proposition that they pertain to a fourth sustainability investment wave is right), older strategies are still the most adopted by investors and keep growing (which is somehow surprising). Negative screening, with a smaller growth rate (and decreasing in Europe between 2015 and 2017 according to Eurosif, 2018), is still the most popular "sustainability" investing strategy, being associated with the first and oldest wave of "ethical investing". ESG Integration is the second largest globally and in Europe, and still displays a significant growth rate. These facts seem to imply that successive waves propel previous ones upwards, in a 'tidal effect'. This leads to our second proposition:

(2)
Each wave of sustainability investing triggers new investment strategies, while propelling preceding ones upwards ('tidal effect').

While this proposition, as a hypothesis, may be hard to verify given the lack of detailed data on asset size of the different strategies before the 2010s, the idea of a "tidal effect" that we propose has more to do with size and growth rates than with novelty (many if not all strategies pre-dates the past two decades). The proposition also reflects the fact that the successive strategies seem to compete with the older strategies, which continue to attract resources[32], so that newer strategies receive a relatively small share of total sustainability investments. Yet, as newer sustainability investing strategies have a higher cumulative growth rate, should they be able to sustain this growth rate they would eventually pass the older strategies. On the other hand, sustaining these growth rates may not be feasible unless ***negative screening*** and ***ESG integration*** were to begin to decline (if we assume a "zero-sum" game) or more funding will have to be directed to sustainability investing.

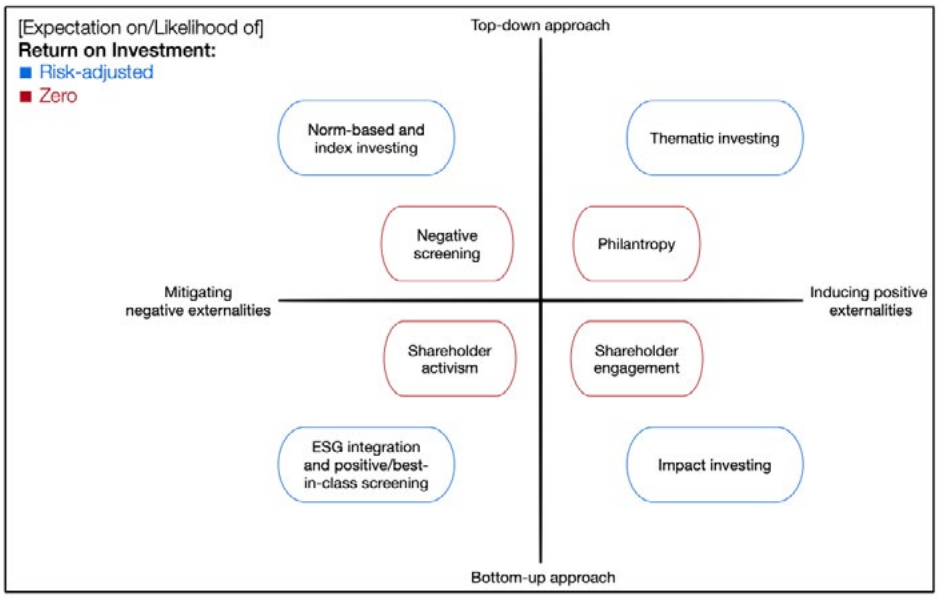
An important question is: what might cause a redirection of resources from 'older' to 'newer' strategies or the attraction of more funding to sustainability investing? We suggest that a better understanding of transition processes may raise the value of the impact-oriented strategies, including shareholder engagement, in terms of market return or perceived impact on systemic change or both (and thus attract new money). We elaborate on this suggestion in section 5.

3.3. Towards a typology of sustainable investing strategies

To better position each investment strategy relatively to one another, and (in section 5) discuss where the insights from transition theory are likely to be applicable, we propose a simple typology (our third proposition) of sustainable investing strategies (Figure 4):

(3)
Sustainable investing strategies can be typified along the following categories:
(a) Approach (top down/ investment thesis or bottom up/ valuation);
(b) Orientation (mitigating negative externalities or inducing positive externalities);
and (c) Return on Investment (from zero to risk-adjusted)

Figure 4: A new typology of sustainable investing strategies



Source: Author's construction.

Although the figure may suggest binomial categories, they are better understood as a continuum, particularly the "return on investment". This category indicates the that investors often accept to forego financial returns in favour of ESG-results, be them mitigating negative externalities or inducing positive externalities. The "Orientation" category reflects the fact that certain strategies seek to avoid investments in assets (companies, projects) that cause societal problems, thus mitigating negative externalities, while others try to support those that promote positive change, i.e. "positive externalities" (loosely speaking). Finally, the "Approach" category represents the fact that certain strategies are based on principles (values, beliefs) that define an investment thesis based on which a portfolio is selected ("Top down" strategies), while others are based on knowledge about an asset's underlying ESG "fundamentals", depending on the quality of associated metrics for its effectiveness. This framework creates an ideal typical space where "pure types" are represented. In practice, investors may adopt multiple strategies or hybrid strategies, so that e.g. shareholder activism or engagement could be based on values and beliefs, but they would still need to be anchored in facts (e.g. evidence of a company's wrongdoings) to reach results.

Our typology seems consistent with the one proposed by Busch ***et al.*** (2021), which has four categories: ***ESG-screened investments***, ***ESG-managed investments***, ***Impact-aligned investments***, and ***Impact-generating investments***. In their typology, these categories would differ in terms of ***objectives*** (mitigation of ethical concerns; identification of ESG-risks and opportunities; addressing societal challenges; and contributing to societal transformations, respectively), ***materiality*** (which is not addressed or measured, in the first two types, respectively; or is addressed through benchmark analysis or measurement of

generated impact, in the latter types, respectively), ***general approach*** (mainly exclusionary strategies in the case of ESG-screened; a combination of exclusion and other nonengagement strategies in ESG-managed; and a combination of screens; other strategies and engagement strategies in the impact types); and ***documentation*** to increase transparency (decision-making and capital allocation is increasingly documented and verified, while impacts measured as we move from the ESG-screened/managed to Impact-aligned/generating types). If we disregard the ***general approach*** category, then we could position ***ESG-screened*** investments in the top-left quadrant of our typology, ***ESG-managed*** in the bottom-left, ***Impact-generating*** in the bottom-right, and ***Impact-related*** in the top-right.

The added value of our framework is, first, its systematization of the main sustainable investment strategies (Eurosif, 2012; Krosinsky, 2017) along simple categories. Second and most important, the framework is useful for our discussion of strategies in relation to sociotechnical transitions theory. Without the horizontal category, non-sustainable (traditional) investing strategies could be positioned such a framework. Therefore, the horizontal axis is key for this discussion, but we will also discuss implications from the two other categories. Indeed, Busch ***et al.*** (2021) conclude their commentary on the need to provide an explicit causal link between what they call impact investments and the solutions to socio-environmental challenges, to determine and measure the positive impacts on the real world. In section 5, we address this suggestion by discussing how sociotechnical transitions theory can help in the formulation of a framework (or Theory of Change) that allow for the explicit identification of the causal links and, potentially, of the elusive aspects of intentionality and additionality behind impact investments.

The intersection of the three categories in our framework logically results not in the traditional seven-strategy typology proposed by Eurosif (2012) and others, but eight ideal-typical investment strategies. We argue that the one missing is not considered nowadays to be a "sustainability investing" practice but was present in the origins of the field: philanthropy. It is not an "investment" strategy as such, for it does not provide a financial return to the investor (unless sometimes in the form of tax-breaks) but it is associated with the early notion of "ethical investments" and currently with "impact investment". Indeed, it sits on the opposite end of traditional forms of investment that seeks financial returns only; philanthropy seeks positive impact and thus "focus[es] on one or a cluster of issue areas where social or environmental need requires 100% financial trade-off" (Eurosif, 2012: p. 21, citing the ***Bridges Ventures***' framework of sustainable investment).

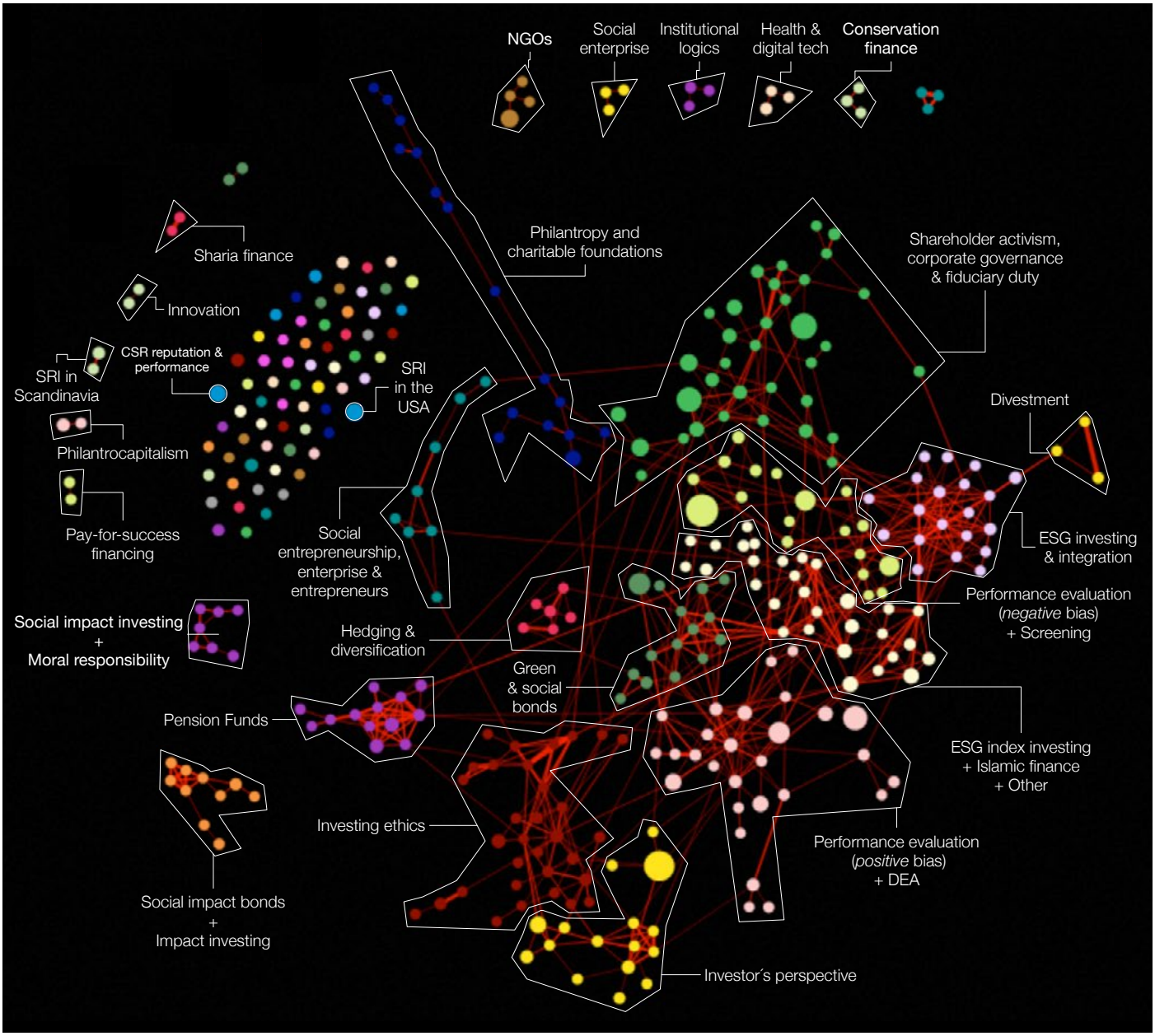
In 2018, there were more than 260 thousand philanthropic foundations in 39 countries (60% of which in Europe and 35% in North America), with assets exceeding USD 1.5 trillion (60% in the United States only and 37% in Europe) (Johnson, 2018). In 2018, the asset value of philanthropic funds was 50% larger than that of impact investing and thematic investing (Figure 3), although this gap may have declined since. An area for further examination is the ***practice*** of philanthropy, since philanthropic funds are engaged in a widening array of investment strategies to meet their "impact" objectives, including new tools or approaches (such as equity or 'venture philanthropy' investments, social investments and income contingent loans/grants) and are developing their own tools for monitoring and evaluating impact (Johnson, 2018; Kingston and Bolton, 2004). "Venture philanthropy" (VP) is a type of support to businesses, i.e. whose business models has societal purpose and which seek both profits and positive impact, whereby VP organization provides financial (through grants, subsidized loans or equity investments) and nonfinancial (e.g. mentoring and capacity building), support (Gianoncelli ***et al.***, 2019). Venture philanthropy tends towards the impact investment strategy when VP institutions use repayable forms of capital (as opposed to grants), which is increasingly the case the more "for profit" is the supported organization (***idem***).

Despite its recent consolidation as a strategy (associated or not to philanthropy), impact investing still appears at the periphery of the sustainable investing literature, as we will show in the next section. While financing transformative change could jump on the bandwagon of impact investing, achieving greater scale would likely require additional criteria to effectively use other strategies in Figure 4.

4. A semantic map of the literature on sustainable investing

Figure 5 shows the bibliographic (semantic) network that results from the search strategy presented in section 2. The network was created with the aid of a specific plugin for building semantic networks in the network analysis software Gephi: its representation was exported as a vector image, so that it could be rearranged with the aid of an image editing software. Thus, some observations on the representation are warranted: first, the arrangement of the clusters in the bidimensional space does not carry any objective meaning, in the sense that they were simply rearranged for the sake of clarity; and second, neither the length of the linkages (edges) carry any meaning, but their colour shades do (the darker the edge shade, the more similar the nodes); and, third, the colour of the nodes indicate the clusters (network's modularity class based on semantic proximity between articles). Fourth, instead of using the indicator degree of centrality to determine the size of each node, "total times cited in WoS" was used. That is, the size of each node represents how many times the document was cited according to the Web of Science database. While this indicator is unrelated to and does not define this type of similarity network (and intriguingly, most highly cited papers have only a modest number of links to other papers in the sample), it allows for visually identifying which clusters contain the most cited papers. Annex I is provided as a way to describe each cluster, and the reader is referred to it to help with the interpretation of the clusters.

Figure 5: A bibliographic network of the sustainable investing literature



Source: Author's construction

Our qualitative analysis of each cluster resulted in the identification of only two spurious modularity classes (in the sense that no common theme was identified), one with three nodes and one with two nodes (neither are encircled in Figure 5; they appear at the top right and top left in the Figure). While the detailed discussion of each cluster exceeds the space available for this paper (for an overview, see Annex I), we here indicate our key insights, which were established through the analysis of the clusters in terms six categories presented in the methodology. In particular, we proposed the labelling for the clusters based on the themes that we identified after analysing the ***wordcloud*** of keywords and the topic of the most central papers in each cluster.

I) The largest cluster, with 35 nodes, is focused on themes related to ***shareholder activism, corporate governance and fiduciary duty***. Papers in this cluster were published on or after 2000, with the largest number of papers published in 2018 and 2019. This confirms the assessment of the field as depicted in Table 1.

II) The second largest cluster, with 32 nodes, is focused on ***investing ethics***, including ethical investing, performance of ethical investing and values-based portfolio selection strategies. It is the 'oldest' cluster in the sample, in that the first paper in it was published in 1988. This cluster is closely connected to another large (yellow) cluster focused on ***investors' perspective*** on ethical investing.

III) While the blue cluster grouping papers that looked at ***philanthropy and charitable foundations*** is also linked to the investment ethics cluster, its papers are more recent (first paper in 2011), and also deals with other contemporary themes such as mission investing and impact investing.

IV) The third largest cluster, with 30 nodes, could actually be broken into three, as it focuses on three seemingly unconnected topics: Islamic finance; index investing; and other 'academic' themes (***ESG index investing*** + ***Islamic finance*** + ***Other***). What linked those groups together were papers that looked at the practice of index investing, be it ESG-related indexes or Islamic-indexes.

V) While performance evaluation or the relationship between mutual fund performance and CSR are (secondary) topics that appear in many different clusters, two clusters can be characterized as having performance evaluation as their primary theme. Interestingly, one of these clusters (large yellowish-green cluster: ***Performance evaluation (negative bias)*** + ***Screening***) grouped papers that achieved a 'negative result' in the performance evaluation, drew on modern portfolio theory (e.g. Markowitz, 1991), and looked at screening strategies. The most cited paper in the sample, with 453 citations, appears in this cluster (Barnett and Salomon, 2006). The other (large light-pink cluster: ***Performance evaluation (positive bias)*** + ***DEA***) grouped papers that achieved 'positive results' in the performance evaluation, also drew on modern portfolio theory, and some of those papers used the Data Envelopment Analysis (DEA) method to evaluate performance against a benchmark. The first paper in the "negative bias" performance cluster appears in 1997, while in the "positive bias" performance cluster the first paper appears in 2005. Once again, this result reinforces the qualitative assessment in section 3.

VI) The light purple cluster with 20 nodes is focused on ***ESG-investing*** themes, particularly those related to ***ESG-integration*** strategies (valuation, fundamental analysis). The first paper in this cluster appears in 2011.

VII) There are other four medium-sized clusters (ranging from 6 to 15 nodes) that are connected to the main network and that focus on specific themes discussed in section 3: (1) ***green and social bonds***; (2) ***pension funds and institutional investors***; (3) ***social entrepreneurship, enterprise and entrepreneurs***; and (4) ***hedging and diversification"***. Interestingly, two other medium sized clusters (on the left side of the Figure) are ***not*** connected to the main network, and both deal with impact investing themes: ***social impact bonds*** (first paper in 2016) and ***social impact investing*** (2009).

VIII) The five two-node clusters on the left side of the figure, and the four-node and four three-node clusters on the top the figure are all related to specific, niche themes. Some of these themes are conceptual or focused on certain constructs (***philantrocapitalism***; ***innovation***; ***NGOs***; ***institutional logics***; ***Sharia finance***) or are country-specific (***SRI in Scandinavia***). The other small clusters seem connected to specific theme-based investing practices: ***social enterprise***; ***conservation finance***; ***financing the health and pharmaceutical industry***; and ***pay-for-success finance***. All papers in those

clusters were published after 2004, which is in line with the qualitative assessment made in section 3, in which thematic and cause-based investing were practices associated with the responsible investing movement of the 2000s. None of these small clusters are connected to the main network. Yet, one small cluster with three-node (yellow, on the right side of the figure) is connected to the main network (through links to the ESG investing cluster) and is focused on ***divestment strategies***.

The results from the analysis of the semantic network seem consistent with discussion of the evolution of the field (section 3). Yet, despite its surge in number of articles since 2014 (see figure 2), the network shows disconnection between the impact investing clusters and the main network. While this seems contradictory, it raises the hypothesis that research focused on the ***impact*** of investments is not disconnected but ***disconnecting*** from the larger field which is still focused on traditional finance themes (such as risk-return assessments of ESG investments). Indeed, "impact" is increasingly discussed from the perspective of development or policy studies. Such a dynamics could lead to a "new wave" of sustainability investing, informed by multi- or interdisciplinary studies. Therefore, we advance our fourth proposition:

(4)
We may be witnessing the emergence of a fifth wave of sustainability investing triggered by new research and practices on "impact investing".

5. Discussion of the four propositions and implications to sustainability transitions

This section is a discussion of the propositions of sections 3 and 4 in relation to an exploratory 'theory of change' based on key results from sustainability transitions field. A theory of change (ToC) explains a change process – in this case, a sociotechnical transition – by outlining causal linkages between elements (in a sociotechnical system) to establish (transition) pathways. This exploratory TOC is based on the understanding that in order to address the sustainability challenges, a fundamental redirection of current socio-technical regimes is necessary. These regimes guide the provision of energy, water, mobility, food, healthcare, education, finance, security etc in functional systems. A change of these regimes occurs through dynamic and complex interactions between niches, regimes and the landscape, as conceptualised in the Multi-level Perspective (MLP) (Rip and Kemp, 1998; Geels, 2002; Geels and Schot, 2007), and emerging couplings across multiple systems (Konrad ***et al***., 2008; Schot and Kanger, 2018). This theory of change embraces the idea that transformations of dominant and unsustainable sociotechnical regimes happens due to the confluence of the emergence and maturity of alternative sociotechnical regimes in niches (protected spaces where actors experiment with technological, institutional and behavioural innovations); the coupling of the regimes inducing change in a similarly more sustainable direction; the influence of trends and shocks (the climate crisis, increasing inequality, pandemics such as COVID-19; digitalisation) called the sociotechnical landscape; and the destabilisation and opening up of existing regimes. Various combinations of these developments are possible, resulting in a wide range of pathways to sustainability (Geels and Schot, 2007). We further detail the elements of this ToC in our discussion of the propositions.

Our first analytical proposition states that: "The literature on sustainability investing coevolved with corporate social responsibility theory and with the practice and events of the field, revealing four distinctive waves of 'sustainable investing'." Each new wave seems to have been motivated by conceptual and practical developments that provided stimuli for sustainability investing innovations. In turn, these innovations led to new conceptualizations. While important developments, from a sociotechnical transition theory perspective, these conceptualizations still have shortcomings for achieving systemic transformations towards sustainability for two reasons: first, they are incremental formulations that keep tenets of the financial regime intact: the exclusive goal of maximizing financial returns (or 'shareholder value') given the degree of calculable (financial) risk. That is, investing intermediaries seek risk-adjusted wealth growth and most sustainability investing strategies are

based on this principle. As Naidoo (2020), Loorbach ***et al.*** (2020) and others have argued this is not sufficient to count for necessary destabilisation of the existing dominant financial regime.

On the issue of traditionally appraised risk, it is also worth exploring the contradiction between the view (by political forces that resist sustainability) that the consideration of ESG-factors is a breach of an investment intermediary's fiduciary duty, due to the supposed near-to-medium term underperformance of ESG-based portfolios. In 2020, for example, the Trump administration's Department of Labour (DOL) issued an executive order that in practice forced retirement plan fiduciaries to base their investment decisions exclusively on traditional financial factors, justified on the argument that ESG investments underperform traditional ones. It can be argued, however, that to the extent that transformative change is set in motion, the medium and longer-term risk of many of the current high-return investments is much higher. Short term returns become increasingly risky in an era of dramatic change.[33] So, in the context of pension fund investment, to keep the example, which is traditionally thought of in terms of a portfolio mix between capital preserving and longer-term growth, the Trump administration proposal is simply an extension of a 'denier' perspective, which is ultimately much riskier than a transformative investing orientation.[34]

Second from a sustainability transitions' ToC perspective, these changes fall short, because they do not provide a substantial stimulus of change of sociotechnical systems deeply implicated in generating the sustainability challenges the world is facing. The underlying assumption is that investment can become 'more efficient' in delivering positive externalities by the selection of 'greener' or 'more socially sustainable' companies. This may involve a change in direction of the companies but does not necessarily make a change in direction in the sociotechnical regimes in which these companies participate.

The practice of sustainability investing seems disconnected from sustainability transition theory, which suggests that sociotechnical niches are key in transition processes (Grin ***et al.***, 2010; Kemp ***et al.***, 1998). Those niches therefore need to be shielded, nurtured and upscaled (Ghosh ***et al.***, 2020; Naber ***et al.***, 2017; Sengers ***et al.***, 2019; Turnheim ***et al.***, 2018), for which funding is needed. The processes of shielding, nurturing and scaling go beyond individual projects and companies, they include processes of learning, networking, and institutionalisation that all go beyond investing in project and companies. But from the mainstream investment perspective, funding will only go to niche building companies that promise higher wealth growth, a principle shared by traditional sustainability investing practices. As a class of investment, niche companies that offer highest potential to disrupt regime incumbents are likely to pose the highest risks. Therefore, these companies are 'adversely selected' (a type of market failure) by sustainability investors. While impact investing seems to be the exception in this respect, it also could benefit from adopting a more nuanced sustainability transitions theory of change, based on the contributions from sociotechnical transitions research on niche development (what makes them develop and expand). Such a theory of change will help to assess, evaluate and monitor niche building capabilities of projects and companies and whether needed complementary measures are in place.

Our second proposition argues that: "Each wave of sustainability investing triggers new investment strategies, while propelling upwards preceding ones ('tidal effect')." This type of layering poses a risk that even impact investing may not be conducive to radical change. Yet, when deployed together as part of a ***transformative investment*** portfolio, different strategies may help to promote transformations. Considering (our third conclusion) that "sustainable investing strategies can be typified along certain categories, namely: (a) approach (top down/ investment thesis or bottom up/ valuation); (b) orientation (mitigating negative externalities or inducing positive externalities); and (c) return on investment (from zero to risk-adjusted)", one may argue that what is missing is a new ***transformative investment framework that provide coherence and align all types of strategies***. Such investment framework should simultaneously

draw on top-down principles/values and be amenable to bottom-up integration of impact metrics. Furthermore, considering that sustainability transitions require not only the supporting of niches, but also the destabilization and opening up of sociotechnical regimes (Ghosh ***et al.***, 2020; Karltorp and Sandén, 2012; Turnheim and Geels, 2012), a new transformative investment framework will need to consider practices that seek to avoid negative impacts, while also promoting positive change.

We know, based on sociotechnical transitions theory, that sudden replacement of dominant regimes is unlikely. Thus, we suggest that the mainstream investing principles that are still sustained by sustainability investing becomes initial pivots for radical transformation – a process similar to what Swilling (2020) calls "radical incrementalism". Investments whose longer-term value can be monetised (and therefore offer calculable risk) rule out those radical yet uncertain (unquantifiable risk) investment opportunities. But those initial monetizable 'transformative' investments should set in motion developments that (a) reduce the value of some existing unsustainable practices (to promote regime destabilisation or hollowing out of regimes) and (b) open up growth space for alternatives which themselves may only in the medium-to-long term become worthy of investment. The level of monetisation of the 'set in motion' investments will vary – some may not themselves yield near market rate returns (even in the long run). However, the 'follow on' investments that benefit from these initial investments can be expected to yield substantial returns. This 'coupling' of nearer-term enabling, monetizable investment with longer-term returns-oriented investment can be thought of as a type of intertemporal portfolio management strategy that we call ***transition enabling*** or a ***transformative investment bundle***. While our focus in this paper has been on ***financing transitions***, we hypothesize that this process of radical incrementalism could lead to a transition in the financial regime (or ***finance in transition***).[35]

Our final analytical proposition states that: "We may be witnessing the emergence of a fifth wave of sustainability investing triggered by new research and practices on impact investing". It is in this new wave that most opportunities for the creation of a destabilizing and potentially disruptive pathway for transforming the financial regime are. However, impacting investing needs to be both scaled up and more sophisticated theories of change must be employed to deliver on its impact promises (as also argued by Busch ***et al.***, 2021). For instance, impact investment funds often select company stocks based on the prospective positive impact of the products and services they offer, without considering the systemic dependencies on which those products/services are contingent. One may favour investment in electrical vehicles because they are better (pollution-wise) than fossil fuelled vehicles, but without further change (e.g. car-sharing, introduction of mobility as a service), a replication of the automobile stock with electrical vehicles does not go far enough in promoting a sociotechnical transition to sustainability in the mobility regime.

6. Concluding remarks

This paper sought to contribute to the field sociotechnical transitions to sustainability, tackling the neglected topic of ***financing*** sustainability transitions. To this end, it mapped the field of sustainable investing, to derive four analytical propositions, which were discussed against an exploratory sociotechnical sustainability transitions' theory of change. In so doing, it provided an initial bridge between the two fields.

Developing a new framework for sustainable investments – what we are calling ***transformative investment framework*** – based on a detailed sociotechnical transitions TOC is an important area for future research that mobilizes concepts from both fields. We conclude by suggesting that such a framework should lead to investments that:

- Go beyond compliance with ESG standards and beyond support for technological innovation (and indirect impacts), to account for systemic dependencies and intertemporal dynamics.

- Are geared to the long term, can cope with uncertainty and are focused on generating benefits

that may include but go beyond financial return.

- Promote radical changes that are aligned with and create synergies at multiple levels in different sociotechnical systems.

- Are coordinated beyond market dynamics, requiring a political (not necessarily public) role and offer new ways to address different 'market failures.'

- Appraise opportunities in terms social, ecological and financial values, risks and uncertainties, a process which would require new valuation methods and indicators that reflect transition and transformation dynamics. (This, in particular, is an important are for future research on finance in field of sociotechnical transitions.)

These suggestions are connected to the exploratory sociotechnical transitions' TOC outlined in section 5. In our concluding remarks, we further speculate about such a ***transformative investment framework.*** This framework requires a multi-actor process due to the systemic nature of the required transformation. On the one hand, the needed aligned or coordinated portfolios (bundles of investments) should target clusters of projects, companies and technologies throughout the transformation process. Some of these investments will offer a return on investment, while other should be pursued on the basis of its 'public good' profile[36], requiring the action from public investors (e.g. development banks, research and innovation agencies) or private donors (e.g. philanthropic foundations). These investments will often need to be accompanied by institutional work not performed by investors, such as policy reform, market articulation or cultural interventions. Open questions remain in terms of governance of this this multi-actor investment process: whether there is a need for a coordinating agent and whether such an agent would necessarily be public.

Still in terms of governance, we suggest, based on sociotechnical transitions theory, the need to reform structures and change rules that continue to be based on the goal of maximization of financial value subject to the minimization of calculable risks. This is likely to pose the highest challenge, as it will directly destabilize the investment regime, so that an alternative to overruling governance principles directly would be to promote new 'investor selection' processes, i.e. seeking and retaining only those who are aligned with the new framework for transformative investment (or 'transformative investment philosophy'), and, in particular, with the new risk and return profile of the bundle of investments. This could be achieved through new types of investing intermediaries, who, if successful, would gain legitimacy and attract imitative behaviour, which might be a way to address the scaling issue of impact investment. In other words, this process could lead to the institutionalization of new practices and promote a transition in finance. Note that the process does not assume that public coordinators are a pre-condition for transformative investment.

While an alternative investment philosophy cannot be a direct substitute for the current financial regime rules, it may be a philosophy that attracts investors through radical incrementalism and hence lead to viable strategy for specific investment intermediaries. Thus, intermediaries who are more constrained by the rules of the existing regime might strive to reduce the barriers to the growth of alternative, radical investments that close the existing financial gap for transformative change. We hypothesize, based on the key findings of sociotechnical sustainability transitions' theory, that, this way, private finance may be effectively mobilized in the support of the series of sociotechnical transitions needed to achieve lasting sustainability.

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Annex I: Summary of bibliographic (semantic) network clusters

Cluster	Number of nodes	Main theme	Other themes	Year of first article	Year with most number of articles	Largest country %	Largest WoS category	Paper with highest degree centrality	Citations	Paper with second highest degree centrality	Citations	Paper with most citations	Citations	Paper with second most citations	Citations
78	35	shareholder activism	cost of capital; corporate governance; financial performance; fiduciary duty	2000	2018; 2019	63% USA	17% Business Ethics	Shareholder activism on environmental issues: A study of proposals at large US corporations (2000-2003)	33	The Impact of Better Corporate Social Responsibility Disclosure on the Cost of Equity Capital	75	Does the stock market fully value intangibles? Employee satisfaction and equity prices	323	The impact of corporate social responsibility on the cost of bank loans	301
64	32	investing ethics	ethical investing; performance; portfolio selection	1988	2010; 2018	39% South Africa	25% Business Ethics	The "ethics" of ethical investing	65	Responsible investing in South Africa	7	Morals, money, ethical investing and economic psychology	75	The "ethics" of ethical investing	65
65	30	ESG indexes; islamic finance	financial performance; institutionalization of SR investing; academic perspectives	2003	2019	23% USA	43% Business Finance & Economics	Are environmental social governance equity indices a better choice for investors? An Asian perspective	6	Is there a role for Islamic bonds in global diversification strategies?	3	A critical review of sustainable business indices and their impact	104	Risk and return characteristics of Islamic equity funds	103
38	28	performance evaluation (positive bias)	data envelopment analysis; modern portfolio (Markowitz) theory	2005	2019	29% USA	32% Business Finance; 21% Management, Operations Research & Management Science	Green and Good? The Investment Performance of US Environmental Mutual Funds	65	The Performance of European Socially Responsible Funds	81	The eco-efficiency premium puzzle	282	The price of ethics and stakeholder governance: The performance of socially responsible mutual funds	223
40	20	ESG investing	financial performance; ESG integration	2011	2016; 2019	40% USA	45% Business Finance	The Alpha, Beta, and Sigma of ESG: Better Beta, Additional Alpha?	0	Measuring the level and risk of corporate responsibility - An empirical comparison of different ESG rating approaches	15	Assessing SRI Fund Performance Research: Best Practices in Empirical Analysis	37	ESG Integration and the Investment Management Process: Fundamental Investing Reinvented	35
52	18	performance evaluation (negative bias)	screening; modern portfolio (Markowitz) theory	1997	2016; 2017	28% USA	22% Business Finance	Socially responsible stocks: a boon for investors in India	2	Do Socially Responsible Investment Policies Add or Destroy European Stock Portfolio Value?	16	Beyond dichotomy: The curvilinear relationship between social responsibility and financial performance	453	2005 report on socially responsible investing trends in the United States	205
45	16	investor's perspective	behaviour; surveys	2002	2016	44% USA	50% Business Ethics + Business Finance & Economics	The investment behavior of socially responsible individual investors	1	Socially Responsible Investing: An Investor Perspective	54	Socially responsible investments: Institutional aspects, performance, and investor behavior	415	A picture of the frame: Frame analysis as technique and as politics	122
77	16	philantropy and charitable foundations	mission investing; impact investing; financial performance	2011	2017	38% USA	50% Business (Ethics, Finance, Economics); 13% Interdisciplinary	Beyond Socially Responsible Investing: Effects of Mission-Driven Portfolio Selection	1	Beyond Grantmaking: An Investigation of Program-Related Investments by US Foundations	0	A tale of values-driven and profit-seeking social investors	109	Overcoming the Challenges of Impact Investing: Insights from Leading Investors	14
71	15	green and social bonds	bonds; religious and faith-based investing; screening	1984	2019	40% USA	20% Business, Finance, Economics	What Future for the Green Bond Market? How Can Policymakers, Companies, and Investors Unlock the Potential of the Green Bond Market?	0	The effect of pro-environmental preferences on bond prices: Evidence from green bonds	18	The effect of green investment on corporate behavior	228	From Preaching to Investing: Attitudes of Religious Organisations Towards Responsible Investment	29
60	13	pension funds	institutional investment; activism/ engagement; financial performance	2004	2013	38% USA	46% Business Ethics	The Drivers of Responsible Investment: The Case of European Pension Fund	33	European Pension Funds and Sustainable Development: Trade-Offs between Finance and Responsibility	7	Pension fund corporate engagement - The fifth stage of capitalism	78	nvesting in socially responsible companies is a must for public pension funds - Because there is no better alternative	68
69	10	social impact bonds	impact investing	2016	2019	30% Italy	20% Green & Sustainable Science & Technology, Environmental Sciences, Environmental Studies	Business Models for Sustainable Finance: The Case Study of Social Impact Bonds	4	Grant-Maximizing but not Money-Making: A Simple Decision-Tree Analysis for Social Impact Bonds	6	In the wake of austerity: social impact bonds and the financialisation of the welfare state in Britain	33	Impact Investing: A Primer and Review of the Literature	11
79	8	social entrepreneurship, enterprise and entrepreneurs	impact investing	2011	2019	50% USA	25% Business	The Social Enterprise Financing Landscape: The Lay of the Land and New Research on the Horizon	8	On the boundaries of social entrepreneurship: a review of relationships with related research domains	6	Everyday discourses of stock market investing: Searching for investor power and responsibility	10	Tip of the Iceberg: The Nonprofit Underpinnings of For-Profit Social Enterprise	10

Cluster	Number of nodes	Main theme	Other themes	Year of first article	Year with most number of articles	Largest country %	Largest WoS category	Paper with highest degree centrality	Citations	Paper with second highest degree centrality	Citations	Paper with most citations	Citations	Paper with second most citations	Citations
63	7	social impact investing	moral responsibility; Africa; Asia	2009	2018	43% USA and England	29% Business	Social impact investing, agriculture, and the financialisation of development: Insights from sub-Saharan Africa	0	Social Impact Investing for Marginalized Communities in Hong Kong: Cases and Issue	0	Stakeholder Duties: On the Moral Responsibility of Corporate Investors	10	Investing for profit, investing for impact: Moral performances in agricultural investment projects	8
8	6	hedging and diversification	GARCH model; commodities; Brazil	2014	2020	33% USA	50% Economics	Modeling volatility and conditional correlations between socially responsible investments, gold and oil	26	Diversification and optimal hedges for socially responsible investment in Brazil	0	Modeling volatility and conditional correlations between socially responsible investments, gold and oil	26	Dynamic relationships between crude oil prices and socially responsible investing in Brazil: evidence for linear and non-linear causality	7
21	4	NGOs	food industry; business leadership	2004	2004; 2012; 2015; 2019	50% USA	Agronomy; Biotechnology; Business Ethics; Food Science	The role of socially responsible investing and media in the environmental stewardship of food industry companies	2	Non-governmental organizations, shareholder activism, and socially responsible investments: Ethical, strategic, and governance implications	147	Non-governmental organizations, shareholder activism, and socially responsible investments: Ethical, strategic, and governance implications	147	The role of socially responsible investing and media in the environmental stewardship of food industry companies	2
2	3	unidentified	unidentified	1984	irrelevant	irrelevant	Business Finance; Biodiversity Conservation; Information Science	Finance: Socially responsible investing can earn you money while you do good	0	More than profits: Selected resources in socially responsible investing	1	More than profits: Selected resources in socially responsible investing	1	Green men	0
11	3	divestment	financial performance; fossil fuel industry; best-in-class	2018	2018; 2019	33% USA; Canada; Netherlands & Scotland	66% Business (Ethics; Finance & Economics)	Fossil Fuel Divestment and Portfolio Performance	17	The effects of the fossil fuel divestment campaign on stock returns	1	Fossil Fuel Divestment and Portfolio Performance	17	Elevating the Role of Divestment in Socially Responsible Investing	2
54	3	institutional logics	Germany	2015	irrelevant	irrelevant	irrelevant	Social Impact Investing in Germany: Current Impediments from Investors' and Social Entrepreneurs' Perspectives	14	The Rise of Socially Responsible Investment Funds: The Paradoxical Role of the Financial Logic	6	Social Impact Investing in Germany: Current Impediments from Investors' and Social Entrepreneurs' Perspectives	14	The Rise of Socially Responsible Investment Funds: The Paradoxical Role of the Financial Logic	6
82	3	social enterprise	impact investing	2017	2019	irrelevant	irrelevant	Impact Investing Strategy: Managing Conflicts between Impact Investor and Investee Social Enterprise	2	Financial social innovation to engage the economically marginalized: insights from an Indian case study	5	Financial social innovation to engage the economically marginalized: insights from an Indian case study	5	Performance of impact investing: A value creation approach	5
89	3	ocean conservation	ecosystem services; impact investing	2015	irrelevant	66% Australia	Environmental Studies; Biodiversity; Oceanography	Marine conservation finance: The need for and scope of an emerging field	16	In oceans we trust: Conservation, philanthropy, and the political economy of the Phoenix Islands Protected Area	2	Marine conservation finance: The need for and scope of an emerging field	16	In oceans we trust: Conservation, philanthropy, and the political economy of the Phoenix Islands Protected Area	2
92	3	health and pharmaceutical industry	digital economy	2010	irrelevant	66% Russia	irrelevant	A sociology of health care in the digital age	0	Benchmarking and Transparency: Incentives for the Pharmaceutical Industry's Corporate Social Responsibility	30	Benchmarking and Transparency: Incentives for the Pharmaceutical Industry's Corporate Social Responsibility	30	From the Institutional to the Platform Economy	0
16	2	SRI in Scandinavia	[same author]	2008	2008	100% Belgium	irrelevant	undefined	-	undefined	-	A History of Scandinavian Socially Responsible Investing	37	A History of Scandinavian Socially Responsible Investing	12
42	2	undefined	undefined	2013	irrelevant	irrelevant	irrelevant	undefined	-	undefined	-	Think Global, Invest Responsible: Why the Private Equity Industry Goes Green	18	Unleashing the Powerful Few: Sustainable Investing Behaviour of Wealthy Private Investors	17
47	2	sharia finance	islamic finance	2016	irrelevant	irrelevant	Business Finance	undefined	-	undefined	-	Do managers of sharia-compliant firms have distinctive financial styles?	8	Sharia disclosures: An exploratory study from the perspective of Sharia-compliant companies and professional users	1
81	2	philantrocapitalism	gates foundation	2014	irrelevant	irrelevant	irrelevant	undefined	-	undefined	-	The philanthropic state: market-state hybrids in the philanthrocapitalist turn	53	Philanthrocapitalism Rising	10
85	2	innovation	technology; social innovation; clean tech	2016	irrelevant	irrelevant	irrelevant	undefined	-	undefined	-	Unlocking finance for social tech start-ups: Is there a new opportunity space?	10	A social capital paradox: Entrepreneurial dynamism in a small world clean technology cluster	7
87	2	pay-for-success	[same organization]	2015	irrelevant	USA	irrelevant	undefined	-	undefined	-	Using Benefit-Cost Analysis to Scale Up Early Childhood Programs through Pay-for-Success Financing	10	Pay For Success And Population Health: Early Results From Eleven Projects Reveal Challenges And Promise	8
all others	66	SRI	performance	1993	2019	33% USA	41% Business	Socially responsible investing in the United States	136	An investigation of corporate social responsibility reputation and economic performance	125	Trends in the literature on socially responsible investment: looking for the keys under the lamppost	56	What's in a Name: An Analysis of Impact Investing Understandings by Academics and Practitioners	54

Endnotes

1 In real terms (December 2020), these values, when corrected by the US Consumer Price Index (CPI), would be USD 5.6-8.3 trillion and USD 3.7-5.0 trillion, respectively.

2 The UNCTAD identifies ten SDG sectors: Power; Transport; Telecommunications; Water and Sanitation; Food Security and Agriculture; Climate Change Mitigation; Climate Change Adaptation; Ecosystems/Biodiversity; Health; and Education.

3 UNCTAD's 2014 estimates can be regarded as optimistic, considering e.g. the current situation due to the COVID-19 pandemic or the "trade war" between the US and China, both of which could lead to lower availability of financial resources.

4 According to the World Bank, annual global gross capital formation has doubled between 2000 and 2019, to reach USD 26.3 trillion in 2019 (in real terms, 2020 USD), implying that up to one third of total gross capital formation must be directed to the SDGs if these are to be achieved. If this is done, what capital investments will be displaced by this level of commitment and will the returns on this type of capital investment be sufficient to sustain gross capital formation in succeeding years?

5 In order to restrict the results to articles that focused on finance, we searched in the Article title field. The additional string was: (investor* OR investing OR investment* OR financ* OR bank* OR capital OR money). We decided not to search in the Article title, Abstract, Keywords field, because it resulted in many articles whose focus was not finance but mentioned in the abstract ("in passing") one of the searched keywords.

6 This is not to say that sustainable finance and investment is a neglected research topic, in general. For instance, Friede et al. (2015) reviewed more than 2,000 empirical studies that looked at the specific question of how and whether environmental, social and governance factors affect corporate financial performance. We thank one reviewer for raising this point.

7 Additional string (Article title field) for energy: (energy OR electricity OR oil OR fuel* OR renewable OR petroleum). And for mobility/transport: (mobility OR transport* OR car* OR automobile*). The results indicate that c. 33% of the articles in our sample deals with mobility or energy, and in the case of the top five journals more than 40% have at least one of these empirical focuses (but here the results are somehow biased by the presence of Energy Policy). An alternative strategy would be to look for articles published in the field's flagship journal – Environmental Innovation and Societal Transitions (EIST) – that used finance-, energy- or mobility-related words in the title. Since 2011, 456 articles were published in EIST (according to the Scopus database). Of these, 17 (3.7%) had a core focus on finance while 87 (19.1%) focused on energy and 43 on mobility (9.4%). Note that not restricting the search to articles that necessarily have transition-related words (string in footnote 1) in the title/abstract/keywords results in a higher number of finance-focused articles.

8 As we will show from session 4 onwards, ESG is part of the jargon of the sustainable investing practice. ESG metrics are used to access the degree of sustainability of companies and thus help in sustainable investment portfolio decisions.

9 A sociotechnical regime "refers to the semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems" (Geels, 2011, p. 27). (A socio-technical system is defined as a network of the resources – material, human or institutional – that are required for fulfilling societal functions, such as transport, communication, nutrition, energy or finance.)

10 Analyzing the other three facets – financial institutions in transition; the overall (macro) transition of the financial system and the (micro) transition of the financial profession – falls outside the scope of this paper.

11 In this paper, we follow Busch et al. (2016) and use the term sustainability/sustainable investment/investing as an overarching (or "generic") terms to cover all investment practices that consider environmental, social or governance issues when making investment decisions. Note that while it is more common to refer to this literature as 'sustainable investing', we prefer to use 'sustainability investing', as the former seems to imply that the investment is sustainable, while the latter would imply investment aimed at sustainability. Nevertheless, we use them indistinctively throughout the paper.

12 We recognize these criteria is somehow arbitrary, but because we intend to give an overview (and not a systematic review) of the field, it is adequate for the purpose. Furthermore, we complement it with the second method.

13 The syntax was ["ethical investing" OR "socially responsible investing" OR "responsible investing" OR "sustainable investing" OR "sustainability investing" OR "green investing" OR "esg investing" OR "impact investing"]

14 English is the language of the vast majority of the papers in the field and, thus, the language for our semantic network. However, all articles in the Web of Science are indexed with a title and an abstract in English, even if they are in another language – this part of the screening was thus a zealous step.

15 This pairwise document comparison is somewhat computationally intensive as for the 369 documents there are 67,896 pairs.

16 The examination of the WoS categories (b) proved less useful.

17 They also mention terms that are less frequently employed such as: community investing, environmentally responsible investing, faith-based investing, mission-based or mission-related investing, moral investing, social choice investing, green investing, red investing, white investing. To this list, it could be further added: philanthropic investment; thematic investment; ESG investment; impact investment, among others.

18 This field was institutionalized in 1971 as the Social Issues in Management (SIM) division of the American Academy of Management (AOM) (Carroll, 1999).

19 In deontological ethics, the morality of an action is judged against a set of principles or values and not in terms of its consequences, as in hedonic or utilitarian ethical position.

20 In a later work, Davis (1973) thus expressed his 'Iron Law': "Society grants legitimacy and power to business. In the long run, those who do not use power in a manner which society considers responsible will tend to lose it" (p. 314).

21 Similar – and in some ways more profound – arguments against CSR were expressed, at least one decade before Friedman, by the Austrian economist Friedrich von Hayek, who constructed his criticism not only on the notion of corporate responsibilities but also on the idea of social (Kusunoki, 2016). The MSV maxim is later associated with Michael Jensen, who published, with William Meckling, a very influential paper (Jensen and Meckling, 1976 – which has almost 100,000 citations) and promoted it in the business school (MBA) context, therefore influencing generations of business executives.

22 The "fiduciary" is a person that acts on behalf of another. Portfolio and fund managers, financial advisors, and other intermediaries are considered fiduciaries who hold the responsibility of acting in good faith to preserve or increase their client's wealth.

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23 Voluntary signatories (currently 2,500 parties) agree to incorporate six principles in their investment decision-making and active ownership practices: (1) incorporating ESG issues into investment analysis and decision-making processes; (2) being active owners and incorporate ESG issues into ownership policies and practices; (3) seeking appropriate disclosure on ESG issues by the entities invested; (4) promoting acceptance and implementation of the Principles within the investment industry; (5) working together to enhance effectiveness in implementing the Principles; and (6) reporting on own activities and progress towards implementing the Principles.

24 This shift from avoiding negative externalities to creating positive externalities seems a consequence of what Busch et al. (2016) call a paradox: "sustainable investments do not necessarily spur sustainable development" (p. 6).

25 Krosinsky (2017) seems to directly draw on the Eurosif (2012) classification of sustainable investment (we thank one of the reviewers for pointing this out), when it merged screening categories from its previous reports (e.g. "ethical screening" and "simples screening" into "negative screening"). This classification is also compatible with other institutions' like the Global Sustainable Investment Alliance (GSIA), UN Principles for Responsible Investment (PRI) or the European Fund and Asset Management Association (EFAMA), which use slightly different terminologies (as Eurosif (2012, 2016) point out, the EFAMA classification does not have categories equivalent to ESG Integration and Impact Investing, while the PRI does not have one for Impact Investing). Since 2012, Eurosif has not changed its taxonomy of strategies (Eurosif, 2018).

26 Given that Islamic or sharia finance prohibits collection of interests (financial rents) and the investment in certain industries (alcohol, gambling and pork, most notably), it is considered a type of negative screening investment strategy).

27 The Global Impact Investing Network suggests the following best practices for impact measurement: establishing and stating social and environmental objectives to relevant stakeholders; setting performance metrics/targets related to these objectives using standardized metrics wherever possible; monitoring and managing the performance of investees against these targets; and reporting on social and environmental performance to relevant stakeholders. See https://thegiin.org/impact-investing/need-to-know/; accessed on 3/5/2020.

28 http://www.gsi-alliance.org/; accessed on 3/5/2020.

29 An important issue that affects estimates of the size of different sustainability investing strategies is double-counting (Scholtens, 2014). However, GSIA (2019, p. 7) claims to have adjusted its numbers to avoid it: "The sum of these individual strategies, after adjusting for double counting since some assets are managed using more than one strategy, results in the sustainable assets under management included in this report."

30 The estimating methodology attempts to avoid the issue double-counting.

31 In the 4-year period between 2013 and 2017, as Eurosif (2018: 73) considered earlier estimates problematic due to "lack of clarity in the parameters governing the integration of ESG factors", making values from different organizations hard to compare.

32 This is problematic, given the "paradox" of earlier sustainable investing strategies failing to promote sustainable development (Busch et al., 2016).

33 The Deep Transitions framework (Schot and Kanger, 2018) suggests we are approaching a discontinuity, which implies that the likelihood of fundamental changes in valuation is increasing. If this discontinuity can be brought forward in time, anticipatory investments for what lays on the other side of the transition process are likely to have nearer term monetary rewards.

34 Note that this argument is different than adopting as a principle the minimization of ecological risks, which Loorbach et al. (2020) call for "transition finance".

35 We thank one of the reviewers for this insight.

36 Strictly speaking, a 'public good' is defined for not being privately appropriable (one cannot exclude others from its consumption or capture rents generated by it) and for being non-rival (its consumption does not diminish its stock), with classic examples being clean air, herd immunity or any type of positive externality (such as those expected from certain transformative investments). Markets are ill-suited allocators of resources for the production of public goods (a market failure).

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