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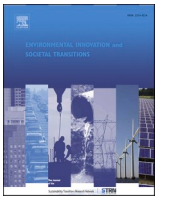

Perspectives

# Transformative investment: New rules for investing in sustainability transitions

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ABSTRACT

Closing the financial gap for promoting systemic socio-economic transformations to achieve sustainability requires both a substantial increase in investment levels and a qualitative change in investment strategies. In this Perspective, we elaborate on this claim and discuss why existing investment approaches that aim to make positive contributions to sustainability are unlikely to foster the systemic transformations needed for sustainability. Qualitative change means changing the current rules that guide investment practices and we outline a new set of rules that should guide transformative investment. These rules are based on the well-established socio-technical sustainability transition theory and the recent development of a theory of deep transitions. We explain why these transformative investment rules offer a promising alternative base for assessing investment opportunities and monitoring progress toward the multi-system changes required to achieve a socially just deep transition to sustainability.

## 1. Introduction

In 2014, the United Nations Conference on Trade and Development (UNCTAD) estimated that the annual investment needed for achieving the SDGs was USD 6.0 trillion (or USD 7.4 trillion in 2022 dollars), about 8 % of global GDP then. Despite public and private pledges to invest in sustainability, and an actual increase in "environmental, social and governance" (ESG) investments (Global Sustainable Investment Alliance, 2021), in 2020 the total annual financing gap has surged to USD 10 trillion (or USD 11.3 trillion in 2022 dollars) (Force for Good, 2021) – equivalent to more than two thirds of the sum of all investments made by OECD countries or roughly half of all global investments in 2020. While we agree that substantially more capital must be deployed, we argue that meeting the SDGs, and addressing the climate, resource, and biodiversity crises as well as rising inequalities, will not only require a substantial increase in the levels of both public and private investments across the globe, but also a *transformation* in the way investments are deployed.

In our view, the focus of investments must go beyond the tenets of ESG and impact investment practices, which are not delivering on their promises of bringing about positive, sustainable impact (Kölbel et al., 2020). The issue is that those practices are still based on rules that lead to system optimisation instead of transformation. We propose a new set of rules for what we call "transformative

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investment", which is focused on realizing *radical system changes* in areas such as energy, water, mobility, housing, healthcare and food provision. The need to focus on system change is increasingly acknowledged in the finance industry (Aviva Investors, 2022; OECD, 2018; Triodos Investment Management, 2020). What is lacking is an appropriate conceptualization. This can be provided by sustainability transitions research.

In this Perspective, we formulate a critical analysis of the financial regime[1] that adds to the existing body of social science research that acknowledges and criticises the profound integration of finance and investment in the capitalist logic, with issues such as "financialisation" and "maximising shareholder value" conditioning sustainability transitions (cf. Davis and Kim, 2015; Hadfield and Coenen, 2022; Hiss, 2013; Krippner, 2005; Lazonick and O'Sullivan, 2000; Wray, 2011). Underlying this conditioning are rules that guide the financial regime: we identify those mainstream investment rules and discuss why existing investment practices are unlikely to foster the transformations needed.

In response, we outline a new set of rules to guide transformative investments that are based on socio-technical sustainability transition theory (Köhler et al., 2019; Truffer et al., 2022) and the recent development of a theory of deep transitions (Kanger and Schot, 2019; Schot and Kanger, 2018). We explain why the transformative investment framework offers a promising approach for assessing investment opportunities and monitoring progress toward the system changes required to achieve a sustainable and socially just transition. The Perspective is also meant as a call for the sustainability transitions community to conduct research on finance not as a secondary topic but as a critical aspect of (multi-)system change and socio-technical transitions – an issue raised by other authors in the transitions field (Loorbach et al., 2020; Naidoo, 2020; Steffen and Schmidt, 2021).

## 2. Current investment rules

The financial system is formed by a complex network of organizations, and intermediaries that operate according to a fundamental rule: allocate investment capital to those activities yielding the highest rate of return adjusted for measurable risk (Loorbach et al., 2020).[2] At a more granular level, the financial regime translates into four investment rules:

(1) *Maximise financial return*, which does not record or take account of social and ecological costs (Lazonick and O'Sullivan, 2000; Mazzucato, 2018).
(2) *Abide by fiduciary duty*, which is defined as seeking maximum growth of investor wealth and excluding ethical considerations not reflected in formal regulation that could reduce investment performance (Schanzenbach and Sitkoff, 2020).
(3) *Manage quantifiable risks*, which leaves aside unquantifiable uncertainties regardless of their potential magnitude (Semieniuk et al., 2021).[3]
(4) *Focus on short-term returns*, which are viewed as more certain and easier to estimate, and therefore do not consider the long-term dynamics of complex social and ecological systems (Davies et al., 2014).

To some extent, the issues with these rules are recognised, and sustainable investment practices to mitigate their effects have been devised. The relevant question here is whether and to what extent the continued evolution of these investment practices have been able to challenge and/or break the dominance of these investment rules (see Annex 1 for a critical account of this evolution) and will be able to produce fundamental system change. Our answer is negative, and therefore we plea for moving beyond ESG and impact investment towards a transformative investment paradigm.

## 3. Challenges for sustainable investing

Four issues dramatically limit the potential of current sustainable investing strategies to address urgent social and environmental issues:

First is the debate on market performance of these investments. Meta- (Fulton et al., 2012; Whelan et al., 2021) and systematic (Friede et al., 2015) reviews provide evidence that firms with superior ESG-performance tend to face a lower cost of capital and possibly outperform in the market. However, the financial performance premium might be diminished (but not eliminated) because sustainable investment portfolios, mutual funds and indices typically engage in negative screening, which lowers short-term financial performance (Trinks and Scholtens, 2017). Other studies (Bhagat, 2022; Bruno et al., 2022; Hartzmark and Sussman, 2019), however, challenge these findings, indicating sectoral factors or no outperformance for sustainability funds. Our point is that the endurance of

[1] Our use of "financial regime" relates to the concept of "socio-technical regime", understood as "the 'deep-structure' or 'grammar' of a socio-technical system, defining appropriate, legitimate and conceivable means-end rationalities in a given sector" (Fuenfschilling and Binz, 2018: 735). As Loorbach et al. (2020) and Geddes and Schmidt (2020), we treat finance as a socio-technical system, focusing on this system's regime rules.

[2] The larger financial system includes the individuals who provide the investment capital from their savings or wealth to investment intermediaries (e.g. brokers or funds). Our focus in what follows is on these intermediaries. However, it is important to keep in mind that these intermediaries market their services based on disclosures of their investment plans and can create specific investment portfolios to appeal to individuals providing the investment capital who value sustainability or social inclusion.

[3] One consequence of the first and the third rules is to prioritise large investments and assets to minimise relative transaction costs (and indirectly maximise returns), leading to a lack of financial support for smaller assets with unknown risk profiles (an unquantifiable uncertainty). We thank one of our reviewers for the observation that the current regime's focus is on large investments.

this debate shows that the four dominant rules are not challenged. On the contrary, ESG investments need to conform to these rules to be regarded as legitimate.

Second is the traditionally narrow view of fiduciary duty and the race to outrun inflationary pressures, resulting in a limited aggregate size of sustainable investments, even if growing rapidly. The narrow interpretation of fiduciary duty amongst many investment intermediaries leads to an emphasis on wealth creation and short-term returns. This constrains investment in sustainable opportunities that may only yield long-term benefits and neglects systemic risks arising from social, environmental, and geopolitical factors, which can significantly impact asset values. Investors guided by current sustainable investment strategies are not able to anticipate or respond to these events, because they are severely constrained by the prevailing interpretation of fiduciary duty, which exclude ethical considerations if they might impair financial performance.[4]

The third challenge stems from the ethical criteria of sustainable investing, which may reward nominal compliance without addressing core environmental and social challenges (Busch et al., 2021). The absence of standardized reporting and rating mandates (Berg et al., 2022; Cerchiaro et al., 2021) and prevalence of greenwashing practices (Lyon and Montgomery, 2015) exacerbate this problem. That sustainable investing strategies fall short of investor expectations for transformative system change thus comes as no surprise.

The fourth challenge lies in the assumptions underlying impact and thematic investments, which often lack adequate scale or transformational quality to address critical social and ecological issues, such as climate change and biodiversity loss (Bhagat, 2022). Under the label of "impact investment" there are a mix of strategies that simply align impact expectations with the mainstream rules. Ultimately, what is needed are mechanisms for assessing whether and to what extent the impact of investment provides an adequate transformative response.

To address these challenges, the finance industry must transcend current rules to foster systemic sustainability transitions. Frontrunners advocate for investing in transformative changes in sectors such as energy, mobility, water, healthcare and food, but clarity on what constitutes systemic change and how the sector can contribute is lacking.

In order to formulate new rules for the finance sector, we propose to draw on the 'deep transitions' thinking (Schot and Kanger, 2018), which is embedded in 25 years of systematic study of sustainability transitions blended with the work of Perez (2002) on the historical role of investment in transforming the economy over the last 250 years, and other relevant historical work on the Industrial Revolution. The Deep Transitions framework suggest that the first Deep Transition (or Industrial Revolution) consisted of five Surges of Development that took 40–60 years to develop. In each surge, a specific set of systems and meta-rules (techno-economic paradigms as they are called by Perez) was built driving the development of industrial modernity. The surges are connected, meta-rules are deepened, and their application is broadened to more systems across these surges, building up a long-term path-dependency defining how system optimisation is pursued. Meta-rules are defined as institutions – embedded in sanctions, norms and values – that guide and constrain actors' behaviour *across* systems. They provide directionality to socio-technical system change. Example of meta-rules build-up during the first Deep Transition are linear production, mass production and consumption, the relentless exploiting of fossil fuels as a fuel and primary source of many chemical products, including plastics, medicines and pesticides, the externalisation of social and environmental costs, and globalization (the building of global value chains). An important claim of the Deep Transition framework is that further optimisation of these meta-rules will not address the current polycrisis[5] (see also Swilling 2013).

Addressing the polycrisis means that the First Deep Transition must make way for a Second Deep Transition, a process that already seems underway, which embraces sustainable meta-rules, such as a circular economy and renewable energy (Kanger et al., 2022). The emerging Second Deep Transition is evident in rapidly growing investments in renewable energy (IEA, 2022), but it needs acceleration and multi-system synergies. Investors can play a crucial role by redirecting capital towards building sustainable socio-technical systems. To do so, a new set of rules for investment is needed, as the current ones contribute to the unsustainable practices of the First Deep Transition.

A sustained and structured two-year dialogue between sustainability transitions experts and a global Deep Transition Panel of investors confirmed the applicability of deep transitions theory to investment practices, resulting in an investment philosophy articulated in a set of transformative investment principles[6] (Schot et al., 2022). The investment philosophy, however, did not reach conclusions about whether or how these principles would reconfigure existing investment rules. Yet we argue they can be seen as a manifestation or consequence of possible new investment rules, replacing the current dominant set. What might these rules be? And how might they come to be adopted as the dominant practice in investment decisions? We propose a new set of rules for transformative investments, outlining enabling conditions and complementary actions needed for them to come to fruition.

## 4. Rules for transformative investment

Sustainable investment practices often result in making individual elements of a system more efficient, usually by investing in

[4] An event study that estimated the impact of the outbreak of the Ukraine war on the return of energy stocks, finding that energy firms outperformed the stock market around the event window, yet "renewable energy firms generated lower CAARs compared with the firms of the industry subgroups coal, oil and gas, oil and gas equipment and services, and uranium" (Nerlinger and Utz, 2022: 3). Indeed, the six western big oil firms more than doubled their profits in 2022, and in the name of energy security rolled back their climate ambitions (Bousso, 2023).

[5] A polycrisis is "a nested set of globally interactive socio-economic, ecological and cultural–institutional crises that defy reduction to a single cause" (2013: 98).

[6] See annex 2 for an overview of the 12 investment principles.

specific new technology options, rather than transforming all components of an individual system or a set of related systems. For example, precision agriculture and electric vehicles (important focuses of sustainable investments) help to optimise current food, mobility, and energy systems; they are incremental changes that do not lead to transitioning away from a food system heavily reliant on meat production and fossil fuel-based inputs and a mobility system centred on individual car ownership. The (implicit) approach – individual system optimisation – does not address the need for changing underlying rules within the food, energy, mobility systems as well as meta-rules across systems and, as such, is not contributing to the Second Deep Transition. Additionally, optimisation can even contribute to the entrenchment of the First Deep Transition as efficiency gains may make it harder to get rid of them and are often used as strategies by incumbent actors to avoid transformative change and keep the dominant systems in place (Penna and Geels, 2015). This approach also does not account for rebound or leakage effects across systems (Freire-González, 2021), or the need for a just transition (Swilling and Annecke, 2012).

To achieve radical transformative change, it is necessary to the replace the current dominant rules in the finance sector and put enabling conditions in place (cf. Loorbach et al., 2020). This is our proposal for a new set of rules:

**Prioritise financial return from investing in system change:** instead of a view whereby non-financial value contributes to financial return,[7] this rule acknowledges that the opposite, maximising financial return should come from its contribution to system change. This implies considering the directionality of investments: whether investments enable system change through the formation of new rules and meta-rules or further entrench or lock-in unsustainable systems.

A key enabling condition is the determination of non-monetary values, which cannot be done through market forces due to prevailing market failures (negative externalities, which are not reflected in prices). Therefore, complementary measures are needed for the establishment of this rule, such as new standards for the appraisal of social and environmental benefits, and a leading role for public authorities in monetising those benefits. Establishing such a rule is not an easy task, as judging whether financial returns are coming from investments in system change would likely need to be legally mandated. This, in turn, may require substantive international regulatory changes to avoid capital flight from jurisdictions where such a rule becomes mandated.

**Abide by an expanded definition of fiduciary duty:** this rule broadens the traditional understanding of fiduciary duty, recognizing the importance of system change in ensuring long-term value, considering that the ongoing polycrisis will lead to shocks that make value creation prospects for many investments bleak. These shocks should not be seen as a possibility, instead they are a certainty (IPCC, 2022). Not taking long-term value into account assures eventual harm to the growth of investor wealth.

Enabling conditions for expanding fiduciary duty include changes in legislation that defines the obligations of an investment fiduciary to prioritise financial returns. Realigning fiduciary duty with system change and making investments more future-shock resilient means that regulatory authorities must promote legal reforms and new guidelines for incorporating and aligning investments with system change scenarios and future shock considerations. In turn, investment intermediaries need to establish new internal policies, norms, and risk assessment tools to reflect the expanded understanding of fiduciary duty and to engage in advocacy with their regulators and asset owners. This involves cultural changes in the investment profession (new belief and cognitive systems), which can be supported by experimentation with transformative investment principles and tools, and by capacity building so that investment professionals are equipped with the knowledge and skills to incorporate system change considerations in their decision-making.

**Map unquantifiable systemic uncertainties:** rather than focusing only on quantifiable risks, which are a weak representation of climate change and sustainability (Hiss, 2013), investors should also account for unquantifiable uncertainties, which include those associated with societal challenges, broader repercussions and rebound effects. These uncertainties can significantly impact system change-related investment outcomes.

While minimising or even managing unquantifiable uncertainties is an elusive task, they can be taken into account for investment decisions. For example, futures and scenario-building exercises may help to understand and possibly rank uncertainties. Establishing and accepting this rule by financial agents necessitates the creation of several enabling conditions, involving new tools, methodologies and collaborative mechanisms. Also multi-stakeholder forums or working groups can provide a platform for collective scenario-building exercises, ensuring diverse perspectives are considered in uncertainty analysis, allowing influence for the people and organisations who are impacted.

**Maximise system change impact with a focus on long-term benefits.** The most important and overarching focus of investment should be on supporting activities, projects and companies that contribute to system change (instead of investing in individual projects and companies that contribute to system optimization). Investing in impact should, therefore, not be an additional rule aligned with the others, but the core rule guiding sustainable investing strategies. The impact focus on system change can be operationalized by assessing the contributions of investments to core socio-technical transition processes (Geels et al., 2017; Ghosh et al., 2021; Hebinck et al., 2022; Kanger et al., 2020) with the aim of establishing the meta-rules needed for a Second Deep Transition, a process that will also involve abandoning key meta-rules inherited from the First Deep Transition. Investing in core socio-technical (Deep Transition) processes implies:

[7] Financial return refers to the profits or returns that are generated through financial activities, including productive investments but also speculation, rent-seeking, and asset price inflation. "Value" refers to those outcomes from financial activities that contribute to the overall well-being and prosperity of society. For the difference between "financial return" and "value" created from finance, see Mazzucato (2018). We thank a reviewer for this observation.

- Investing in the *construction of socio-technical niches* and ecologies or groupings of niches that embody meta-rules capable of shaping interactions across systems;
- Investing in the *scaling and consolidation of these niches and ecologies of socio-technical niches* that become meta-rule carriers;
- Investing in the *destabilisation and phasing out of socio-technical regimes* that carry the meta-rules that have generated strong couplings across systems causing the current polycrisis; and
- Investing in the *phasing out of socio-technical regimes* that are key coupling generators.

One implication of this rule is for investors to invest in competing clusters of projects/companies that contribute to the construction, consolidation, destabilization, and phasing out of socio-technical systems, targeting system (un)couplings and promoting transformative change across interconnected systems. The importance of investing in competing niche clusters is underscored by the inherent uncertainty of early-stage niches. Diversifying investments across various, even rival, niche portfolios allow investors to hedge against the unpredictability of which niches will eventually prevail and disrupt the established regime.[8] At the same time, not all niches (and companies) deserve investment, because some of them may have very low potential for contributing to system change.

As systemic transformations are long-term processes, the focus of transformative investments should move from short-term financial gains to long-term benefits. Investments which might not yield immediate monetary and non-monetary returns can still be valuable for their long-term benefits of enabling the emergence of new rules and meta rules that make systems more resilient to polycrisis challenges. Therefore, those investments should be appraised on their potential to contribute to long-term transformation.

Enabling conditions include the creation of novel portfolio management strategies that consider how a cluster of investments interact and collectively contribute to socio-technical system transitions. This contrasts with current portfolio approaches that seek to minimise the correlation of assets within the portfolio to minimise risks. This rule, however, also implies the emergence of collective portfolio management strategies, e.g. blended finance (strategically combining public and philanthropic resources to attract and unlock private sector investment[9]) or transformative investment bundles that combine projects promoting complementary system changes (with some being attractive to private investors and others requiring public investments). Another enabling condition for this rule would be the development and standardisation of impact metrics, to capture not only the direct effects of an investment on system change, but also its indirect effects on for example system (un)couplings, broader repercussions and the just transition requirement.

Yet, merely possessing advanced management strategies and impact metrics might not be enough. We must pair them with novel appraisal techniques that transcend traditional financial rules. While we recognize the importance of traditional financial metrics like net present value (NPV) and internal rate of return (IRR) in reflecting the time value of money and the cost of capital, we advocate for the introduction of complementary appraisal techniques. Several authors have indeed proposed quantitative non-market or environmental valuation and appraisal techniques for long-term developments (Hajkowicz and Collins, 2009; Huguenin and Jeannerat, 2017; Tolmasquim et al., 2001). Many of those techniques are associated with cost-benefit analysis and approaches from ecological or environmental economics, but even those are not widely adopted (Cook et al., 2016). While steps in the right direction, for the appraisal of non-calculable risks (i.e. fundamental uncertainties), other techniques such as multi-criteria-mapping (Stirling and Mayer, 2001), collective foresight (Eames and McDowall, 2010) and scenario exercises (Schot et al., 2022)[10] can be instrumental in understanding the potential trajectories of socio-technical systems and their implications for sustainable investments.

Regulatory reforms can introduce incentives for investments that contribute positively to transformation and future societal resilience. Shifts in market expectations concerning short-term gains can be facilitated by thought leaders and industry influencers. Learning processes and experiments promoting the importance of transformation, long-term societal resilience, and foresight can further drive this shift, by inducing changes in investors' and intermediaries' mindsets. Here we suggest the need to reform the training curricula of investment intermediaries. By including subjects related to systemic transformation, socio-technical transitions and new appraisal techniques, we can equip professionals with the tools and perspectives needed to evaluate the long-term value of investments.

The four new rules should not be considered individually, but as a new rule-set in which each rule reinforces the others. For instance, maximisation of system change impact can be achieved only in the long run, so that mapping unquantifiable uncertainties can contribute to the impact appraisal and valuation, while helping intermediaries to abide to the expanded definition of fiduciary duties. Conversely, the indicative enabling conditions that we associated with each rule should be seen as a package of measures conductive to the emergence of the new rule-set. Table 1 provides a summary of the proposed rule-set for transformative investment and the suggested enabling conditions.

[8] We thank one of the reviewers for this observation.

[9] Public development banks (also called state investment banks) are an important instrument to this end, which has historically been used to catalyse private investments in development projects and increasingly promote investments to address societal challenges (Mazzucato and Penna, 2016; Geddes and Schmidt, 2020).

[10] The Deep Transition Futures project advanced a fruitful methodology based on the exploration of different pathways to transformation. Investors explored different "transformative theories of change", leading to three scenarios for the second Deep Transition, which allowed them to gain insights into shifts in societal values, technological advancements, regulatory changes, and environmental conditions. These insights not only contribute to enhancing the resilience and adaptability of investment portfolios to potential transformations but also enable the capturing of financial value from these transformations. For details on the methodology, see Schot et al., 2022.

**Table 1**
Rules for transformative investment and enabling conditions.

| Rule | Summary definition | Enabling conditions |
|---|---|---|
| *Prioritise financial return from investing in system change* | Financial return measurement should reflect investment that contributes to system change (non-financial value), thus considering the directionality of investments. | Determination of non-monetary values; establishment of new standards for the appraisal of social and environmental benefits; legislative and international regulatory changes; involvement of public authorities in monetising benefits. |
| *Abide by an expanded definition of fiduciary duty* | Fiduciary duty should include considerations of system change and long-term value, acknowledging the certainty of shocks in the ongoing polycrisis. | Changes in legislation defining obligations of investment fiduciaries; new guidelines and reforms aligning investments with system change scenarios and future shock considerations; cultural changes in the investment profession; capacity building for investment professionals. |
| *Map unquantifiable systemic uncertainties* | Investors should account for unquantifiable uncertainties associated with societal challenges, broader repercussions, rebound effects, and just transition considerations. | Development of new tools, methodologies, and collaborative mechanisms to assess unquantifiable uncertainties; creation of multi-stakeholder forums or working groups for collective scenario-building exercises; consideration of diverse perspectives in uncertainty analysis. |
| *Maximise system change impact with a focus on long-term benefits* | Investment should focus on advancing activities, projects and companies that have the potential to foster system change, and be evaluated based on their contribution to long-term transformations. | Development of novel portfolio management strategies considering contributions to system transitions; emergence of collective portfolio management strategies; development and standardisation of system change impact metrics; new investment appraisal techniques; regulatory reforms; shifts in market expectations concerning short-term gains; changes in investors' and intermediaries' mindset (via e.g. new training curricula). |

Source: Authors' elaboration.

## 5. Concluding remarks

In this Perspective, we examined current (sustainable) investing rules from a socio-technical transitions and deep transitions perspective, suggested a new transformative investment rule-set and set of enabling conditions based on current conceptual understandings of socio-technical transition and deep transition dynamics. While we agree that strong societal and regulatory pressure is key, its effectiveness depends on investors learning to prioritize systemic change. The investment community must undergo a significant cognitive shift, recognizing the long-term importance of systemic transformations that generate both monetary and non-monetary value, such as societal and ecological resilience. Multi-stakeholder platforms and intermediary actors -see for example the *Deep Transition Lab*[11]- can support this shift through scenario building and collective learning, aiding the integration of new rules into investment decision-making.

Further research is needed to operationalize the rule-set and specify enabling conditions. We identify four interconnected research avenues: (a) developing new valuation and appraisal methods, systemic metrics, and transformative outcome indicators aligned with transition theories to inform investment decisions[12] (*ex-ante*, formative and *ex-post* evaluation of sustainability impact); (b) mapping meta-rule carrier niches and identifying their investment and complementary needs; (c) characterising ideal investor federations and investment bundles to define investor roles in advancing niche development and regime destabilisation across systems; and (d) investigating methods to induce the creation of enabling conditions, considering the roles various actors should play in driving significant transformations in the investment regime.

This Perspective aims to reinforce the call on the socio-technical transitions community to focus on finance and investments, including through engaged scholarship (Van de Ven, 2007), in order to further develop the transformative investment framework that can help advance a deep transition to sustainability.

## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

All authors report financial support was provided by Baillie Gifford and Co Ltd. for the research that resulted in this paper.

[11] See www.transformativeinvestment.net; accessed on 15/09/2023.

[12] An important on-going development is the EU taxonomy for sustainable activities, to help direct investments towards sustainability projects (see https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en; accessed on 23/06/2023). The taxonomy, which sets out specific technical screening criteria that economic activities must meet to be classified as environmentally sustainable, is a good starting point for the development of new valuation and appraisal methods and systemic metrics and indicators aligned with transitions theory. Future research could advance a systemic perspective on how those sustainable activities classified contribute to system transformation, which would contribute to the improvement of the taxonomy.

## Data availability

No data was used for the research described in the article.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.eist.2023.100782.

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