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Measuring investments progress in ecological transition: the Green Investment Financial Tool (GIFT) approach

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Highlights

- Sound indicators are required in sustainable finance to monitor the ecological transition.
- An approach to assess environmental impacts of investments vs. their counterfactual is developed.
- Life-cycle based key performance indicators and social safeguard boundaries are introduced.
- The approach can support policies aimed at implementing the ecological transition.

Abstract

Driving and monitoring the transition toward a sustainable economy requires sound social and environmental indicators. In this paper we outline the 'Green Investment Financial Tool' (GIFT), a pilot project developed by the Italian government to assess environmental impact of investments from a life cycle perspective, ensuring they contribute to environmental progress while fulfilling social safeguard requirements. We explain how GIFT can be applied to small and medium business investments without creating competitive barriers associated with high cost of implementation. We also discuss how the approach could be potentially used in support of policy applications (e.g., enhancing green private investments, issuing green government bonds) and which are the implication for knowledge creation (monitoring and accounting).

Key words

Ecological transition; Environmental impacts; Green investment; Key performance indicators; Life cycle assessment; Sustainable Finance

1. Introduction

Scientific opinion and public interest are calling for societal transformations in the direction of sustainability (Linnér and Wibec, 2020). The role of finance in boosting the transition toward

a sustainable economy is gaining momentum worldwide. Green and sustainable finance are today central themes on the European and global agendas. Indeed, finance plays a predominant role in the current economic system and must be increasingly oriented towards a low-carbon, inclusive and sustainable development model (MATTM – UN Environment Program, 2016). This is all more important in the light of the COVID-19 crisis. While addressing the short-term health and economic urgencies related to the pandemic, policy makers must consider long-term sustainability objectives in the planning of green recovery.

Such transformation of the socio-economic system requires large investments: while public funding is vital to fuel the transition, a substantial part of the financial flows will have to come also from the private sector. Orienting public and private funding toward sustainability is paramount. However, the emerging concepts of green and sustainable finance can be defined in different ways, which ultimately affects whether investments are considered green, sustainable, or not. OECD (2020) has highlighted how the multiplicity of definitions is a significant barrier to the massive spread of sustainable investments. Only an adequate harmonization of rules can guarantee the growth of an efficient financial market.

Bearing this in mind, this paper presents an approach, the 'Green Investment Financial Tool' (GIFT), designed for measuring the greenness of public and private investments and promoting the uptake of green finance. The approach builds on a pilot project developed by the Italian Ministry of The Environment, Land and Sea Protection[1] for the application of such tool, which feeds the broad discussion on sustainability assessment and green finance and can also be used to pave the way for a green recovery. First, we introduce the concept of sustainable and green finance and main initiatives undertaken globally in this area (Section 2). Then, we present key characteristics of the GIFT including its scope, coverage and 'modus operandi', along with a discussion on its links with the EU Taxonomy and orientation for possible further development (Section 3). Finally, we describe possible policy applications and implications (Section 4).

2. Setting the scene

Sustainable finance relates to the consideration of Environmental, Social and Governance (ESG) factors when evaluating financial investments. Green finance is a subset of sustainable finance focused on the 'environmental' dimension which covers objectives such as mitigation and adaptation to climate change, sustainable use and protection of water and marine resources, preservation of biodiversity and reduction of pollution, and promotion of the circular economy (European Commission, 2021). Furthermore, according to the UN Environment Program, green financing represents the increase in public, private and not-for-profit financial flows towards the achievement of sustainable development goals, thus placing it within the framework of the Sustainable Development Goals (SDGs) set for 2030 (UNEP, 2021).

Despite the plurality of definitions, the main objective of green and sustainable finance is making the transition towards a green and sustainable economy possible by diverting economic investments from activities that are not sustainable in the long-term towards those that can support green and sustainable growth patterns. It is urgent that investments and innovations take the right direction to address environmental emergencies, as the environmental directed

[1] The name of the Ministry was changed into 'Ministry for the ecological transition' since February 2021. The pilot project was launched in November 2020. Legal references can be found here: https://www.minambiente.it/bandi/avviso-pubblico-di-manifestazione-d-interesse-la-selezione-di-istituti-di-credito-e-finanziari (accessed 6 March 2021). The pilot involves 7 credit institutes, 9 companies and 4 accounting firms addressing investment projects on agri-food, bio-based and cosmetic products, as well as intermediate materials from renewable and non-renewable resources.

technological change theorists advocate (Acemoglu et al., 2012). This is what green finance is expected to do, based on a consistent and practical set of indicators showing the direction to take and allowing monitoring progresses.

According to G20 (2017), the development of green finance could not only solve the climate emergency but also generate economic growth and employment. However, both microeconomic and macroeconomic hurdles must be removed. The former includes information asymmetries creating excess cost and rationing of external finance, the misalignment of deadlines between long-term green investments and the short time horizon of savers, and the inadequacy of analytical skills. The latter include not only the general macroeconomic barriers (such as exchange rate volatility, inflation, capital market controls), but also specific barriers associated with limited public fiscal capacity as well as regulatory and political risks that vary from country to country. Four areas of intervention are needed to remove these hurdles: (1) promote sustainable finance standards; (2) increase the degree of transparency required from operators; (3) support the development of markets for sustainable investments; (4) assist developing countries on green financing.

These actions have the potential to unlock the necessary resources at all levels of the economic system. The fundamental goal is to make sustainable investments affordable for financial operators while avoiding, or at least minimising, the risk of greenwashing – i.e. the financing and promotion of activities that are misleadingly perceived or communicated as 'sustainable'. The risk of greenwashing affects all players (issuers, investors, and intermediaries) and constitutes an additional major obstacle to the development of green finance. This remarks the importance of having rigorous, sound and widely agreed standards. In particular, the European Union (EU), in parallel and in synergy with other international institutions, has instilled intense efforts to regulate this matter, also to ensure that 'reliable, comparable and verifiable information' is provided (European Commission, 2019).

In 2016, the European Commission (EC) set up a High-Level Expert Group on Sustainable Finance, which expressed the need to clarify the definition of 'green' and 'sustainable' finance from the beginning of its work (European Commission, 2016). Then, an action plan for financing sustainable growth was published in 2018 (European Commission, 2018a).

One of the first objectives set by the EC was the development of the so-called 'Taxonomy', a classification system for economic activities according to rigorous and agreed sustainability criteria. The work was entrusted to a Group of Technical Experts (TEG) (European Commission, 2018b). The result was the Regulation (EU) 2020/852 (later referred to also as (EU) 'Taxonomy Regulation' or ´Taxonomy´) (European Union, 2020). Recipients of the same are financial operators who place sustainable finance products and companies subject to the obligation to publish a non-financial statement or non-financial consolidated financial statements.

The central point of the EU Taxonomy Regulation is Article 3, according to which an activity is sustainable if: (1) contributes substantially to achieve at least one environmental objective; (2) does not significantly harm (DNSH) any other objective; (3) respects minimum social standards; (4) complies with technical screening criteria (to be defined further with Delegated Acts). The goal of the European Commission is to adopt six Delegated Acts by the end of 2021, each one addressing a specific environmental objective. So far, a public consultation for the first two Delegated Acts on climate change mitigation and adoption closed on 18 December 2020, with more than 45'000 comments being submitted. The adoption of these documents,

initially due by 1 January 2021, was thus delayed[2], while work on other Delegated Acts is currently ongoing (Simon, 2021).

In the meanwhile, the Italian Minister of the Environment, Land and Sea Protection has launched in November 2020 a pilot project aimed at the development and application of a tool (i.e. the GIFT), which builds on and complement the EU Taxonomy (see Section 3). Specifically, the tool can be used by companies to assess the environmental impacts of their projects, allowing credit institutions to select projects to finance based on environmental considerations. This is expected to encourage greater mobilization of capital towards 'green' initiatives and, therefore, to support the decarbonization of the economy and the ecological transition.

3. Development of the Green Investment Financial Tool (GIFT)

The GIFT shapes an approach for assessing the environmental performance of investments made by an organisation in sustainable projects. The goal is not the assessment of ESG factors of an organisation (Boffo and Patalano, 2020).

The GIFT builds on the EU Taxonomy (EU TEG on Sustainable Finance, 2020), which sets binary criteria for the identification of sustainable activities and goes beyond that by assessing environmental impacts associated with investment projects (Richter, 2019). Through its alignment with the EU Taxonomy, the GIFT aims to reinforce and promote the fundamental role of this EU initiative in the sustainability landscape.

The approach resorts to Key Performance Indicators (KPI) that integrate system thinking and LCA aspects (ISO 14040; ISO 14044). Linking LCA with sustainable finance is a still relatively innovative practice (Gibon et al., 2020), although its gradual integration and improvement should be promoted for a holistic consideration of environmental mechanisms.

The approach consists of three steps:

1. Pre-screening of investments.
2. Assessment of investments.
3. Verification, documentation and reporting of results.

Similarities and complementarities between GIFT and EU Taxonomy are summarised in Table 1.

Table 1: Similarities and complementarities between GIFT and EU Taxonomy

Similarities between GIFT and EU Taxonomy	**Complementarities between GIFT and EU Taxonomy**
• Environmental improvement and 'Do Not Significant Harm' logic with respect to 6 environmental objectives: 1. Climate change mitigation. 2. Climate change adaptation. 3. Sustainable use and protection of water and marine resources.	• The GIFT does not define criteria or improvement thresholds. • The GIFT aims to assess the variation of impacts due to investments through LCA-based KPIs. • While the EU Taxonomy is still in the development phase, the GIFT offers a

[2] June 2021 is the possible adoption date for Areas 1 and 2, while adoption of other delegated acts is planned by 31 December 2021.

4. Transition to a circular economy.
5. Pollution prevention and control.
6. Protection and restoration of biodiversity and ecosystems.

- Sustainability criteria of the EU Taxonomy as 'entry level' for the GIFT.

ready-to-use and flexible tool, which can be adapted in the future (even to adhere at future developments at EU level).

3.1 Pre-screening of investments

A financial investment can in general refer to projects related to the modification of existing processes, products, activities (e.g., the retrofitting of a building), or to the ex-novo deployment of additional ones (e.g., the construction o a new building).

Activities excluded from the EU Taxonomy do not carry the right to apply for the GIFT. Furthermore, although the GIFT focuses on environmental aspects, the organisation requesting the financing of an activity must demonstrate the respect of minimum social and governance criteria. In accordance with the EU Taxonomy Regulation, such minimum criteria require the alignment with the OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights.

The fulfilment of the above requirements constitutes the entry point to the GIFT.

3.2 Assessment of investments

3.2.1 Counterfactual impact assessment

An investment produces changes at system level. The environmental performance of an investment is assessed ex-ante by comparing expected impact changes produced by the investment compared with what would have happened without the investment (i.e., the counterfactual).

Changes are assessed through LCA-based KPIs. For illustrative purposes, KPIs considered in the pilot phase of GIFT are reported in Table 2. The KPIs allow for taking a picture of the system before and after the investment. For each KPI it is possible to quantify the variation Δ of the parameter before and after the investment. A negative value of Δ corresponds to a reduction of environmental burdens associated with a KPI. The ratio between Δ and the money invested provides a measure of the efficiency of the investment in terms of environmental sustainability.
For investments aimed at directly modifying an existing condition, Δ can be intuitively assessed. For investments aimed at deploying ex-novo projects, a counterfactual analysis is necessary to estimate the activity(-ies) replaced by the project (Sartori et al., 2014).

An investment is considered 'green' and to support the transition towards a more sustainable economy if at least one KPI is improved without compromising the others (DNSH principle). When trade-offs occur between KPIs, so that the improvement of an indicator comes at the expenses of at least another one, the investment cannot be considered green, unless measures are taken to modify the environmental profile of the investment. Apart from supporting environmental safeguard, this requirement has also the benefit of stimulating innovations. In fact, the ex-ante assessment refers to projects for which financing is requested but which still have to be executed, which offers a certain margin of manoeuvre in the design and implementation of the projects.

Alternative ways to handle trade-offs could be tested in the future. These could include the possibility of defining margins of tolerance for each Δ, the aggregation of indicators through normalisation and weighting procedures (ISO 14040; ISO 14044), as well as the use of scoring system approaches (Bracquené et al., 2021).

Table 2. Key Performance Indicators considered in the first version of GIFT

Area	***KPI (unit)***	***Methodological references***
1. Climate change mitigation	I1. Net emission of GHGs (kg $CO_{2,\,eq}$)	Calculation of life cycle GHG emissions to and removals from the atmosphere, and characterisation of their overall Global Warming Potential over 100 years (GWP100) based on the IPCC model, as described in PEF (Zampori and Pant, 2019).
2. Climate change adaptation	I2. Climate change vulnerability proxy (dimensionless)	Characterisation of the vulnerability of the analysed system through the quali-quantitative assessment of its exposure (E), sensitivity (S) and adaptation capacity to extreme climatic events (adapted from GIZ (2014)).
3. Sustainable use and protection of water and marine resources	I3. Water scarcity footprint ($m^3_{eq.}$)	Calculation of the overall water consumed from a life cycle perspective, corrected for its scarcity according to the AWARE model, as described in PEF (Zampori and Pant, 2019).
4. Transition to a circular economy	I4a. Consumption of fossil fuels and non-regenerative biomass (MJ) I4b: Consumption of primary minerals (kg) I4c: Production of non-recyclable waste (kg)	Calculation of a) consumption of fossil fuels and non-regenerative biomass, b) consumption of primary minerals, c) production of non-recyclable waste, adopting a LCA perspective aligned to PEF (Zampori and Pant, 2019).
5. Pollution prevention and control	I5a. Emission of particulate matter (disease incidence) I5b. Photochemical ozone formation (kg NMVOCeq.) I5c. Acidification (mol H+eq.)	Calculation of life cycle emissions of pollutants of concern (e.g., PM2.5, NMVOCs, NOx, SOx, NH3) and characterisation of the impacts associated with emission of particulate matter (UNEP (2016a) model), photochemical ozone formation (LOTOS-EUROS model), acidification (Accumulated Exceedance model), freshwater eutrophication (EUTREND model), as described in PEF (Zampori and Pant, 2019).

	I5d. Freshwater eutrophication (kg Peq.)	
6. Protection and restoration of biodiversity and ecosystems	I6a. Direct land use for anthropic activities (ha) I6b. Direct deforestation balance (ha)	Calculation of a) direct land use for anthropic activities (green areas excluded) related to the investment project, b) direct deforestation (positive value) / afforestation (negative value), adopting a LCA perspective aligned to PEF (Zampori and Pant, 2019).

Note: KPIs were defined with reference to a primary environmental area. Due to the interconnected nature of the environment, KPI can have an influence also on other areas.

3.2.2 Key Performance Indicators (KPI)

From a LCA perspective, the environmental performance of an activity can be assessed through alternative metrics (JRC, 2011; Pré Sustainability, 2020; UNEP, 2016a, 2016b).
In its pilot phase, the short-term priority of GIFT is to provide a 'ready-to-use' approach and avoid technical-economic barriers potentially hindering its penetration onto the Italian market. For practical reasons, a compromise between the coverage of an extensive set of impact categories and the ease of quantifying and interpreting results was sought (Cordella and Hidalgo, 2016).
A limited but manageable set of KPIs is selected, as reported in Table 2, which address the six environmental objectives of the EU Taxonomy, as well as SDGs referring to the environmental dimension of sustainability (United Nations, 2015). Only quantitative indicators measuring environmental pressures and impacts in absolute terms are proposed.
While acknowledging that adaptations may be necessary in future, also to reflect specificities of sectors or applications, the initial intention of the GIFT is to provide a general framework of KPIs to be tested independently from the scope of the investment.
KPIs for area 1 ('climate change mitigation'), area 3 ('sustainable use and protection of water and marine resources') and area 5 ('pollution prevention and control') refer to Life Cycle Impact Assessment indicators to quantify according to the EU Product Environmental Footprint (PEF) (Zampori and Pant, 2019). PEF is referred to also for the calculation of KPIs for area 4 ('transition to a circular economy') and area 6 ('protection and restoration of biodiversity and ecosystems'), although an analysis at the Life Cycle Inventory level is needed in this case. A quali-quantitative proxy indicator is instead considered for area 2 ('climate change adaptation') to estimate exposure and vulnerability of the project to climate change impacts.
A system thinking perspective was applied for all KPIs, which implies the consideration of direct pressures and impacts associated with an investment project (e.g., emissions associated with the combustion of fossil fuels for transportation), as well as system level contributions (e.g., emissions associated with the production and distribution of fossil fuels).

It follows that, preliminarily to the calculation of KPIs, it is needed to define:

- The system boundaries of the investment, in terms of time horizon, life cycle stages, processes and aspects covered in the assessment (e.g., raw material extraction and processing, parts and product manufacturing, distribution, use, maintenance, end of life).

- The system boundaries of the modified/avoided activity(-ies) (e.g., the generation of electricity from photovoltaic panels avoids the consumption of electricity from the grid and the related impacts of production and transmission).
- The functional unit of the object of the investment, i.e., the calculation basis to which KPIs must be referred to (e.g., average production of 1 MWh of electricity per month during the time horizon).

Given the counterfactual nature of GIFT, it is sufficient to include in the assessment only the parts of the system that change as consequence to an investment. For each part, it is necessary to compile elementary flows (consumption of resources and emissions) and all information that allows the quantification of the KPIs.

It should be noted that KPIs only address environmental issues since the scope of GIFT is on green finance. Nevertheless, the inclusion of social criteria embedding a life cycle approach (UNEP, 2020) could be considered in future versions of the GIFT.

Areas 1 and 2: Climate change mitigation and adaptation

The first two areas addressed by the GIFT are 'climate change mitigation' and 'climate change adaptation' (ISO 14080), which respectively refer to:

1. reducing anthropic sources and enhancing sinks of greenhouse gases (GHGs).
2. system level adjustments to manage risks and opportunities associated with climatic change.

The KPI selected for climate change mitigation is the 'net emission of GHGs' (I1), measured as kg $CO_{2,\,eq.}$ and calculated based on the Global Warming Potential over 100 years of IPCC (Zampori and Pant, 2019).

Climate change adaptation entails more complex modelling and assessment of climate scenarios and associated risks on ecological, social and/or economic systems (ISO 14080, ISO 14090). Given the importance played by the adaptation dimension of climate change, a simplified 'climate change vulnerability proxy' inspired by GIZ (2014) was introduced as KPI (I2). Vulnerability is 'the degree to which a system is susceptible to and unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system' (GIZ, 2014).

I2 is conceived as a quali-quantitative indicator aimed at stimulating the analysis of the vulnerability of investment projects to physical impacts of climate change (e.g., floods, droughts, sea level rise) and the integration of possible solutions to reduce such impacts. Other types of climate risks and opportunities are not considered at this stage (e.g., reputational, competitive, regulatory risks). After defining system boundaries for investment project and counterfactual scenario, I2 can be calculated as shown in eq. 1.

$$\text{Climate change vulnerability proxy (I2)} = \frac{E \times S}{AC} \qquad \text{(eq. 1)}$$

Where:

- E is the level of exposure of investment project, or counterfactual scenario, to extreme climatic events during its time horizon (Very Low: 0.1; Low: 0.2; Medium: 0.5; High: 0.8; Very High: 1). This requires the observation of past climate data and the analysis of climatic trends (GIZ, 2014).

- *S* is the sensitivity of investment project, or counterfactual scenario, to such climatic events (Very Low: 0.1; Low: 0.2; Medium: 0.5; High: 0.8; Very High: 1). The sensitivity represents the degree to which a system is affected by such climatic events (e.g., a crop yield change, the damage caused by an increase in the frequency of coastal flooding) (GIZ, 2014),
- *AC* is the adaptive capacity of investment project, or counterfactual scenario, to such climatic events (Very Low: 0.1; Low: 0.2; Medium: 0.5; High: 0.8; Very High: 1). Adaptive capacity refers to the ability of a system to adjust to climate change to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (GIZ, 2014).

Recently, international guidelines on vulnerability, impacts and risk assessment have been also published (ISO 14091) that could be integrated in future developments.

Area 3: Sustainable use and protection of water and marine resources

The third area addressed by the GIFT is 'sustainable use and protection of water and marine resources'. The KPI selected for this area is the 'Water scarcity footprint' (I3), measured as m^3 $water_{eq.}$ and calculated based on the AWARE method (Zampori and Pant, 2019). Protection of water resources against pollution is directly addressed also by KPIs of area 5.

Area 4: Transition to a circular economy

The fourth area addressed by the GIFT is 'transition to a circular economy', i.e. an economy where wastes are recycled into resources, either through technological or natural ecosystem feedback mechanisms, so that the stock of resources is preserved (Peña et al., 2021).

A variety of circular economy metrics exist (Moraga et al., 2019), including both absolute and relative indicators of different levels of complexity, with relatively simple parameters used already for financial applications (UNEP Finance Initiative, 2020). Considering that the goal of circular economy is an overall reduction of natural resources consumption and non-recyclable waste generation (Cordella et al., 2020), this environmental area was dissected into three simple KPIs addressing specific elements of circularity:

1. I4a: 'Consumption of fossil fuels and non-regenerative biomass' (MJ).
2. I4b: 'Consumption of primary minerals' (kg).
3. I4c: 'Production of non-recyclable waste' (kg).

Such KPIs address the main objectives of the circular economy and can be calculated through mass and energy balances involving the quantification of the following elementary flows for the analysed system:

1. Use of primary and secondary metals and non-metallic minerals.
2. Consumption of fossil fuels, as well as non-regenerative biomass (Cordella et al., 2013).
3. Generation of recyclable and non-recyclable waste.

Relative composite indicators such as the Material Circularity Indicator (Ellen MacArthur Foundation, 2021) were not considered at this stage, giving priority to the overall decrease of consumption of primary and non-renewable resources and production of non-recyclable waste. Relative indicators could complement absolute indicators, but they would not be able alone to reflect the performance of an investment project in the real economy (e.g., a more 'circular' but heavier product could require more materials in absolute terms). In that sense, it could be

more interesting to refer to the overall consumption of resources and to the overall production of waste.

As introduced in Section 3.2.1, the approach does not consider the weighting and aggregation of indicators, which entails subjectivity and can mask possible trade-offs. This methodological choice means that green investments addressing this area must promote an improvement for all three KPIs.

Future developments for this area could see the differentiation between types of minerals and the consideration of midpoint or endpoint indicators (Bare et al., 2000) taking scarcity of materials into account (e.g., Abiotic Depletion Potential) (Zampori and Pant, 2019). Furthermore, alignment with ISO/TC 323 on 'Circular economy' may be sought once its working documents will be released.

Area 5: Pollution prevention and control

The fifth area addressed by the GIFT is 'pollution prevention and control', which covers a broad set of indicators and methods (Zampori and Pant, 2019). A functional number of KPIs of PEF (Zampori and Pant, 2019) was considered:

- I5a. 'Emission of particulate matter (PM)', measured as disease incidence (UNEP (2016a) model).
- I5b. 'Photochemical ozone formation', measured as kg $NMVOC_{eq.}$ (LOTOS-EUROS model).
- I5c. 'Acidification', measured as mol $H+_{eq.}$ (Accumulated Exceedance model).
- I5d. 'Freshwater eutrophication', measured as kg $P_{eq.}$ (EUTREND model).

The proposed KPIs, which must be analysed separately, have direct effects also on areas 3 and 6, and cover impacts due to the emission of key pollutants such as $PM_{2.5}$, NMVOCs, NO_x, SO_x, NH_3.

The assessment of toxic effects is excluded in the present version of GIFT but could be included in future revisions of the tool. Furthermore, indicators of this areas could be characterised at the endpoint level and aggregated (together with others) to quantify the overall impacts on human health (e.g., years of life lost) and ecosystems (e.g., biodiversity loss).

Area 6: Protection and restoration of biodiversity and ecosystems

The sixth area covered by GIFT is 'protection and restoration of biodiversity and ecosystems'. This is an area partly addressed by other indicators used in GIFT, but particularly affected by land-use changes (Marques et al. 2019). In particular, land uses different from primary forest can result in dramatic loss of biodiversity and ecosystem service losses, which are further aggravated for urban areas (García-Vega and Newbold, 2020). The need of protecting land areas and primary forests is also highlighted, among others, in the recent Biodiversity Strategy of the European Commission (2020b).
To reflect these aspects, the following parameters (to be considered separately) were added for this area:

- I6a. Direct land use for anthropic activities (ha), measuring the extension of land directly transformed and/or occupied for anthropic activities related to the investment project (e.g., urban areas, industrial activities) and not covered by green areas.

- I6b. Direct deforestation balance (ha), measuring the extension of areas directly deforested to sustain the investment (positive value), or afforested (negative value).

The reference to biodiversity equivalence factors between different types of land use could be interesting for future applications (Huijbregts et al., 2016). Future developments of the approach may also explore the integration of indirect land use changes, for which there is however a certain level of uncertainty (Finkbeiner, 2014), as well as the consideration of aquatic biodiversity and other relevant aspects (e.g., pesticide emissions) that are currently excluded from the approach. Furthermore, taking the disappearance of species (biodiversity loss) as an endpoint, different contributions influencing this area (e.g., KPIs of area 5) could be characterised and aggregated into an overall indicator assessing the Potentially Disappeared Fraction (PDF) of species (Huijbregts et al., 2016).

3.3 Verification, documentation and reporting

Adherence to the PEF guidance is requested to limit margin of uncertainty and improve the reliability, comparability, and verifiability of results (European Commission 2020a). For transparency reasons, assumptions and data used must be 3rd party verified, documented, and reported (ISO 14040; ISO 14044; ISO/TS 14071). These include, among others:

- Main characteristics of the project.
- Details of the calculation carried out to calculate KPIs and Δ.
- Interpretation of results.
- Considerations over the quality of data.
- Resources used.
- Evaluation of the usefulness of the KPIs, critical elements and improvement suggestions.

As possible follow-up of the pilot phase, the information collected through the pilot could be presented through advanced visualisation tools for the creation of a 'Green Finance Dashboard'.

3.4 Feasibility of GIFT adoption

A crucial issue for the successful introduction of the GIFT is whether costs of adoption are affordable, especially for small and medium sized enterprises (SMEs) given that corporate social responsibility (CSR) reporting can easily transform itself into a competitive barrier for SMEs, when fixed costs of reporting are too high.

In addition to it, the adoption by multinationals of socially and environmentally responsible standards of conduct is sometimes reversed across the value chain. This occurs when multinationals define codes of conduct and high standards for suppliers and subcontractors[3]. This translates into high costs for SMEs being asked to adopt those standards to be part of the value chain.

For these reasons, defining CSR reporting standards that can fit properly also for small business, or that have affordable costs for them, is of paramount importance.

[3] A famous code of conduct is that of Nike, created for the first time after activists' campaign against low labour standard conditions among company suppliers and subcontractors. https://purpose.nike.com/code-of-conduct (accessed 6 March 2021).

An estimation of the costs that a company could embark for assessing an investment through the GFIT has been carried out with the contribution of an ESG service provider (ESGeo[4]). Findings are reported in Table 3 according to four net sales classes ranging from below EUR 100 million to above EUR 1 billion. For the lowest size class, the cost to assess an investment through the GIFT is between 0.003%-0.005% of the average class net sales, as a sum of evaluation, certification and digital workflow management costs. The ratio goes up to 0.013%-0.023% in case the company has no previous LCA information available and carries out a full LCA study. The availability of LCA information reduces substantially ('near to zero') the costs for evaluating future investments given that LCA provides base ingredients to calculate the KPIs used in GIFT. Costs for the highest-class size become much smaller and negligible given they are almost fixed or rise much less than the net sales class the ratio. Costs calculated in Table 3 assume that the ESG evaluator makes at least 100 evaluations per year, a reasonable assumption given the concentration of the market allowing ESG evaluators to have substantial economies of scale.

[4] https://www.esgeo.eu (accessed 6 March 2021)

Table 3 Costs in EUR of CSR reporting for different sizes of companies

Size class of the company	A. LCA cost	B. GIFT measurement cost for the single investment *	C. Other costs (digital platform, audit, certification) *	D. Total costs in case no LCA was made (A+B+C+D)	E. Total cost in case LCA is available (B+C+D)	D-to-F ratio **	E-to-F ratio **
Type I: - Net sales (F): < EUR 100 million - Products/services offered: < 10	10'000-18'000	1'800-3'000	1'000-1'500	12'800-22'500	2'800-4'500	0.013%-0.023%	0.003%-0.005%
Type II: - Net sales (F): EUR 100-1'000 million - Products/services offered: 10-50	12'000-20'000	2'000-3'500	1'000-1'500	15'000-25'000	3'000-5'000	0.003%-0.005%	0.001%-0.001%
Type III: - Net Sales (F): > EUR 1 billion - Products/services offered: < 100	20'000-30'000	2'800-4'000	1'000-1'500	23'800-35'500	3'800-5'500	0.002%-0.004%	0.0004%-0.001%
Type IV: - Net Sales (F): > EUR 1 billion - Products/services offered: > 100	30'000-50'000	3'500-5'000	1'000-1'500	34'500-56'500	4'500-6'500	0.003%-0.006%	0.0005%-0.001%

* The cost implies that the ESG evaluator makes at least 100 evaluation per year.

** EUR 100 million for type I, EUR 550 million for type II, EUR 1 billion for types II and III.

4. Policy applications and implications of the GIFT

The GIFT introduced a set of indicators to assess the environmental sustainability of investments in six areas mirroring the EU Taxonomy. This provides institutions and corporations with instruments that can help monitor their position in the transition towards a more sustainable economy. The approach can provide useful insights and support to local, national and intergovernmental institutions in addressing sustainability challenges in the implementation of policy tools such as subsidised green investments, green government bonds, green public procurement, reform of corporate and work bonuses accounting for green KPIs, border adjustment mechanisms.

4.1 Subsidised green investments

Acemoglu et al. (2012) with their theory of directed environmental technological change suggest that without a proper set of incentives it is impossible to achieve the goal of sustainable development and ecological transition and add that countries lagging behind will be forced to pay a higher cost for it..

The KPIs proposed in the GIFT can be used for this objective as they aim to assess the impact of a given investment for the six environmental areas of the Taxonomy Regulation and promote investments that 'do not substantially harm' those areas, thereby helping clarify whether the investment represents a green Pareto improvement in the direction of ecological transition.

However, an issue that the KPIs cannot address by themselves is understanding the interaction between the changes produced by the investment and the overall position of the firm in the ecological transition and exposure to ESG risk, which requires complementary information. There may be in fact cases in which the move in the right direction towards ecological transition is realized with an investment leaving the company below the environmentally efficient technological frontier. This is the case when GIFT scores indicate that the investment meets the green Pareto improvement criterion of producing a positive change in at least one area without falling behind in any of the other five areas, while the improvement with respect to the counterfactual leaves the company below the frontier[5]. The trade-off here is between stimulating progress toward ecological transition at the cost of inefficient financial support to investment that still leaves the company distant from it. This is a further reason for the complementarity of the GIFT with the definition of in-scope economic activities provided by the EU Taxonomy Regulation.

4.2 Green government bonds

The GIFT can be a useful tool to define thresholds of admissible investments in green private and government bonds. Green bonds are an increasing source of external finance that private and institutional investors use to raise funds for ecological transition on financial markets[6]. Its growing role is going to affect even the European Central Bank reserve holding strategies, with

[5] An example can be an investment in a new more energy efficient (while not fully electric, not hybrid or not frontier diesel) car model.

[6] According to the last report of the Climate Bond Initiative the total amount of private and government green bond totalled an adjusted USD 257.7 billion in 2019, a 51% increase with respect to the previous year. https://www.climatebonds.net/resources/reports/2019-green-bond-market-summary (accessed 6 March 2021).

the perspective of 'green quantitative easing' thereby giving further stimulus to the development of this market segment (De Santis et al., 2018; Fender et al., 2019).

Beyond the 'green' attribute, the quality of a rigorous definition of what 'green' means is crucial to trigger the willingness-to-pay of sustainable financial investors, gain (negative) green premia (i.e., a relatively higher demand and price for the green bond and therefore lower interest charges with respect to its non-green (brown) bond equivalent), as well as avoid greenwashing (Bachelet et al., 2019; Zerbib, 2019).

More in detail, factors that contribute to the perceived quality of the green government bonds, and therefore to the negative premium, are: the clear indication of the destination of funds to green investments and the rigorous definition of admissible expenses; the share of new projects financing versus financing already operating activities; rigorous yearly interim reports on the process and the involvement of a third-party certifying the report and, finally, the ex-ante assessment of expected impacts of the investment and the ex-post evaluation of those impacts. On this last point (impact assessment and evaluation), the approach provided with GIFT could ensure that an investment financed with green government bonds generates improvements towards the ecological transition in the six environmental domains of the EU Taxonomy.

4.3 Green public procurement

Green public procurement (GPP) is a third relevant domain where the GIFT could be used. Around 20% of the aggregate consumer demand in the market comes from institutional sources and is therefore related to public procurement. Local, regional, national and intergovernmental institutions are called today to define green and sustainable public procurement rules in accordance with UN SDG12 'Sustainable Consumption and Production'.

The implementation of GPP requires: 1) the definition of minimum environmental criteria in each specific sector, and 2) adequate training of contracting authorities, given the complexity of integrating environmental criteria in tendering procedures. Activities or investments below minimum environmental criteria are excluded from tenders, or at least penalised in the offer evaluation process.

The indicators used in the GIFT could support GPP in the definition of minimum environmental criteria and in the development of SDG-consistent and improved offer evaluation systems, where bidders are required to fulfil minimum requirements and are then evaluated based on the impacts that their provision of goods and/or services produces in terms of ecological transition.

4.4 Reform of corporate and work bonuses accounting for green KPIs

A fourth example of possible application for the approach provided by GIFT concerns the reform of corporate bonuses and workers wage premia so they are directed towards a promotion of the ecological transition (Hristov and Chirico, 2019). Most corporate incentives include bonuses or premia related to indicators such as share prices, profits or value added. However, no reference is made to the positive/negative externalities that corporate activity can create on other stakeholders. The limit of this approach is that it does not discourage strategies targeted toward profit increase, even at the cost of negative social and environmental externalities such as higher carbon or water footprints, more job accidents or lower circularity of production processes.

The perverse effects of not including stakeholder wellbeing and environmental sustainability among bonus indicators can be substantial, especially under less favourable corporate economic conditions., n 'slack times', when the corporate 'value cake' is constant or even shrinking, managers can be tempted to cut benefits for other stakeholders (e.g., saving on wages and worker benefits or on environmental costs) to increase the slice of corporate profits and cash their own bonuses. Consequently, disregard for social and environmental KPIs in the definition of corporate bonuses and workers ends up creating the perverse incentive for managers of extracting and not creating corporate value.

The GIFT could be used to reform indicators of corporate bonuses as its KPIs can allow gauging bonuses to ensure that managers cash bonuses only if they increase profits and promote environmental benefits at the same time (i.e., meeting the green Pareto improvement criterion). The indicators can be used to set minimum requirements or more ambitious goals towards the ecological transition. It is noteworthy to remark that an ecological transition consistent reform of corporate bonuses can help to increase competitiveness and reduce exposure to ESG risk as demonstrated by the recent stock market overperformance of companies more ahead in the ecological transition.

4.5 Border adjustment mechanisms

A fifth example where the GIFT could be used is in the definition of a carbon border adjustment tax, and more in general in the cross-fronter regulation of other sustainability aspects. In global competition, the optimal localisation choice of profit maximising companies implies the search for the minimum production costs when considering labour, environment and taxation for a given level of product quality. The search for the lowest-quality-adjusted costs creates a race-to-the-bottom 'Bertrand competition' among countries, each one competing with the others to attract foreign investments and producers, by reducing regulatory and non-regulatory costs of labour, environmental regulations and taxation.

The only way for a geographical area to set high environment, labour, and tax standards without triggering harmful delocalisation processes is that of combining them with a border adjustment tax that discourages social and environmental dumping by imposing an added consumption tax on foreign products below local social and environmental standards (Ismer and Neuhoff, 2007). The positive effect of the carbon border adjustment tax is as well that of stimulating progress toward environmental and social sustainability in exporting countries, thereby contributing to the improvement of social and environmental outcomes at global level.

The awareness of the importance of implementing a carbon border tax is growing in high-income countries. The EU has set the goal of creating it by the beginning of 2023 to avoid that the Next Generation EU plan (i.e., the post-COVID-19 recovery plan of the EU) is financed by increasing financial contributions of EU Member States[7]. At the same time in the US, with the highest consensus ever reached, more than 3'000 economists including 28 Nobel laureates and

[7] More specifically the EU aims to raise up to EUR 34 billion per year as its own budget from four sources: i) extension of the Emissions Trading System (EUR 10 billion per year); ii) Carbon Border Adjustment Mechanism (EUR 5-14 billion per year); iii) New taxes on 'operations of companies that draw huge benefits from the EU single market' (EUR 10 billion per year); iv) Digital services tax (EUR 1.3 billion per year) (Bunn, 2020; European Commission, 2020c).

4 former chairs of the Federal Reserve have signed a document asking for the introduction of a carbon tax accompanied by a carbon border tax[8].

Sets of adequate indicators on which there is broad international consensus could provide the infrastructure for the implementation of border measures (also beyond carbon issues, potentially) since the decision to charge the border tax on foreign products below minimum standards needs to be based on the measurement of such indicators, without entering in other methodological considerations. The approach described in GIFT could offer a base of discussion to define consistent and internationally agreed indicators.

4.6 Knowledge creation implications (monitoring, accounting)

Based on what discussed above, the adoption of a tool like the GIFT can provide relevant contributions in terms of knowledge creation for business and institutions.

First of all, it can help companies to get prepared, in terms of accounting knowledge, to the likely introduction of more rigorous standards for non-financial reporting. As known, regulations are moving worldwide in that direction[9], becoming progressively more severe, and often introducing compulsory quantitative requirements which must be fulfilled by all companies along the value chain of products, possibly in a collaborative way (Villa Todeschini et al., 2020). With this respect, the GIFT adoption could in particular support SMEs to get familiar – in terms of accounting knowledge – to the likely request of large companies with whom they have subcontracting relationships about the introduction of more severe non-financial reporting standards, needed to ensure compliance along the entire value chain. In fact, one of the strengths of the approach is that of providing a simple but exhaustive set of measures that can be easily implemented also by smaller companies.

Furthermore, the GIFT can prompt the development of accounting and monitoring skills needed to access to GPP, as well as to government and private green bond investments which set challenging quantitative standards in their frameworks to investors[10]. Companies using GIFT can acquire knowledge and competences to meet such demands. Furthermore, by addressing interlinked objectives and SDGs thorough its KPIs, the GIFT can also stimulate the collection and availability the data that governments may require to monitor the progress of their economies towards sustainability. Ultimately, these elements can thus contribute to reduce the sustainability governance gap (Bergsten et al., 2019).

5. Conclusions

This paper presented an approach (the GIFT) to assess the environmental sustainability of new investments, which places it in the ongoing debate on sustainable finance and is expected to facilitate the allocation of private and public resources towards green projects, avoiding greenwashing and accelerating the ecological transition.

[8] Economists' Statement on Carbon Dividends Organized by the Climate Leadership Council. https://www.econstatement.org/#:~:text=A%20carbon%20tax%20should%20increase,and%20large%2Dscale%20infrastructure%20development (accessed 6 March 2021).

[9] E.g., the compulsory Business Responsibility Report in India for the top 500 listed companies, the European Union Non-Financial-Reporting Directive - 2014/95/EU making non-financial reporting compulsory for companies with more than 500 employees, the US Environmental Protection Agency imposing information on carbon emission for facilities with emission exceeding 25 metric kilotons per year.

[10] For example, in the recent issuing of Italian green government bonds, financing of energy production is limited to investments below 100g $CO_{2,eq.}$/kWh.

Specifically, in the sustainable finance scenario, the GIFT is an approach that introduces a LCA perspective in the assessment of the sustainability of investments, and that entails a focus on specific projects of organisations and the counterfactual analysis of their effects at system level.

The approach does not consider directly economic and social aspects. The economic viability of investments is given for granted, while minimum requirements for organisations are introduced to address social aspects of sustainability.

LCA-based KPIs of the GIFT specifically address environmental sustainability, which can cover a broad spectrum of aspects and add complexity to the assessment framework. In its first stage, applicability and ease of assessment have been prioritised over comprehensiveness and complexity of the indicators, resulting in a manageable number of relevant indicators.

A background level of uncertainty is associated with the calculation of LCA-based KPIs. Repeatability and reproducibility of results are fundamental to avoid greenwashing, as well as their critical interpretation and transparency on how they have been obtained. This calls for appropriate assessment, verification and reporting methods, an issue that has been addressed by referring to the Product Environmental Footprint of the European Commission.

Methodological improvements could be applied to the approach in the future, also following international evolutions. Methods and regulations are a technical-scientific and legislative substrate that evolves continuously. Although the GIFT offers adequate flexibly to adapt to such variations, possible orientations for future developments were indicated. These include the refinement of KPIs in terms of scope and type. However, apart from the comprehensiveness and robustness of indicators, it is also necessary to evaluate the occurrence of trade-offs and how to handle them. The larger the number of indicators the greater the possibility of trade-offs. This may require a more flexible approach depending on the type of activity considered in the investment, or the consideration of tolerances, weighting and scoring approaches. Referring to endpoint indicators could help handle the trade-off issue but it would come at the expenses of transparency.

In the authors' view, the GIFT provides a valuable approach to decision makers for assisting them in the development, implementation and monitoring of policies. Although the GIFT has been developed in Italy, its application could be in general envisaged both in developed and developing countries (Wieczorek, 2018).

As means of exemplification, five possible domains were suggested and discussed: subsidised green investments, green government bonds, green public procurement, reform of corporate and work bonuses accounting, border adjustment mechanisms. Indeed, the GIFT can be a base to promote an international discussion around global trade standards on environmental sustainability required to establish and gain consensus about border adjustment taxes. If the idea of border adjustment mechanisms could be difficult to implement for social standards, given the strong differences on what can be considered fair wage and workers conditions in countries with far different levels of economic wellbeing and purchasing power parities, the possibility of reaching consensus around environmental indicators is much more likely given the overall agreement about role and importance of carbon and water footprints. The path toward consensus on circularity measures can be longer given the issue related to weighting the different circularity components.

Further debate is needed to gain consensus on the optimal measurement and weighting process. In this respect, the debate and the interplay among the different stakeholders involved in the definition of the GIFT (ESG evaluators, governments, companies, organisations of the civil society) can contribute to further testing and refining the approach. in particular, experimental

tests are important to stimulate further research to understand whether size- and industry-specific adaptations to the GIFT are needed.

Another issue relates to the further discussion between relative progress and absolute position of 'green' investments with respect to the ecologically efficient frontier, to see which combination of the two criteria should prevail in measures of public support to the ecological transition.

Finally, while the GIFT can stimulate the eco-efficiency of the supply side of the economy, the sustainability implementation debate should not exclude broader macro-economic and social considerations related to the level of consumption of countries and possible rebound effects (Giljum et al., 2008; Liobikienė and Dagiliūtė, 2016).

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