



## **Master's Thesis**

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**Green Accounting : How do firms measure environmental externalities and how does it reflect in their business models?**

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## Introduction

In April 2022, the International Panel on Climate Change (IPCC), composed of experts from the United Nations, reiterated the emergency to solve the climate crisis worldwide, and provided new recommendations to mitigate climate change. It stressed the necessity of shifting our production and energy consumption, with the goal of limiting global warming to 1,5°C compared to the pre-industrial era. To attain that objective, greenhouse gases (GHG) emissions should reach their maximum in 2025 and decrease by 43% by 2030 compared to 2019. As this report, and many others, point out, the environment has become a key topic in today's world.

Among private corporations, we observe a growing focus on environmental, social, and governance (ESG) concerns over the years. They face demands from customers who pay increasing attention to the impact of the goods and services they purchase. They are evaluated by investors and rating agencies specialised on ESG like Viego Eiris and Sustainalytics, but also by traditional financial actors like fund BlackRock, that performs ESG screening of its investments. Finally, they are constrained by new regulations such as the 2014 European Union Non-Financial Reporting Directive (NFRD), to be completed by the Corporate Sustainability Reporting Directive (CSRD) this year, or the recent European Taxonomy (2021) to classify green activities and investments.

One of the key issues in the field of sustainability is how to measure ESG performance. While companies have been measuring their financial performance for decades, with the help of accounting and financial indicators, initiatives for tracking ESG have mostly emerged since the 1990s and are still under construction. Among others, we can quote the Global Reporting Initiative (GRI, 1998), an independent organisation that published a set of standards to harmonise ESG reporting. The Sustainable Accounting Standards Board (SASB, 2011) created in the United States after the model of the Financial Accounting Standards Board, identifies the most material ESG metrics and propose reporting guidelines. The Task Force on Climate-Related Financial Disclosures (TCFD, 2015), created by the G20 Financial Stability Board, proposes a framework to disclose the risks posed to the company by climate change scenarios. Along with those reporting guidelines, new certifications have emerged to attest of the good practices of a company in environmental, social, and governance matters. One of them is the B-Corp certification, created in the United States in 2006 by a non-profit, that assesses voluntary companies on all ESG dimensions. Many more could be added to that list and are still emerging. Some are proposed by international institutions like the United Nations or the European Union, others arise from the cooperation among private actors, and others are developed by independent organisations and non-profits.

Beyond international frameworks and regulations, private companies have developed their own ways of tracking ESG performance and impacts. While some stick to traditional indicators prescribed by laws like the EU NFRD, others innovate and adopt a proactive stance. One of the objects of those innovative approaches is externalities, that are the external effects of economic transactions not reflected in market prices. Externalities are considered as a failure of the market to capture some of the negative value of economic activities like resource depletion or pollution, but also positive value, like education or natural site preservation.

Firms tend to approach externalities through the lens of quantification. They translate their externalities into amounts of impacts or costs to the company and society. This contrasts with the traditionally qualitative approach to ESG, that is addressed in mission statements, strategic roadmaps or lists of commitments.

The quantification of externalities is far from obvious, as it requires to identify the relevant topics and categories of impact, and to have the right data and methods of calculation to support them. The environment is a broad concept, that includes biodiversity, fossil and renewable resources, water, air, land, climate, and more. All these topics are highly interrelated and interdependent

and affect the livelihood and well-being of populations. In addition, the environment has a time frame that by far exceeds that of companies' reporting and forecasts, such as the thousands of years of radioactivity of nuclear waste. Offering a valuation of externalities and the environment requires to confront those difficulties to define and calculate value. With that in mind, we will explore how companies attempt to quantify their environmental externalities; what are the methods they develop or select, and what are the advantages and drawbacks of these methods; whether these attempts reveal the expected virtues and limitations of quantification; and what the quantification of externalities reveals about companies' goals, ambitions, strategies, and action plans?

To answer that question, I studied the initiatives of different companies and consulting firms. I interviewed Veolia and Michelin on their quantification of externalities, and relied on webinars, reports, and other resources to study Kering, BASF, Danone, Carrefour, and L'Oréal. I discussed with an ESG auditor at EY about the implementation of ESG reporting and its limits. Finally, I studied various articles and reports by consulting firms and independent organisations to have a more holistic point of view. I analysed the results in a qualitative way, through comparison between frameworks. I attempted to categorise them to display their common points and differences. I focused on what they try to measure, the underlying assumptions they use, or the way they communicate the results.

First, we will explore all the "value to society" methodologies, that monetises the impacts of a company's activities on human health and well-being at group-level. These approaches, used by Kering and BASF and contemplated by Michelin, have been developed with consultancies like PwC, EY and KPMG. They rely on the postulate that impact is not measured as an effect on the natural environment itself, but on humans that live in this environment. They do not put a "price tag" on nature but monetise how much humans suffer or benefit from a firm's activities, often through the prism of willingness to pay. They also promote a holistic view of externalities, by considering several types of impact drivers, like greenhouse gases (GHG), waste, water consumption and pollution, or air pollution. Their scope extends beyond the entity itself to its whole value chain, by relying on the concept of life cycle of the product, from raw materials extraction to end of life. The output of "value to society" frameworks is a consolidated environmental reporting expressed in monetary units and modelled after financial statements.

Second, we will look at targeted methods, that take a product-based or location-based approach to measure externalities on a smaller scale. The results are not consolidated, as these approaches focus less on reporting and more on the possibility to drive targeted changes with the relevant teams. These methodologies are more disparate as they seek to capture a firm-specific reality rather than provide harmonised reporting. They tend to engage local stakeholders more, both in building quantification and in turning it into concrete action.

Building on the review of these frameworks, we will take a critical stance and see that actual implementation is not developing as fast as methodology papers. The financial cost, as well as human and time resources required are often a limiting factor within companies. The complexity of some models can play in favour of simpler and more traditional ESG performance reporting, that only seeks to measure amounts of input (resources) and output (pollution) generated. So far, ESG and externality reporting does not fully answer investors' concerns, especially on the long-term outlook for ESG.

Finally, we will discuss the virtues of accounting for externalities, and the potential for positive changes in business models and environmental impact from companies. We will also explore the limitations to the accuracy, neutrality, and usefulness of quantifying or monetising externalities.

# 1. Literature review

## 1.1. What are externalities?

An externality is “a consequence of an industrial or commercial activity which affects other parties without this being reflected in market prices” (Oxford Dictionary), “a cost or benefit caused by a producer that is not financially incurred or received by that producer” (Investopedia). Externalities can either be positive, for instance the development of electric transportation that also reduces noise for residents; or negative, for instance a polluting factory negatively affecting the well-being of communities around it. Externalities arise from interdependencies and interactions outside of the market and affect citizens and natural ecosystems.

In efficient markets, all information, benefits and costs of a product, service or operation are reflected in the market price. Externalities are a market failure: the benefit or cost to the producer is smaller than the total benefit or cost to society and the planet. It leads to a sub-optimal equilibrium where activities leading to negative externalities are over-produced, because the producer does not bear the social cost of the negative externality. On the contrary, activities leading to positive externalities are under-produced, because the producer bears the cost of the activity but does not reap the social benefits.

In *The Economics of Welfare* (1924), economist Arthur C. Pigou advocated for a resolution of externalities through taxes, known as the “polluter-payer” principle. Negative externalities should be taxed, and positive externalities subsidised so that they are valued at their true cost. The fact of making economic actors take externalities into account in their decisions and pricing is called internalisation.

In *The Problem of Social Cost* (1960), Ronald Coase proposed a resolution through private markets, where parties trade their legal rights to solve the externality. If a factory pollutes and degrades people’s health, and citizens have the right to a clean environment, the factory can compensate them to be allowed to keep polluting. If the price received exceeds the healthcare costs, citizens should accept the trade. Coase specifies that this solution only works in the absence of transaction costs, as the latter modify the equilibrium of the market. In the environmental field, Coase’s proposition has been implemented in the form of carbon markets. The European Union has a carbon Emission Trading Scheme (ETS), and the United Kingdom has opened its own market after Brexit. Emissions trading is developing worldwide has a “cap-and-trade” system, where companies who exceed the authorised level of carbon emission must buy additional rights.

It may be impossible for market participants to agree on a price, if the price offered by the factory does not cover all healthcare costs. There might also be a timing issue, as pollution is immediate, but health consequences likely arise only several years or decades later. Some rights like fundamental human rights cannot be traded against money at all. Public goods like clean air are non-rival and non-excludable, hence they cannot be traded either.

The above example assumes that externalities are quantified in monetary terms, in this case healthcare costs can be estimated through medical bills or days of work lost. In reality, many environmental externalities are difficult to quantify, especially qualitative concepts like climate change or biodiversity. A crucial step towards internalising externalities is to be able to quantify them reliably.

## 1.2. The challenge of environmental externalities

Both Pigou’s and Coase’s visions are set in a capitalistic, liberal economy where private actors exchange goods and services by following their own interests. Gray (1992) challenges the guiding principles of traditional economics. Liberal economics do not care about ethics or human aspects,

do not address the issue of initial inequalities of wealth, power, and opportunity among individuals, and view growth as always desirable. Environmental issues are seen as a failure of the market, that are left out of the offer and demand mechanisms by which prices are determined. Hence the concept of externalities: the environment is external to economics. Gray takes an antagonist view by considering that environmental “externalities” are a failure of economics to capture the physical environment, and that they should be internalised if we want to support human life and the planet.

Sustainability is the planet and biosphere ability to renew itself and maintain its “carrying capacity”. It can also be defined, from an anthropocentric view, as the fact that current generations are not taking away from future generations and leaving them with the same resources and well-being they benefitted from. For an activity to be sustainable, we must preserve three types of capital (Gray, 1992).

Critical natural capital is the irreplaceable part of the biosphere, such as the ozone layer, the rainforest, wetlands, critical ecosystems... It should be preserved and remain immutable.

Sustainable or substitutable natural capital is the renewable part of the biosphere (timber, agricultural and cattle products...), or substitutable materials (some mineral materials can be substituted for one another in production).

Man-made capital is capital that does not exist without human activity: buildings, machinery, technology, know-how... Some have a market value, but others should be preserved as they do not have a price: human freedom, justice, community, ethical values...

The deep green movement aims at taking a holistic point of view on environmental matters “*one recognizes that all things are connected and thus total understanding of any one thing requires a complete understanding of all other things*”. “*One recognizes that such complete understanding is impossible and that issues must be addressed through the consideration of bounded subsystems - a complex process by which the universe of all possible events or things is reduced to more manageable systems, at a higher level of resolution*”. Each issue should be approached through the main things that influences it and the main things on which it has influence, but environmental matters cannot be divided into separate topics or disciplines.

In response to the growing challenge of sustainability, green accounting has developed over the past decades. Green accounting (Christophe, 1995) is “*an efficient information system about the degree of rarefaction of natural elements caused by corporate activity, usable to reduce this rarefaction and inform third parties*”. It is used by external stakeholders like investors, authorities, and customers, but also internally by management to measure performance, identify risks and opportunities, and make improvements. Green accounting connects environmental concerns to financial and strategic information, which is a step towards the more holistic and interconnected view defended by the deep green movement.

Accounting influences decisions and expresses accountability (Gray, 1992). It can integrate the green dimension through different processes and reports: compliance and ethical audits (law, codes of conduct), waste and energy audit (make the best use of resources), environmental budget (set targets), environmental impact and risk assessment (make investment choices), environmental and social reporting, environmental asset accounting and maintenance... These disclosures should ensure transparency from the company. They measure how much natural capital the company is destroying to create man-made capital. Accountability is also a tool to tighten relationships with stakeholders and give them more power in decisions. Hence, communication may be open to a large public or targeted towards certain stakeholders.

Another question is whether environmental data should be presented in a financial form, like traditional financial accounting. While non-financial data can inform decision-makers and society, it runs the risk of being more difficult to accept as it not widely used or understood by all

stakeholders, who are used to financial statements. Gray distinguishes three types of data that a company collects to capture its environmental impact.

Input data is concerned with the physical and human resources used for production, as well as the impacts and disturbances caused by this use (depletion of water resources, Deforestation...). Processing data gives information about the efficiency of production processes: what happens from input to output, how much material is lost, what is the accident rate, how are employees controlled...

Output data measures what the company releases into the environment and society because of production. On the physical side, it can measure elements like pollution and waste. On the human side, we can think of the influence and control exercised on society.

The most conventional approach to analyse this data is sustainable cost: *“what it would cost at the end of the accounting period to return the planet and biosphere to the point it was at the beginning of the accounting period”*. The cost would come in reduction of net income. However, within this approach, critical natural capital has an infinite cost. For renewable raw materials, the cost can be high enough to prevent all economic exploitation. And for substitutable materials, we consider the cost of using alternative materials and processes, including research to find new alternatives.

To report on sustainability costs, the method of Sustainable Cost Accounting (Déjean, 2021) is used. It considers sustainability costs as *“the monetary amount that an organisation would have to spend at the end of an accounting period to take the biosphere back to the situation in which it was at the beginning of the period”*. It is useful either when the magnitude of an externality cannot be measured, or when comparing impacts on a common scale is difficult. For instance, it is difficult to calculate equivalents for biodiversity, as ecosystems are diverse, host different species and provide different services. The value of a hectare of Amazon rainforest cannot be expressed as a multiple of the value of a hectare of wetlands, one cannot make up for the destruction of the other. Sustainable Cost Accounting provides an estimate of costs to preserve each type of ecosystem without comparing them.

Another way of reporting on sustainability is Full Cost Accounting, which calculates the costs of externalities on the whole supply chain. Financial statements are presented in a traditional way but are accompanied by extra-financial reports presenting quantification of environmental impacts. Full Cost Accounting uses commensuration to obtain an aggregated total impact. For instance, GHG reporting is done by multiplying CO<sub>2</sub> equivalent emissions by the price of carbon. Indeed, the effects of carbon on climate are uniform across the globe, and the capture of a ton of CO<sub>2</sub> effectively offsets the emission of a ton of CO<sub>2</sub>.

### 1.3. Measurement, quantification, commensuration, monetisation

Accounting relies on ideals of precisions and accuracy (Mennicken and Espeland, 2019). It is crucial to understand capitalism, including its methods of valuation and pricing. Organisations use aggregated indicators, that give a single picture of a situation, as we shown in the total impact in Full Cost Accounting. Societies have been undergoing a phenomenon of “economization”, which is the extension of economic rationality (*homo oeconomicus*) to areas that were previously out of the market. *“[O]ne can define economizing as the process through which individuals, activities, and organizations are constituted or framed as economic actors and entities”*.

Quantification is an essential building block of economization. *“Quantification makes individual and organizational performance visible, trackable and comparable, thereby allowing for organizing in accordance with principles of efficiency”*.

Previously nonmarket areas are not always put on the market for exchange but are pushed to adopt a competitive behaviour (cost optimization in hospitals, competition for rankings among universities...). The returns and gains must be visible and quantifiable from the perspective of



investors; hence we can extend the concept of profitability to environmental and social value. A few examples include considering employees as assets or human capital, calculating the net present value of ecosystem services... Quantification is also used in risk management, as it makes uncertainty calculable and manageable.

We often hear of measurement, quantification, or monetisation, but these terms are not synonyms. Measurement is *“inspired by the traditional epistemology of natural sciences, which implies that something exists under an already measurable form according to a realistic metrology, like the height of the Eiffel Tower”* (Desrosières, 2008). Measurement expresses a magnitude or quantity with an instrument marked in standard units: height in meters, weight in kilos, ...

Quantification is creating a number that depends on conventions and does not arise naturally. *“The verb to quantify, in its active form (to make a number), supposes that a series of prior equivalence conventions be worked out and explained, involving comparisons, inscriptions, coding, codified and replicable procedures, and calculations leading to numbering. Measurement comes next, as the regulated implementation of conventions”* (Chiapello and Gilbert, 2013).

Commensuration (Espeland and Stevens, 1998) is the process that leads to comparing the qualities of different items based on a common metric like a price or a score. Commensuration requires to select certain characteristics of an item or a concept, while others are left out. These characteristics are placed on a common scale and given a relative value and weight to enter a common metric. While counting adds things that are alike, commensuration creates relations among qualities and things that seem fundamentally different. It allows to hierarchise and choose between contradictory elements, making it a useful tool for decision-making and performance evaluation. *“Commensuration transforms qualities into quantities, difference into magnitude. It is a way to reduce and simplify disparate information into numbers that can be easily compared. This transformation allows people to grasp, represent, and compare differences”*. Examples of commensuration include calculations of utility, pricing, cost-benefit analyses, rankings, censuses. It provides a standardised proxy, in the form of a single number that is easier to apprehend for decision-making.

Finally, monetisation is the fact of expressing a quantity in monetary units, in the form of a price or a cost associated with that quantity. Putting a price on a good or service is a common example of monetisation.

The “scientificisation” of economics that occurred in the XX<sup>th</sup> century relies on quantification and mathematisation (Chiapello and Desrosières, 2006). Quantification is the use of empirical observation to produce statistics and aggregates. A census is an exercise of quantification as it observes individuals to categorise them and make statistics. Mathematisation is the fact of creating theoretical models and functions that use inputs (numbers) to calculate a result in a fixed way. Financial formulas like the return on capital employed or weighted average cost of capital are examples of mathematical formulas used by companies. Economics and accounting can combine both, by using empirical observation to forge a general mathematical model that represents a phenomenon or reality. It may also use quantification alone, without generalising the findings into mathematical models, or use neither and remain at a qualitative and literary approach.

#### 1.4. [The relationship between commensuration and value](#)

The results of quantification depend on the posture adopted to build it (Chiapello and Desrosières, 2006). Two conflicting views can be identified. The first is *“data as tool of proof and measurement of reality”*. Data results from the concrete reality that is observed on the field, it is a translation in numbers of a pre-existing fact. It can be used to negotiate, build classifications, encode, sort, format. Alternatively, it can be used to make aggregates of individual values (e.g., aggregate individuals in socio-professional categories). This posture requires a reflection on the



way that quantification is built. It is what happened from the 1940s to the 1960s when accounting norms were defined: *“the debate was about the construction of accounting convention, the meaning of the financial statements that it produces, and the nature of the relationship between the numbers reported and the underlying economic reality of the companies whose activity is depicted”*.

The second is *“data as a conventional tool for coordination or domination”*. In this case, the most important is the social and political aspect of data. Quantification is shaped by what actors want to show or tell, reality is produced by quantification and not the other way around. The focus is taken away from the measurement methods and put on the social effects of quantification. For instance, a company may index bonuses on share price to govern the behaviour of its managers. This vision gives up on the idea that accounting should be neutral and accepts that it is oriented to serve the company's interest.

Like quantification, commensuration can be biased and influenced by those who build it (Espeland and Stevens, 1998). The malleability and subjectivity of numbers can be partly predicted by four criteria that describe instances of commensuration.

First, the level of elaboration or sophistication indicates how many elements or calculations are needed to obtain a result. Higher technicality makes the results more complete, but it can make them opaquer and more manipulable by experts who become the only ones to understand them. Second, visibility or explicitness is the extent to which input information is made public, and the explicitness of the assumptions, as opposed to “commonsensical” decisions. The more well-established categories are, the more difficult it becomes to modify them and exert discretion. Visibility and explicitness ensure that commensuration is rigid and well-defined, with less opportunity to shape numbers. *“Strategic commensuration, our capacity to create numbers that reflect our will, is perhaps greatest when commensuration is less public and less accessible and when methods are new or not grounded in academic theory”*.

Third, institutionalisation describes how accepted an instance of commensuration is. *“Instances of commensuration [...] vary in how automatically commensuration gets done and in how natural the process seems to involve parties”*. The more widely accepted a form of commensuration becomes, the more objective and “real” it seems. The reality depicted becomes taken for granted, to the point that commensuration can create new interpretation frameworks. *“Commensuration can radically transform the world by creating new social categories and backing them with the weight of powerful institutions”*. For instance, the use of a discount rate in accounting is widely accepted and conveys the idea that the short-term weighs more than the long term in decisions. Fourth, the parties involved in producing commensuration may be experts, managers, workers, external stakeholders, or other individuals and organisations. The interests of these people and groups can shape the ideas and realities that are brought forward by commensuration.

Commensuration attributes a relative value to items and characteristics, by comparing them to each other (Espeland and Stevens, 1998). Anything can be compared with and traded off for something else of equivalent value, including something that has a completely different nature. Some elements remain out of commensuration and are considered incommensurable. It means they either cannot or should not be valued against other elements because they are incomparable. Incommensurability is often rejected as leaving space for chaos, risks, and human biases, since something that is incommensurable cannot be rationally chosen. However, anything that is unique is, by definition, incommensurable. Incommensurability can show the cultural and moral boundaries of society: what is incommensurable has an absolute value, is unique, and cannot be traded. For instance, a land might be linked to core values, cultures, and identities, and thus cannot be exchanged. Anything that enters commensuration is at risk of losing some of its value and becoming a substitutable commodity. As a result, different groups can have different claims about what should remain incommensurable in the name of their values or identity.

On the other hand, leaving something out of commensuration is running the risk of making it increasingly distant and unreal. As a form of commensuration becomes taken for granted, anything that is excluded from it gradually loses visibility and importance. For instance, for a

company using monetary indicators to measure its performance, anything that is not expressed in monetary terms risks losing importance or being disregarded.

### 1.5. [The virtues of numbers](#)

As we have seen, measurement and quantification are usually opposed to a qualitative understanding of the world, as things that are left out of quantification may be associated to individuality and subjectivity. By gathering a large quantity of data and producing aggregated indicators, quantification condensates information and tries to objectivise it.

Commensuration is adopted because it is assumed to be a prerequisite for rationality and a truthful way of representing reality (Espeland and Stevens, 1998). By comparing different aspects of a topic in a quantitative way, commensuration is seen as an objective and rational approach to decisions. It builds on the idea that disparate qualities can be expressed in a unified and standardised way, which enable transactions and trade-offs between them.

Commensuration can limit discretion, justify decisions, impose control, or secure legitimacy. The use of well-defined and justified indicators leads to a more rational result than individual subjectivity.

Commensuration is a disciplined method that uses objective and verifiable measurement to justify decisions. With numbers, anyone, including outsiders, can prove an issue like discrimination and challenge the status quo. The authority of commensuration is mechanical and technical and does not require a powerful leader. It can even challenge the authority in place and restrict the prevalence of leaders. Since commensuration is more rigid and harder to control than discretionary power, it is a way of democratising decision power.

By democratising decisions, measurement and quantification put forward the relationship between an organisation and its stakeholders (Mennicken and Espeland, 2019). The “voice” of external actors can be included in indicator design, by using their knowledge and expertise. A plurality of opinions can be included in the debate around quantification, to challenge the indicators and their construction. This discussion around indicators can be a basis for debate around the topic being measured. Numbers have a double role *“in representing and criticising reality”*. Statistics and quantifications can be used to describe the state of things, but also as a tool for activism, decision-making, and challenging the current state of things. *“[M]otives for quantification vary, but often they amount to some means for regressing uncertainties, exerting control, overcoming distrust, or improving communication and coordination among entities”*.

### 1.6. [The limits of numbers - Quantification is not neutral](#)

All measurement and quantification rely on pre-established definitions, categories, and conventions (Mennicken and Espeland, 2019). Achieving quantification implies that we agree on what needs to be measured, as well as relevant classifications and indicators to measure it. Categories like revenues, expenses, assets, and liabilities do not arise naturally and need to be defined, so that accounting items can be categorised.

Because numbers have an important role in shaping reality, the concern for their accuracy should not be taken lightly. Quantitative indicators *“can lead to oversimplification and homogenization if not grounded in qualitative, locally informed systems of knowledge production”*. *“Aggregate numbers are often arbitrary, uncertain and error-ridden. At the same time, these uncertain, composite numbers take on a misleading air of accuracy and play a key role in allocating scarce resources”*. It is crucial to understand how accounting indicators are calculated, and what their consequences are. If numbers are not properly explained, we are left in the dark about what has been included, voluntarily excluded, or overlooked in their construction. Because of the risk of

creating a black box that leaves space for errors, proper quantification is resource intensive. “[T]o count or calculate accurately on a big scale often is resource intensive and requires training, discipline and standardization, especially in classification”. Because of the cost of those resources, models tend to exclude items for which data is not readily available, even if those items are important to the topic at hand.

The rationality and objectivity associated with commensuration can be misleading (Espeland and Stevens, 1998). Commensuration relies on several assumptions and on the choice of a model to combine and aggregate attributes into a single indicator. Value is expressed in relative terms. “Value emerges from comparisons that are framed in terms of how much of one thing is needed to compensate for something else”. Commensuration does not directly picture reality; it provides an interpretation of reality by combining items in a certain way. “[I]n abstracting and reducing information, the link between what is represented and the empirical world is obscured and uncertainty is absorbed”. The assumptions leading to commensuration should be explicit, and we should keep in mind that “[c]ommensuration is no mere technical process but a fundamental feature of social life”. Numbers are malleable and can be used to show only what one wants to show. “Commensuration changes the terms of what can be talked about, how we value, and how we treat what we value”.

Measurement, quantification, and commensuration rely on a classification of things and people, which means they promote reflection on the similarities and differences that form categories, but also on what cannot be categorised within a given framework (Chiapello and Gilbert, 2013). Because classification is not natural nor spontaneous, these methods have a concern for cognitive representation. They select, more or less explicitly, which ideas or underlying political and social philosophies matter behind a phenomenon. It entails a concern for political representation, which is the choice of the spokespeople and stakeholders who take part in building the classification and quantification. In the end, the choice of a method over another is arbitrary. It results from social conventions and from the ideas and convictions of the people creating it. This choice matters because the classification criteria influence the judgements of their users. It can lead to a phenomenon of “self-fulfilling prophecy”, where human or financial resources are allocated to the more highly regarded categories, hence reinforcing their importance. The tools used have consequences on the treatment of people and things and can create new social hierarchies and exclusions. Hence, quantification is not neutral but rather performative, as it has direct consequences on actions and on shaping the reality that it describes.

Another risk of quantifying externalities is commodification (Gómez-Baggethun and Ruiz-Pérez, 2011). “The concept of commodification refers to the expansion of market trade to previously non-market areas”. The authors date the concept of ecosystem services to the 1990s, when the failure of the traditional conservation policies led to a reflection on new ways of framing ecosystem functions. “[T]he ecosystem services approach is proposed as a strategy for moving away from the logic of ‘conservation versus development’ towards a logic of ‘conservation for development’”. “The ecosystem services approach portrays ecosystems as natural capital stocks that provide diverse goods and services for human societies”. Some ecosystem services like timber or raw materials are already commodities, but others had so far been excluded from the market, like clean air, climate regulation, recreation, or cultural heritage. Commodification is a four-stage process. First, economic framing of ecosystem functions is the fact of distinguishing separate services in natural ecosystems. Instead of being seen as a whole with no defined boundaries, ecosystem services are split, and units are defined. The second step is monetisation, to express the value of ecosystem services in a monetary form. Third is the appropriation of ecosystem services, which is the formalisation of property rights on ecosystem services or the lands producing them. This step often implies privatisation of what was previously public goods. Finally, commercialisation of ecosystem services corresponds to the creation of institutionalised structures to sell and exchange ecosystem services. It is the case of Markets for Ecosystem Services, of which the European Emission Trading Scheme (ETS) for carbon is a good example.

These steps are distinct, and ultimately society decides on what is commodified or not. Economic framing does not imply monetisation. *“Goods and services refer to any object or act with the capacity to fulfil human needs or wants”*. Since ecosystem services serve human needs, they can be defined as goods and services, but it does not mean they are attributed a monetary value. Monetisation itself may not lead to commoditisation, as something that has a monetary value may not be sold or exchanged on a market. However, from a realistic point of view, monetisation often leads to commoditisation in the current institutional and economic context. It is unclear whether it is the tool of monetisation or rather the ideological, economic, and institutional context that leads to commodification of ecosystems.

While it is unclear whether commodification is an efficient tool for environmental conservation, it does raise a few concerns. First, there is an ethical concern about things that can morally be sold or exchanged. For instance, the abolition of slavery is a case of decommodification for ethical reasons. Another concern is that expressing value in monetary terms may obscure the complexity in the value of ecosystems. Indeed, ecosystems may have symbolic value, and their diversity itself is valuable, suggesting that the total can be worth more than the sum of the parts. In addition, ecosystems work through interrelations and interdependencies, so separating them into distinct services may not make sense and neglects the importance of interrelations. Finally, the attribution of property rights poses a risk that only those with purchasing power will be able to have access to ecosystem services, which may exacerbate social inequalities.

### 1.7. [An example of externality valuation](#)

Outside of the corporate world, environmental damages are valued in the context of litigations, to determine compensation of the affected parties (Fourcade, 2011). The advancement and outcome of trials reflect the assumptions and processes leading to valuing environmental impacts. The author compares the trials for two oil tanker spills: the Amoco Cadiz in Britain in 1978, and the Exxon Valdez in Alaska in 1989. The outcomes of the trials are a proxy for the way that the environment is valued in France compared to the United States. The processes leading to the selection of a methodology and the application of economic valuation to the environment are different. The Exxon Valdez trial gave rise to much higher indemnifications than the Amoco Cadiz trial, that concluded around the same time: over \$3.5 billion for Exxon Valdez, against \$200 million for Amoco Cadiz.

France and the United States are culturally different when it comes to their vision of the environment. France is more averse to discussing and accepting monetisation than the US, due to its religious, historical, and political background. In addition, France views nature as a patrimony shaped by human activities like agriculture, forestry, or fishing, while the United States pursue and ideal of untouched wilderness, expressed through institutions like National Parks.

Another reason for the discrepancy in indemnification is the difference in the nature of the damage that were compensated. France compensated the direct economic losses for the fishing and tourism industries, as well as active use losses, which encompass recreational activities like fishing or going to the beach, and the “reputational loss” for towns and villages.

On the contrary, the damages in the Exxon Valdez case were mostly for non-use losses and punitive damages. Non-use losses are the losses incurred by all American people who do not live near the place of the accident, but who are willing to pay for the natural area and its biodiversity to be preserved. The Alaska Department of Law spent \$67 million on research to understand the extent of environmental damages. It includes a study led among American households, using a contingent valuation method where individuals expressed their willingness to pay for this environment to be preserved. Contingent valuation creates a demand curve for non-market goods, by evaluating the demand. The value of the environment becomes the aggregation of individual preferences. In this case, each household was willing to pay on average \$31 for restoration and preservation of the area, which amounts to a total of \$2.8 billion. Non-use losses can also be approached by estimating the clean-up costs to restore the area to its initial state.

Economic valuation aims at being a neutral and accurate representation of a phenomenon. However, economic valuation is performative rather than neutral, as it influences action to be taken. The nature of what was calculated was different in both trials. In the Amoco-Cadiz case, the environment was seen as the patrimony of towns, departments, and regions, while in the Exxon-Valdez case, it was seen as the abstract idea of nature belonging to the whole nation. The affected area in Alaska was sacralised in the form of a natural reserve, to preserve its subjective utility. This comparison proves that economic valuation incorporates all sorts of social assumptions and imageries about worth. All valuation has a philosophical, political, and social background. The definition of nature itself is highly dependent on the social context in which we are.

Departing from legal proceedings, we will focus on the way that companies value their environmental impact. As ESG reporting grows, it seems to undergo a process of “scientificisation”, as firms build models to quantify, commensurate, and monetise their environmental impacts with a concern for neutrality and objectivity. Literature tells us that quantification relies on pre-existing assumptions and social structures and is influenced by the goals of those building it and bears a part of subjectivity. By comparing things and relativising value, commensuration influences the reality it attempts to measure and has a performative dimension.

We will explore how private companies attempt to quantify, commensurate or monetise their environmental externalities; what methods they develop and what the advantages and drawbacks of these methods are; what assumptions they rely on and how these assumptions influence valuation. We will then wonder whether companies’ initiatives reveal the expected virtues and limitations of quantification; and what externality valuation reveals about firms’ goals, ambitions, strategies, and action plans.

## 2. Research methods

### 2.1. [Data sources](#)

I adopted a qualitative approach, by studying several cases of companies who have taken initiatives in measuring, quantifying, or monetising their environmental impacts. I have had ongoing contact with Veolia. It included four interviews with Veolia’s sustainable finance director and finance training director, and one with Veolia’s vice director of sustainability. In addition, we regularly exchanged documents, information, and feedback. Veolia is a French group specialised in water management, and waste and pollution treatment, that had €26 billion revenues in 2020. It is currently leading a task force to develop a methodology to capture positive and negative environmental externalities.

In addition, I met with Michelin and EY to obtain complementary points of view. Michelin presented its initiatives to quantify and monetise externalities across its business units. With EY, I discussed the implementation of frameworks to measure externalities, as well as the role of environmental audits.

For corporates with whom I did not have interviews, I used their published content, such as extra-financial reporting, methodology papers, webinars, and articles. Kering is one of the companies that releases the most information about their Environmental P&L (EP&L) and their work on externalities. I completed such information with publications from large consulting and auditing firms such as EY, PwC, and KPMG.

Finally, I used publications from independent institutions such as the United Nations, the World Economic Forum, the European Commission, the French Markets Authority (AMF) and WWF to obtain a complimentary point of view on externalities.

## 2.2. [Focus of the study](#)

Given the abundance of data available on environmental topics, I decided to restrict my field of study to companies and methodologies that go beyond what is requested by law. Following the 2014 EU NFRD, extra-financial reporting has been imposed by law in France since 2017 in the form of “annual declaration of extra-financial performance” (*déclaration annuelle de performance extra-financière*, DPEF). It must describe the main environmental, social and governance risks linked to the company’s activity; the policies to prevent, identify and reduce those risks; and the results of these policies in the form of KPIs. This reporting covers the scope of the legal entity’s own operations. Because of this requirement, all the large groups implanted in Europe publish an ESG report with metrics in physical amounts. Many reports use KPIs like tons of CO<sub>2</sub> emitted, cubic meters of water consumed, or, in the social field, percentage of women in management positions. While these indicators summarise ESG performance, they do not measure the external effects per se. Among others, they do not quantify the positive or negative contribution of the firm to the well-being of ecosystems and populations. They also tend to treat each topic separately and do not integrate ESG in the overall financial performance.

All the frameworks and initiatives selected here are those that seek to apprehend externalities specifically. As there are many complimentary or competing approaches, and as some companies only use them internally without publishing them, this selection is not exhaustive, but represents a variety of methodologies among the most prominent ones.

Some of the approaches reviewed are formalised methodologies with explicit guidelines, others are more general reflections, drafts, experiments, and pilot studies. Thus, not all of them have the same level of precision and maturity. Some frameworks are general, theoretical principles provided by consulting firms, to be adapted and appropriated by corporates. Others are concrete attempts that have been or are being implemented and are thus more targeted to a given sector and company setting.

## 2.3. [Method of analysis](#)

To compare the frameworks and initiatives, I selected several relevant dimensions.

First, I focused on the measurement level used by each framework. As explained by EY (2015), the first level, measurement, consists in expressing data in the physical units in which it was gathered. It is usually useful for regulators. For instance, the number of work incidents and accidents is of interest for work safety regulators, much more than any valuation of these incidents. The second level, valuation, consists in translating all measurements in common terms or units. An example would be a rating on a scale or the relative distance to a target. Valuation is often used internally to create dashboards or assess progress against a roadmap. The third and final level, monetisation, is a valuation in monetary terms, comparable to what is done in financial reporting. It is useful for quantitative needs, such as assessing the future returns of a project or communicating with investors. However, monetisation, if done improperly, may lead to overly prioritising financial capital over other capitals. It might also lead to the false idea that capitals are substitutable.

A second dimension to compare initiatives is the scale at which they apply. Some experiments are local and assess a site, or a store. Others are targeted at a particular product or production process but encompass all geographies. Finally, some frameworks are designed to be applied at a consolidated level, like financial accounting. The latter are usually used for group-level reporting on environmental externalities, and to communicate with stakeholders on the group’s commitments, strategy, and performance. Most of the methods studied here are group-level initiatives. Indeed, companies mainly communicate on group performance in their reporting,



while project-based or product-based indicators are more often confidential. In addition, some group-level methodologies also serve as targeted methodologies if indicators are calculated at a smaller scale before being consolidated.

Related to the question of the scale is that of the goals. Not all initiatives pursue the same goals, they are not directed towards the same stakeholders, and are not communicated in the same way.

Third, I examined the scope of measurement of each framework. In France, the law only requires measuring ESG performance at the legal entity level. However, the life cycle of products extends beyond the boundaries of the entity. The life cycle is the total of the stages in a product's existence, that usually includes raw materials extraction or production, transformation, manufacturing, transport, distribution, use by customers, and finally end-of-life. The term Life Cycle Assessment (LCA) designates the systematic and standardised analysis to quantify the potential environmental impacts of products along their life cycle. An analysis of environmental externalities may cover some or all the steps in the life cycle of products. In the case where the assessment goes beyond the direct impacts of the company, it implies that impacts from suppliers, clients, or final customers may be considered in the analysis.

In the light of the characteristics of each methodology, I analysed their advantages and limitations, and how they might help companies assess their environmental impacts. I discuss the criteria that encourage or limit the adoption of externality valuation, and the demands of shareholders and stakeholders regarding externality reporting. Finally, I discuss the contribution that these methodologies have in changing the view of the environment and preserving ecosystems. I particularly focus on the question of the objectivity of quantification, and its relation to the perception of the environment and of the value of natural capital.

Natural capital is composed of the soil, air quality, water quality and living organisms. It provides services to human societies and economies, such as drinking water, timber, agricultural resources, the ability to produce energy... Those different types of resources can either be seen as substitutable or non-substitutable, and the importance given to their conservation can vary depending on how sustainability is defined. Different methods of measurement can lead to different visions of what the natural capital is, and how much to preserve it.

## 3. Findings

### 3.1. Double materiality

Before diving into externality valuation, we will see which principles it relies on. Financial statements are built on materiality. An item is material if omitting, misstating, or obscuring it would affect the decisions of investors. Financial statements aim at giving a faithful representation of the rights, obligations, risks, and opportunities that financially affect the entity. In 2019, the European Commission introduced the concept of double materiality for sustainability reporting in its Guidelines on Non-Financial Reporting. Double materiality expresses the interdependency between economic activities and the environment. Like the deep green movement, it considers that financial and environmental matters should not be considered separately but rather as facets of the same reality. Double materiality encompasses two dimensions: financial materiality and impact materiality.

**Financial materiality** is defined by the European Financial Reporting Advisory Group (EFRAG) as: *“Identifying sustainability matters that are financially material for the reporting entity based on evidence that such matters are reasonably likely to affect its value beyond what is already recognised in financial reporting. The determination of financially material effects on the reporting entity can rely on non-monetary quantitative, monetary-quantitative, or qualitative data, while recognising the dynamic relationship between the two. Many impacts on people and the environment may be considered ‘pre-financial’ in the sense that they may become material for*



*financial reporting purposes over time (so-called 'dynamic materiality'). Financial materiality for sustainability reporting cannot be extrapolated from financial materiality for financial reporting".*

**Impact materiality** encompasses the environmental and social impacts of the organisation, including the natural and built environment, and human health and wellbeing. Impact materiality is defined by EFRAG as: *"Identifying sustainability matters that are material in terms of the impacts of the reporting entity's own operations and its value chain (impact materiality), based on:*

*(i) the severity (scale, scope and remediability) and, when appropriate, likelihood of actual and potential negative impacts on people and the environment*

*(ii) The scale, scope and likelihood of actual positive impacts on people and the environment connected with companies' operations and value chains.*

*(iii) The urgency derived from social or environmental public policy goals and planetary boundaries".*

Double materiality goes both ways: the material impacts of the company on the environment and the material impacts of environmental changes on the company. Contrary to financial materiality, double materiality takes the point of view of all stakeholder groups. It is forward-looking as it includes potential impacts that are not material yet but may become material over time. Thus, it keeps track of all types of impacts, even those that appear to be immaterial today.

Both types of materiality can be connected in integrated reports (financial and sustainability) or presented separately in the form of a sustainability report. The EFRAG stresses the risk of gaps, overlaps, or lack of coherence between financial and sustainability reporting when they are separate. This risk calls for connectivity between both reports. The EFRAG suggests using "anchor points" for sustainability reports. They may be monetary values used in sustainability reporting, directly drawn from financial accounting, or indirect links through disclosures. Conversely, financial reports should be connected to sustainability reports by considering ESG regulations and risks in financial estimates.

A double materiality assessment is a single assessment to identify items that are material to stakeholders, including investors and other groups. Like financial materiality, double materiality has a subjective dimension and there are no GAAP rules defining materiality thresholds. The EFRAG encourages companies to complete a five-step process.

First, they must list all the potentially material issues to avoid overlooking any factor. Information can be collected in regulations, best practices, peer reports or the media.

Second, they collect evidence to identify which items are material to their business. An impact may be material if: it is regulated by law; it is important given the current political and economic conditions on the market; the company identifies it has a significant positive or negative impact; stakeholders express interest in this impact for their decision-making.

Third, companies should engage with the stakeholders, the board, and the executives so they can help identify priorities, vulnerabilities, risks, and opportunities. Engaging with stakeholders helps reach an agreement on the materiality assessment and makes sure to hear all points of view. Fourth, a report is published on the process and its results. The company should be transparent about its sources of information and evidence, as well as on the dialogue with stakeholders. The sustainability report and the materiality decisions should be audited for greater robustness.

Fifth, they should monitor the evolution of material issues, to capture new topics that arise. It is important to look at signals that indicate that society may stop accepting some externalities and push organisations to internalise them, for instance through new regulations.

The well-defined process for double materiality assessment reflects the ideal of rationality and structure that underpins quantification and commensuration. A corporation that implements these five steps tries to ensure that it captures all important environmental items, without relying on its pre-existing judgement, to foster objectivity.

Environmental materiality assessments usually present three scopes of impact, called scope 1, 2, and 3. They were originally defined by the Greenhouse Gas Protocol, created in 1998 to account for GHG emissions. The Protocol, now used by 9 out of 10 Fortune 500 companies, guides corporates in accounting for and reporting on their GHG emissions, which improves transparency

and lets them identify opportunities for mitigation. The Protocol presents sector-specific corporate standards that allow companies to make a GHG inventory, product standards to assess GHG emissions on the life cycle of a product, and project standards to evaluate mitigation projects. GHG emissions are broken down into three scopes to facilitate the execution of the emissions inventory.

Scope 1 is direct emissions, that arise from the company's facilities and transportation. It can be the emissions of a factory for an industrial company, or those of a fleet for a carrier.

Scope 2 is indirect emissions linked to the production of the energy consumed by the company. The energy may be electricity but also heating, cooling, steam... Scope 2 emissions depend on the main sources of energy in the area (coal, nuclear, oil, renewables...).

Scope 3 is indirect emissions that arise in the value chain. It is a broader category that encompasses emissions by suppliers, distributors, clients, and service providers. In an industrial company, scope 3 emissions may be GHG emitted for raw materials, components, distribution, use and disposal or recycling of products. Scope 3 is the most challenging to measure because data is located outside of the company and the supply chain is usually complex with multiple stakeholders and flows involved.

While the scopes were originally formulated for GHG evaluation, they are now used to classify other types of externalities, like water consumption or biodiversity impact. This classification gives visibility to impacts located outside of the company, which may encourage mitigation actions all along the value chain.

Through these tools, companies acknowledge the interdependency between business and the environment, and they look beyond their own operations at the whole supply chain. They create a detailed inventory of material impacts as a first step towards quantification. The guidelines and standards provided by organisations like EFRAG or the GHG Protocol are an attempt to standardise and rationalise the quantification process. Beyond GHG, several companies and organisations have developed frameworks to quantify and commensurate their externalities on scopes 1, 2, and 3. While they do not all explicitly use the concept of double materiality or the three scopes, the goal is still to capture environmental impacts along the value chain.

## 3.2. [Group level methodologies](#)

Among the methodologies studied, a key distinction is the scale at which they apply: a whole group, a business unit, a site, a product... We will start with looking at frameworks that apply to a whole entity and are reported on at a consolidated level.

### 3.2.1. [Kering's Environmental P&L](#)

One of the most famous instances of quantification of environmental externalities is Kering's environmental P&L. Kering is a global luxury group making €17.6 billion in revenues in 2021, headquartered in France, that owns renowned Houses in the sectors of fashion, jewellery, leather goods, and more. The group has taken qualitative and quantitative sustainability commitments at a 2025 horizon. In this regard, it needed a tool to set targets, and the progress achieved against these targets. In 2011, Puma, one of the Houses of the Kering group, introduced an Environmental P&L (EP&L) as an experiment to better capture the environmental impacts of its value chain. The group formally committed to it in 2012. The methodology was developed at group scale and published in 2015, with the guidance of PwC. Since then, Kering keeps improving its EP&L, the latest additions being the impact of use and end of life of products, and the creation of an interactive online report. Given the evolutions in its calculation methods, Kering keeps calculating a pro-forma EP&L with the methodology from 2015 to track how much progress has really been made. Today, the methodology and the coefficients used in calculations, like the cost per ton of

CO<sub>2</sub>, are available in open source on Kering's website, to entice other companies to adopt the EP&L.

To gain more objectivity and consensus, Kering commits to include stakeholders in an ongoing dialogue and to take their input into account. The reporting has been made interactive and is published annually with the objective of being understandable and timely to all stakeholders.

The EP&L that is publicly available is consolidated at group level, but internally, Kering tracks environmental impact for each House, to determine action plans. The EP&L is used at a macro and strategic level, such as the sustainability committee of the board, to define strategic goals, estimate risks, and see how to integrate Science-Based Targets (an initiative to help companies align with the latest climate science and the Paris agreement). It has even been integrated in the variable compensation of top managers to align incentives. At the same time, it benefits Houses, by helping them track their progress against their targets, receive support from the group, and estimate the benefits of projects like switching from conventional to organic cotton. The EP&L is relevant at operational level, to make everyday decisions such as the materials to purchase for a new fashion collection, and the best country and supplier to purchase from. However, given the complexity of the process, data is only published annually, which does not allow for short-term guidance of the business.

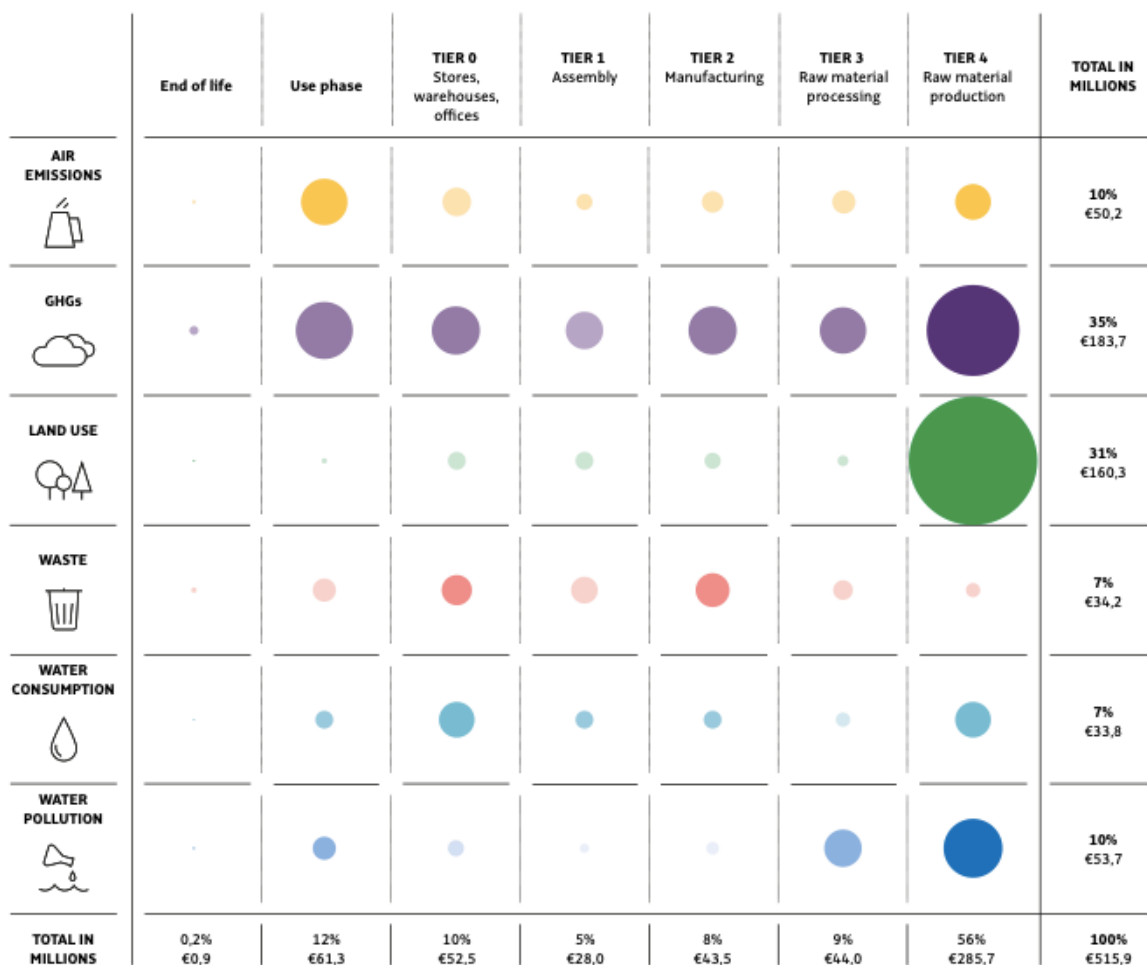
Making the EP&L required a lot of human resources. Initially, a full team was dedicated to developing it, supported by external consultants from PwC. The finance team was also involved, as the IT tools used by the EP&L are modelled after the financial reporting tools. Today, at group level, around fifteen people are dedicated to sustainability, and four work on the EP&L. In addition to that, each brand has sustainability team. It can vary from one or two people in the smallest brands to a large team in bigger Houses. They take care of following environmental indicators at brand level and of ensuring that measures are really implemented.

In financial statements, environmental impacts were valued at the financial cost they caused for the company, for instance the rehabilitation cost for an industrial site. The EP&L brings about a new approach, that considers the impact of natural capital degradation on human wellbeing, independently from the company's financial interests. The EP&L, as well as other methods of externality valuation, aims at calculating the final impact of resource use and pollutant emissions on humans. The measurement does not stop at the quantity of resources used or emissions generated. It considers how much impact they have on society and the planet. The approach to valuation is anthropocentric, which means that impacts are only valued so far as they provide services to humans or affect their wellbeing (increase or decrease in utility). The EP&L does not intend to calculate the absolute value of natural capital, including utility to all species. This approach would be more uncertain, as other species do not solicit value from ecosystems the way that humans do.

The EP&L can be summarised in four steps. First, Kering mapped its supply chain and defined the most important metrics to capture. The double materiality assessment is a relevant tool to select metrics. This step does not have to be repeated every year but must be led thoroughly before defining an EP&L. Second, Kering collects information internally and from its suppliers. Data regards the nature and quantity of materials used, the manufacturing processes, or the distribution channels. For standard data, external databases can be used to simplify the collection process. Third, data is consolidated to establish a complete mapping of the value chain. This mapping highlights the most material impacts for the company. Fourth, impacts are monetised depending on their impacts on human well-being.

Kering designed the EP&L with two main specificities in mind. First, a broad perimeter. The EP&L has four tiers, that correspond to all the steps in the life cycle of products. Tier 0 encompasses the operations that Kering directly owns in the legal sense, including warehouses, shops, and office space. It corresponds to the traditional environmental reporting, and data is easy to collect as it is internal. Tier 1 is direct suppliers (internal or external) who perform assembly, and tier 2 is

indirect suppliers who provide manufacturing. The impact is calculated by asking suppliers for their environmental performance indicators and weighting them by how much each business unit at Kering spends on each supplier. Data is collected from the most important or most representative suppliers and extrapolated to the smaller ones to reduce the time and financial cost of the study. Tier 3 is the transformation of raw materials, and tier 4 is the production of raw materials. These two tiers have little relationships with Kering, so data is harder to collect. For generic materials and processes, life cycle assessment databases are used. However, for materials and geographies that are specific to Kering, direct studies are led to estimate impact. In 2020, the group has added use phase and end of life on top of the four tiers previously defined. Kering is looking to make the scope of the EP&L as broad as possible to make sure it captures all impacts from its products. In addition, the EP&L aims at covering all types of impacts, by including air emissions, GHG, land use, waste, water consumption, and water pollution. For now, it measures negative externalities but aims at extending to positive externalities for a balanced representation.



1 - Kering's 2020 EP&L across the tiers split by impact area

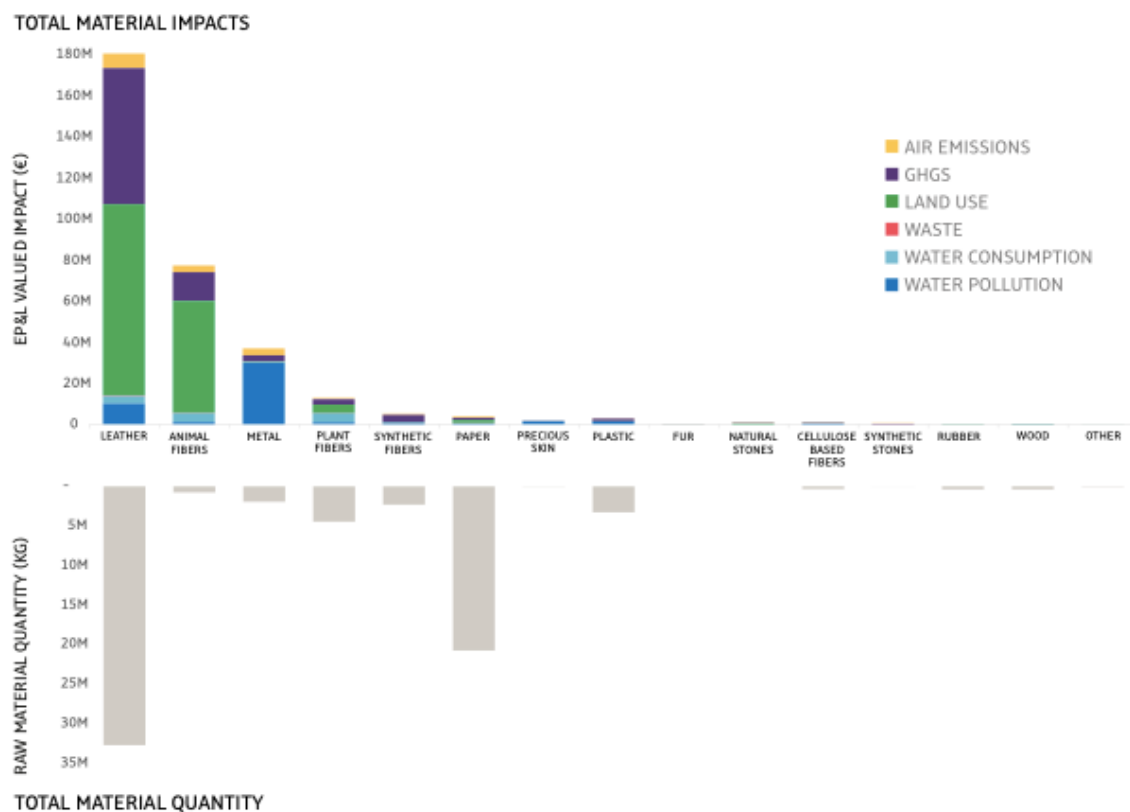
The second specificity is monetisation. Expressing all environmental impacts in the same unit allows to prioritise action, by making sure that all dimensions (GHG, air, water...) are considered in decisions. Transforming physical quantities in euros enables to compare environmental externalities to revenue and profit. Kering calculates an EP&L intensity, equal to total impact divided by sales. In 2017, Kering committed to a reduction of 40% of the EP&L intensity between 2015 and 2025. It has already achieved a 33% reduction from 2015 to 2020, with a total impact of €516 million in 2020, against revenues of €13,100 million. To obtain this result, Kering applies monetisation coefficients to its environmental data. The easiest example is the price per ton of

CO2, set at €86 by Kering, that is multiplied by the quantity of GHG emitted to obtain a monetary value of GHG emissions.

The data, as well as the monetisation coefficients, should be credible and robust. They should either be drawn from scientific literature or from a solid data collection process. All estimates and assumptions should be transparent and rationally explained. Data should be audited and updated regularly.

In the EP&L impacts are quantified in regards of regional factors to prioritise action. For instance, a tannery in Switzerland may consume a larger volume of water than a tannery in India. However, Switzerland has sufficient water supply to satisfy inhabitants and industries, and benefits from efficient treatment of wastewater, which India does not. If we factor in the risk of water scarcity and the health issues from polluted water, the Indian tannery has a higher negative impact and should be improved in priority.

As shown in the 2020 results of the EP&L, over half of externalities are in tier 4, to produce the raw materials used in luxury goods such as leather, plant and animal fibres, or metal. Kering set targets to improve its sourcing, especially on high impact materials like leather or metals. As shown in the results by materials, leather and animal fibres have by far the most impact.



2 - Kering's 2020 EP&L, by contribution of major groups of raw materials and quantity of consumption

### 3.2.2. Deep dive in the EP&L methodology

The method published by PwC (2015) is the same as that of other organisations and companies we will see later, including BASF and the Value Balancing Alliance. PwC's methodology relies on the monetisation methods commonly used in Life Cycle Assessments. The object of monetisation is to translate a physical quantity, such as m3 of water or changes in life expectancy, into a monetary value that expresses a price or a cost. To monetise environmental impact, three steps are necessary. The first step, as discussed above, is to collect data within the value chain to obtain

environmental metric data, such as tons of air pollutants released. From there, the second step is to determine the environmental impacts of the metric. For air pollutants, we want to estimate the corresponding degradation in health, biodiversity, and visibility (smog). The third and final step is to monetise these environmental impacts, which means finding a way of pricing those impacts.

### Valuation methods in life cycle assessment

Life Cycle Assessment methods are not specific to PwC. They are used across organisations to monetise market and non-market impacts and preferences. They estimate a reliable price or cost for all types of goods, services, and preferences, even those that are not subject to monetary transactions on a market. The techniques used are the following, from most reliable to least reliable:

For well-documented topics such as GHG, **meta-analysis** of existing literature is used. It is important to take a representative sample of papers, or a weighted average of results, as they may have divergent views and baseline assumptions.

The **market price** is used when impact translates into economic gains and losses on a market. If pollution reduces crop yield, we use the market price of crops to evaluate the damage. The **human capital method** designates the market price of labour. The local average annual wage is a proxy for the willingness to pay for a year at full wellbeing. Health is measured through the Quality Adjusted Life Years (QALY), that give a coefficient between 1 (full wellbeing) and 0 (death) to individuals. These indicators give the Value of Statistical Life (VSL) used by insurance and public powers to give a value to human life. A similar indicator is Disability Adjusted Life Years (DALY) that represent the sum of life years lost to disease, disability, and premature mortality at society level. These indicators estimate how much could be paid or invested to improve health and life expectancy, but do not pretend to measure the value of a human being.

Market prices have the advantage of reducing uncertainty as they are observed and not estimated. However, it can be argued that they reflect the balance between demand and offer rather than the actual value of an externality. It is particularly true in contexts where market prices are volatile. They can also create unjustified discrepancies among countries. In the case of the VSL, people in developed countries are willing to pay more to preserve their health than people in developing countries. This could lead to estimate human life as being worth more in some areas than others and calls for an adjustment of the estimates.

For non-market items, we use **revealed preferences**. We observe the price on another market, called surrogate market, as a proxy for a non-marketable good.

Within this category, **preventive and remedial costs** are the costs incurred to prevent or remediate damage. They correspond to money that has already been committed or spent, thus revealing how much companies or public authorities are willing to spend on a matter.

The **hedonic pricing method** consists in studying the housing prices in an area to measure the disamenity caused by the presence of an activity such as an industrial site or a landfill. The lower the housing market is in the area, the higher the disamenity, because housing prices reveal how much people are willing to pay to live in the area.

The **travel cost method** calculates how much people are willing to pay to travel to visit a site, which reflects its recreational or cultural value. This measurement is biased as the willingness to visit a site may be influenced by proximity or ease of access rather than by its inherent value.

In the absence of market prices, we use the **stated preferences** approach. A survey quantifies people's preferences, or the utility (benefits) they derive from something. In contingent valuation surveys, we estimate the willingness to pay or willingness to accept compensation in a hypothetical scenario. For instance: "would you accept an increase of x€ of your electricity bill if it meant 100% of your electricity came from renewable sources?"

In **conjoint analysis**, we identify the preferences of individuals for specific characteristics of an offer. We can ask whether respondents prefer a larger apartment near an industrial plant, or a

smaller apartment further away from it. In this case, we can estimate the relative importance of apartment surface and disamenity from the plant in respondents' decisions.

Finally, we can use the **abatement cost method**. Abatement costs are the estimated costs that should be engaged to reduce or remediate a damage. Unlike the remedial costs, they reflect what would be the total investment to completely avoid damage, but the money may not have been put on the table yet. Thus, the estimate relies on the current state of technology. The cost of such technologies is likely to have evolved by the time remediation starts. There is no guarantee that the abatement cost will ever correspond to an effective investment, as remediation is hypothetical.

For all those methods, the estimates may be global, regional, or local depending on the type of impact at stake. GHG are global as they spread and affect climate across the globe. On the contrary, some pollutants make very localised damage, like smog caused by air pollution. Local data is preferably obtained through studies in the affected areas. However, depending on the budget, timeline, and technical feasibility, it is not always feasible to obtain data for all localities. In this case, we use the **benefit transfer method**. It extrapolates the willingness to pay from one area to another by adjusting for the income and development differences. The transfer function may factor in the differences in population density, meteorological patterns, water scarcity, access to healthcare, and more. For instance, if a study in the US reveals that people are willing to pay \$1000 a year for the recreational value of a lake, it might be estimated that people in India would be willing to pay \$50 a year given the income differences.

If the impacts measured extend in the future, we may need a **discount rate** to obtain the net present value of impacts. The discount rate usually does not exceed 2-3% as it should not erase the long-term consequences. However, its use can be challenged if one adopts a vision of sustainability where the wellbeing of future generations matters as much as that of present generations. In that case, the discount rate would be zero since future periods are as important as present periods.

Method type	Method name	Method description	Example
Literature analysis	Meta-analysis	Average results from academic literature	Cost of CO2
Market observation	Market price	Observe price on the market	Loss in crop yields
Revealed preferences - Observation of a surrogate market	Preventive and remedial costs	Cost engaged to reduce damage	Investment done to de-pollute water
	Hedonic pricing method	Housing price in the area reveals disamenity	Housing prices around a landfill site
	Travel cost method	Willingness to pay to visit a site	Entry ticket to a National Park
Stated preferences - survey individuals	Conjoint analysis	Identify relative preference for characteristics of an offer	Importance of apartment size vs distance to a factory
	Abatement cost method	Theoretical cost to solve environmental damage	Total cost to de-pollute water
Benefit transfer		Estimate equivalents between areas	Equivalence between willingness to pay in the US and in India
Discount rate		Time value	Impacts in the future are worth less than current impacts

3 – Summary of Life Cycle Assessment methods



Usually, no single method is sufficient to cover all the impacts of an entity. Conjoint analysis is recommended in life cycle assessment as it can be applied to most impact categories and allows for a fine distinction between the value of different attributes.

PwC and Kering use these monetisation methods to express environmental impacts in the form of an EP&L. Impacts are translated into a single currency and differences among areas are accounted for by the benefit transfer method, which allows the EP&L to sum all impacts across categories and geographies. Life Cycle Assessment methods offer the advantage of valuing externalities that do not have a market price and depend on individual preferences. However, their estimates are uncertain, as surrogate markets and survey responses are not a perfect equivalent for what would happen on an actual market. The quantity and quality of data, the method employed, and the assumptions used for extrapolation can also influence results. Hence, Life Cycle Assessment provides useful approximations, but not mathematically exact results.

### Methodology by impact type

PwC published specific guidance for each category of impact included in the EP&L.

**Air pollution** affects human health, reduces yields in agriculture and forestry, causes phenomena like smog that reduce visibility, and causes acid rains that may damage natural and built environments. Air pollution is a local phenomenon, so we need contextual data to quantify its effects, notably the weather patterns in each area, such as wind and precipitations. We also need to know which other activities are present in the area to estimate the impact on them. The main variables identified were population density, presence and type of agriculture or forestry, and extent and nature of the built environment. If exact data is unavailable, we can use the type of location (urban centre, industrial area, agricultural land...) to make average estimates of the local conditions. To value the health effects of air pollution, we first map the change in pollutant concentration that results from the company's activities in an area. We then estimate the dose-response function, which indicates the relationship between the concentration of a pollutant and health damage. Finally, we estimate people's willingness to pay to avoid morbidity and mortality linked to those health damages. For the effects on agriculture, we calculate the change in pollutant concentration, the resulting decrease in agricultural yields, and the lost revenues for farmers based on the market price of crops.

**GHG** are known to cause climate change and climatic events including floods, melting of ice, droughts, or erosion. Those changes can reduce the yields of agriculture and forestry, cause the desertification of habitable or arable lands, affect biodiversity and ecosystem services, damage the built environment, and affect human health. GHG benefit from an extensive literature describing their environmental impacts and climate change scenarios. Thus, it is possible to rely on meta-analysis of existing papers to value GHG impacts. However, estimates differ from one paper to the other, so the selection of assumptions and data should be done carefully.

**Land use** and losses in biodiversity are apprehended through land conversion and exploitation. When a land is converted and occupied by an economic activity, the ecosystem services it can provide decrease. These services can be expressed as use value (food, fuel, climate regulation...) and non-use value (culture, leisure, and spiritual value). We only value the loss of ecosystem services in the current year, regardless of past occupations. The impacts are attributed to the entity that currently exploits the land, and not to the one that originally converted the land.

For lands that are newly converted in the current year, we consider the marginal impact of conversion on the scarcity of natural ecosystems. The first hectare of land converted has a lower impact, since ecosystems are not scarce yet, and value increases as more land is used.

Depending on the nature of the activity, it may be necessary to allocate the impact of land use to the different outputs provided. For a field used to raise cows, we want to separate the supply chain for milk, meat, and leather. Then, we further break down the overall impact of land use by ecosystem service. We allocate a value to the loss in food, raw materials, air purification, cultural and spiritual value, climate control, flood protection... depending on the geography and

population of the area. Thus, we need specific contextual data about the type of ecosystem, population, and socio-economic conditions in the area. We use a mix of valuation methods depending on which ecosystem services are material for the land in question.

The impact of **solid waste** depends on two main variables. The first one is the type of waste and whether the substances are hazardous or not. The second one is the mode of treatment of waste: incineration, landfill, recycling, or another specialised processing. We measure the amount of waste by composition and by disposal method. Again, contextual data like the type of ecosystem surrounding the site and population density are necessary to make reliable estimates of impact. From this data, we can calculate the value of the different types of damages caused by waste disposal.

Disamenity (odour, noise, landscape degradation) can be estimated by housing prices around a waste treatment site. The decrease in average prices gives the disamenity for the whole site. This total amount can then be divided by the quantity of waste treated by the site and multiplied by the number of inhabitants of the area.

The release of liquid components into the soil in landfills (leachate) can be estimated by combining the composition of waste, geology of the soil and the average precipitations in the area. The quantity of leachate found in the surrounding environment depends on the presence of a liner isolating the landfill from the ground. The most used valuation is the clean-up cost to remediate the leachates. Alternatively, we can value separately the consequences on human health, livestock, agriculture, fishery...

Air pollution mostly comes from the incineration of waste. The methodology is identical to that of air pollution seen above.

GHG are emitted by landfills and incineration. They are measured with the methodology seen above, and by deducting GHG capture and recovery from the total.

The impacts of recycling should be treated like the impacts of any other industrial activity, which means that all impacts should be accounted for throughout the value chain.

**Water consumption** is the amount of water that is either incorporated in a product, evaporated, or polluted to the point of being unusable. When water is scarce, consumption by corporates reduces availability of water for other users and increases its costs. We can consider that basic human needs must be covered as an ethical obligation and should not be given a monetary value. Beyond this basic need, we can evaluate other impacts of water stress.

Corporate water consumption reduces availability of water for agriculture, which reduces yields and leads to malnutrition. The effects of malnutrition are measured in Disability Adjusted Life Years (DALY). The value of a DALY is estimated by the willingness to pay to avoid morbidity and mortality. The impact on malnutrition is heavily influenced by the human development index and malnutrition rate that pre-exist in the area.

Water consumption can limit the quantity of water available for domestic use. The use of non-drinking water by households leads to the development of water-borne diseases. The impact of diseases is, again, measured by DALYs. The impact on health is also related to the level of development of the area, and to the effectiveness of the healthcare system.

The depletion of groundwater supplies requires populations to transport water over longer distances or to invest in desalination technologies, that are costlier than pumping of fresh water. The valuation of depletion is estimated by the marginal cost to produce and transport fresh water. In most countries, water is in part subsidised by governments, so the price paid by individuals is inferior to the total cost of producing water. If a corporate pays the same price as individuals, it benefits from government subsidies that could have funded other projects. The subsidy cost can be estimated by the amount of government subsidies on the water consumed by the company.

Finally, if water could have been used in a more productive or environmentally beneficial way, the use of water by a corporate generates an opportunity cost. We estimate the loss of social and environmental benefits between the most efficient way of consuming water and the way in which the corporate consumes water.

**Water pollution** encompasses different types of pollutants. Toxic pollutants affect human and animal health and decrease ecosystem services. Nutrient pollutants cause eutrophication, which is excessive algae growth, to the detriment of other fauna and flora. Finally, pathogens carry bacteria that cause diseases to humans and animals. We measure the concentration level of each pollutant. To assess impact, we need to know the quantity and type of pollutants, as well as the context of the area: receiving water body, water treatment systems, surrounding populations and ecosystems.

We use the dose response function to estimate health damage corresponding to the concentration in toxic and pathogen pollutants. We value health damage using DALYs. For a more accurate estimate, we need to know the time of persistence of the pollutant, and the actual intake of the pollutant by humans. Intake may happen through ingestion, inhalation, or consumption of fish that has been exposed to pollution.

Eutrophication affects fish stock, and recreational value of sites. The loss of recreational value can be estimated through property value, that reflects willingness to pay to avoid eutrophication.

Currently, the EP&L monetises negative externalities in the categories mentioned above. The total impact is the sum of the negative impacts of Kering on human well-being. Some categories may overlap, such as air pollution generated by solid waste. In this case, Kering chooses to put the impact in one category or the other to avoid double counting. Such a calculation should give exhaustive and mutually exclusive categories, that help identify trade-offs in a common currency. Monetisation and consolidation facilitate communication to external and internal stakeholders. However, EP&L calculations rely on multiple assumptions, estimates, and calculations, which makes it a highly sophisticated model. The abundance of mathematical models, approximations, and extrapolation enhance the risk for uncertainties and errors.

### 3.2.3. A similar approach: EY's Long-Term Value Framework

Other methods that resemble the EP&L have been published to monetise environmental externalities at group level. EY Long-Term Value Framework (2015) helps companies measure their shared value creation and their externalities. It can be used at different scopes, from company to project or product level, and should be helpful both for internal decision-making and external reporting. The framework can be used ex-post to evaluate the results of a policy or an investment, or ex-ante to make decisions and set targets.

EY introduces a distinction between shared value and externalities. Shared value is a cooperative value creation between a company and one of its stakeholders. A company may help one of its suppliers improve its energy efficiency. The value created is shared with the company through a decrease in the supplier's prices.

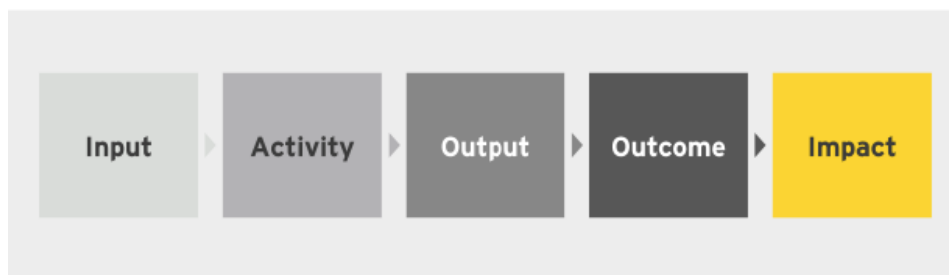
On the contrary, externalities affect the external environment and society with no counterpart for the value created or destroyed. According to TEEB report (*The Economics of Ecosystems and Biodiversity*, Pavan Sukhdev, 2007-2011), in 2009 externalities amounted to \$7.3 trillion, or 13% of the global economic output. EY prescribes a seven-step approach to determine the long-term value creation of the company.

A company should start with its objectives. It might want to evaluate a past policy, make strategic decisions, guide product development, negotiate client contracts... It should specify whether the evaluation is lagging or leading, and which stakeholders it addresses. This step gives a clear vision of the scope of the study and the key points to be addressed. EY recommends to "start small". A more limited scope will make the monetisation process easier and serve as a test run before expanding the methodology. It also makes it easier to ensure that all involved parties are aligned on the scope, boundaries, and objective of the study.

Then, the company determines the most material impacts associated with the project, policy, or business unit to assess, as well as the types of capital that are most impacted (human, natural...).

This step allows to specify the scope of the analysis and focus on priority topics without getting lost in detail.

As in the EP&L, the company should determine which activities in its value chain led to a given impact and map the impact pathways leading to it. An impact pathway is the succession of steps that explains a change in environmental conditions. A company may use raw materials (inputs) to manufacture products (activity), which results in generating waste (output). The output may have positive or negative, internal, or external outcomes. One internal, positive outcome is that part of the waste can be reused in other products, while one external, negative outcome is that the remaining waste goes to landfill and pollutes the soil. The impact is the portion of the outcome that can be attributed to the organisation. If the company participates in 10% of the volume of waste in a landfill, its impact is 10% of the pollution caused by the landfill. The impact is understood as a marginal effect, beyond what would have happened anyways, without intervention from the entity's activities.



4 – EY (2015): impact pathway

The mapping helps determine which indicators should be used for each type of impact, and to find the corresponding data sources. The company should reflect on what precisely needs to be measured, and how to measure it. Potential limitations of the chosen measurement method should be clarified.

Once indicators are defined, we need to collect data, make measurements, model the data, and analyse the findings. Like before, data can be collected directly, or derived from databases. Input/output models consist in calculating the share of the company in a supplier's output or customer's input and valuing it using industry averages and statistical models. The greater number of assumptions may reduce data reliability but allows to capture the whole value chain. For a product-specific study, a Life-Cycle Assessment can be run for more completeness, but it is a complex technique that is time- and labour-intensive. The conversion of data into monetary value is also done through monetisation coefficients, as in the EP&L.

The results from previous steps should be communicated internally and/or externally. As much as possible, they should be auditable and understandable by all relevant parties. In this last step, the company should look towards the future: What are some levers to reduce negative impacts or increase positive impacts? Are there any trade-offs in improving total value? It should design an action plan or a roadmap that builds on the results of the Total Value assessment.

EY's method resembles the EP&L in many ways: it is a group-wide methodology focused on external communication and internal decision-making. It monetises the material externalities across the value chain and consolidates them into a total value. EY does not give as much detail about the calculations performed, but the key difference seems to be the distinction established between shared value and externalities.

### 3.2.4. A competing view: KPMG's True Value framework

KPMG (2014) published a similar framework aimed at capturing the real value created by companies, by evaluating three types of impacts in addition to financial profit. Economic impact

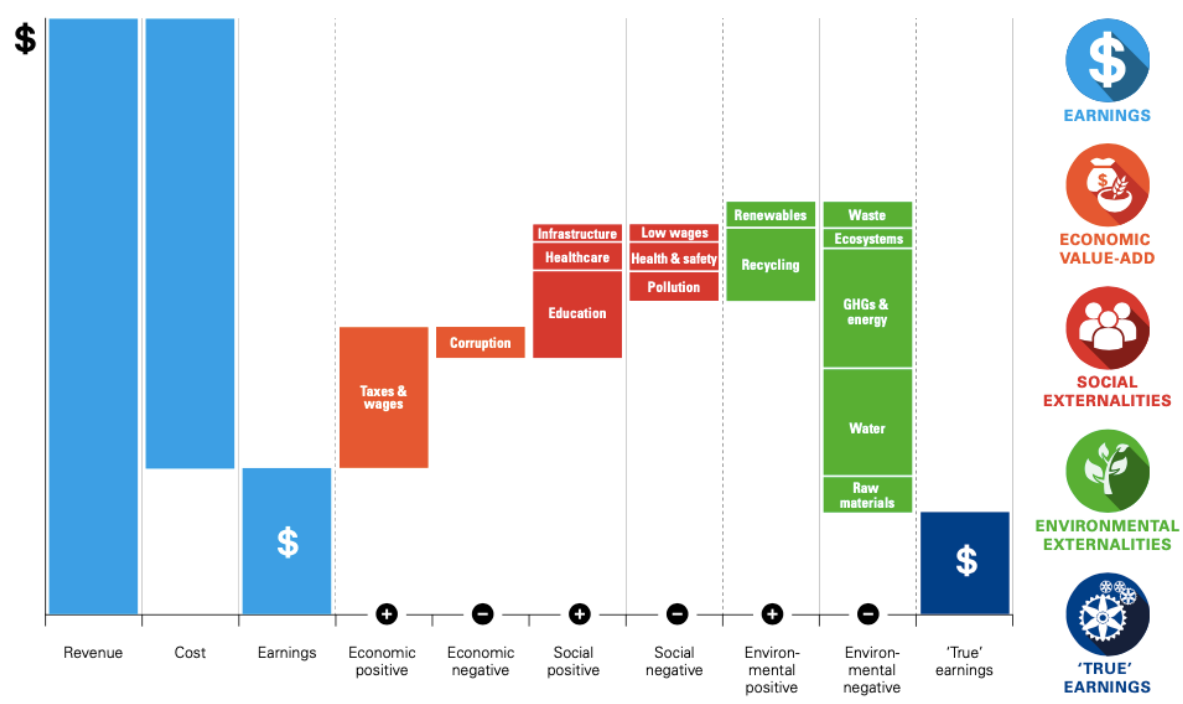
encompasses job creation, tax contribution, level of corruption or bribery. Social impact includes health, education, community development or data privacy. Finally, environmental impact includes renewable energies, recycling practices, land use and rehabilitation, GHG emissions, pollution, and water use. This categorisation aims at encompassing all material externalities on society and the planet. However, it does not follow the usual subdivision into environmental, social and governance.

Companies must first identify the value that they create or destroy through their externalities and express it in financial terms. On this point, KPMG’s methodology remains quite generic. Companies should be the ones choosing their key indicators and valuation methods depending on their sector and needs. Unlike PwC, KPMG does not give details on the calculation and monetisation methods for the true value bridge. While it adjusts to companies’ needs, this high level of freedom may lead to distorted results or some form of “greenwashing” if valuation formulas are chosen internally. KPMG does not specify the methods that should be used for data collection and modelling.

Companies can present the result of valuation as a “true value bridge”, that shows what the true earnings would be if externalities were internalised.

Let’s examine the true value bridge of a brewery in India. True earnings are 30% lower than financial earnings. The brewery generates positive impacts: economically, it pays wages and taxes that contribute to prosperity in the area; in the social field, it educates barley farmers, allowing them to improve their productivity, earnings, and quality of life; in the environmental field, it uses biomass as a source of electricity. However, the negative impacts exceed the positive ones. The brewery contributes to GHG emissions and uses large amounts of water to irrigate barley and to produce beer.

Figure 17 / ‘True’ earnings bridge for brewery in India



Source: KPMG (2014). *A New Vision of Value: Connecting corporate and societal value creation.*

### 5 – KPMG (2014): True Value Bridge of a brewery in India

The second step of the true value process is to assess the future risks and opportunities, and their probability. The framework assumes that three main forces will drive the internalisation of externalities in the future.

First, regulations will be strengthened, with new taxes, penalties, disclosure regulations or certification standards.

Second, stakeholder action will intensify through protests, strikes or class actions.

Third, market dynamics show that demand is shifting towards greener products and services, insurance costs are growing due to extreme weather... Hence, companies should assess the future benefits and costs from internalisation to obtain a dynamic vision of their true value creation.

The third and final step is to analyse the financial and societal value of future investments, by considering the cost of internalising externalities on top of the financial returns. Ideally, companies should strike a balance between financial viability, costs of internalisation, and impact on reducing negative externalities and increasing positive ones.

This medium to long-term vision requires a rigorous data analysis and a sensitivity analysis, with different scenarios for internalisation, depending on how strongly the internalisation forces apply. A relevant discount rate should be applied depending on the time frame chosen for the project.

From this analysis, companies should distinguish three different profiles of projects. The most favourable profile are projects that have a positive net present value, whether externalities are internalised or not, which indicates viability on the long run. Another possibility is projects that deliver a positive net present value (NPV) only when considering the positive effects on internalisation. These projects are riskier as they depend on assumptions about the future but direct the company towards more sustainability. Finally, some projects may have a negative NPV regardless of internalisation. This last category should probably be abandoned.

KPMG does not address the case of a positive NPV that becomes negative with the cost of internalisation of externalities. These projects are directed toward the short term, with a negative impact that would become costly in the medium to long term. They are likely to compete with projects that are less profitable financially but with more positive impacts, so companies may need to address this trade-off.

KPMG's framework has the advantage of looking into the medium to long term with a dynamic vision of externalities. It encompasses economic and social dimensions, in comparison to the EP&L that is only environmental.

Unlike Kering and EY, KPMG integrates ESG with financial indicators. Performance is still measured by returns or present value, adjusted for impacts. Hence, the True Value still prioritises financial returns. In addition, the bridge suggests that positive impacts in one area offset negative impact in another. It implies that financial, economic, social, and environmental capitals are substitutable, which is debatable.

In this framework, the value of externalities is the cost of their internalisation by the company, which is an abatement cost. Hence, results may differ from those of Full Cost Accounting suggested by EY and Kering. For example, in water consumption, Kering considered that an Indian tannery has more impact than a Swiss tannery because water infrastructure is poorer in India, causing higher damage to society. Conversely, KPMG may consider that the Swiss tannery has a higher impact on the company, because regulation is more stringent in Switzerland and forces internalisation of the impact on water use and pollution. These results are not contradictory, as the impact on society and the risk for the company are not always equal, but they denote different visions of externalities.

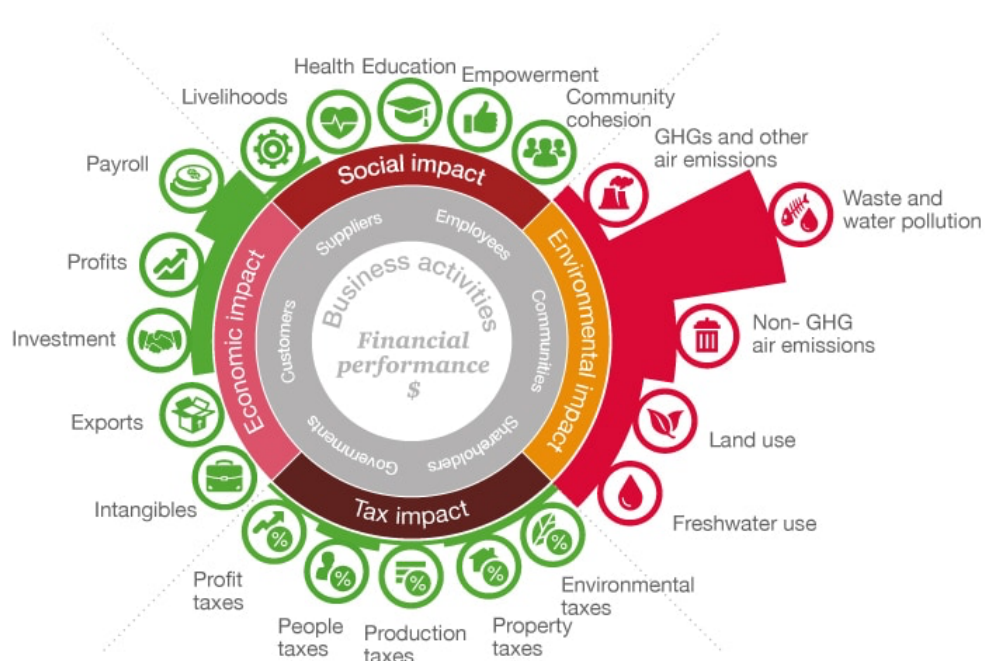
### 3.2.5. PwC's model: Total Impact Measurement and Management (TIMM)

PwC (2015) published another group-wide methodology to measure sustainability impacts, called Total Impact Measurement and Management (TIMM). It is used to assess the overall impact of a company or to decide between alternative projects.

The TIMM proposes to evaluate impact in four dimensions: social impact (health, education, community), environmental impact (air, land, water, resources), tax impact (contribution to the

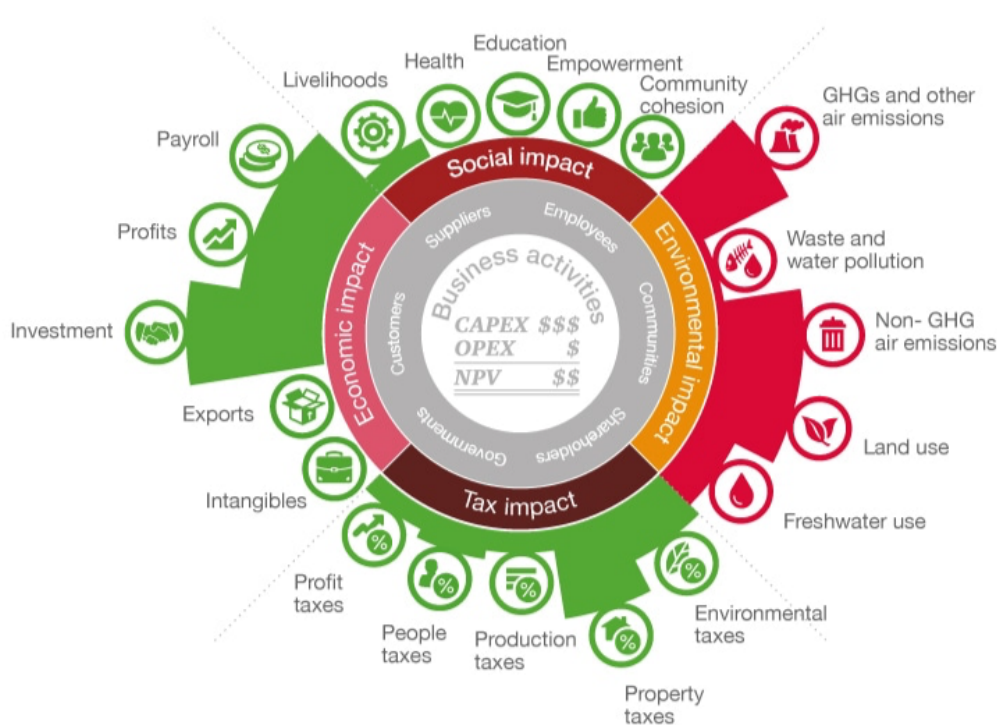


public finances by paying taxes) and economic impact (growth and employment in an area). Positive and negative impacts are monetised to identify trade-offs in a project or situation. The illustrative case study is that of a wastewater treatment company that discharges its affluent water in a coastal area. The assessment of the current business shows strong water pollution.



6 – PwC TIMM: initial situation of a wastewater treatment company

The first option considered is to expand the water treatment plant. The building cost is high but creates employment. Later, operating costs are lower and fewer jobs are required. The plant will efficiently reduce water pollution but will emit GHG. On the tax side, the company will pay taxes on the land occupied by the plant and on the construction. The project has the following impact:



7 – PwC TIMM: impact of expanding the wastewater treatment plant



The second option considered is to establish a mussel farm. Mussels consume algae and filter water, so they will decrease water pollution. They are a valuable source of protein in food, and their shells can be used in farming. The initial cost of installing a mussel farm is lower than the plant, and it occupies less land. The farm should create more jobs on the long-run, especially low-qualified jobs. This activity will be subject to ongoing taxes.



8 – PwC TIMM: impact of establishing a mussel farm for wastewater treatment

The options above show that the company should implement one of the projects to limit its negative environmental impacts. Financially, both options have the same, positive, net present value. From an impact standpoint, the mussel farm is more beneficial economically and socially, while limiting negative environmental impacts. The final recommendation will depend on the local context and the company’s strategy, but the TIMM helps us identify the broader impact on the environment and communities. The above example was calculated at the scale of a project, but a Total Impact chart can also be done for a whole company, in a consolidated way.

Like KPMG’s True Value, PwC’s TIMM considers social and economic impacts in addition to environmental externalities. It also uses a graphic overview to facilitate understanding by non-expert audiences. However, unlike KPMG, each impact is monetised separately, and positive areas do not offset negative ones. PwC, like Kering and EY, values the cost of externalities on society and not the internalisation cost for the company.

By using the net present value of impacts, TIMM accounts for the medium and long-term repercussions of decisions. However, the weight given to the long-term impacts highly depends on the discount rate selected.

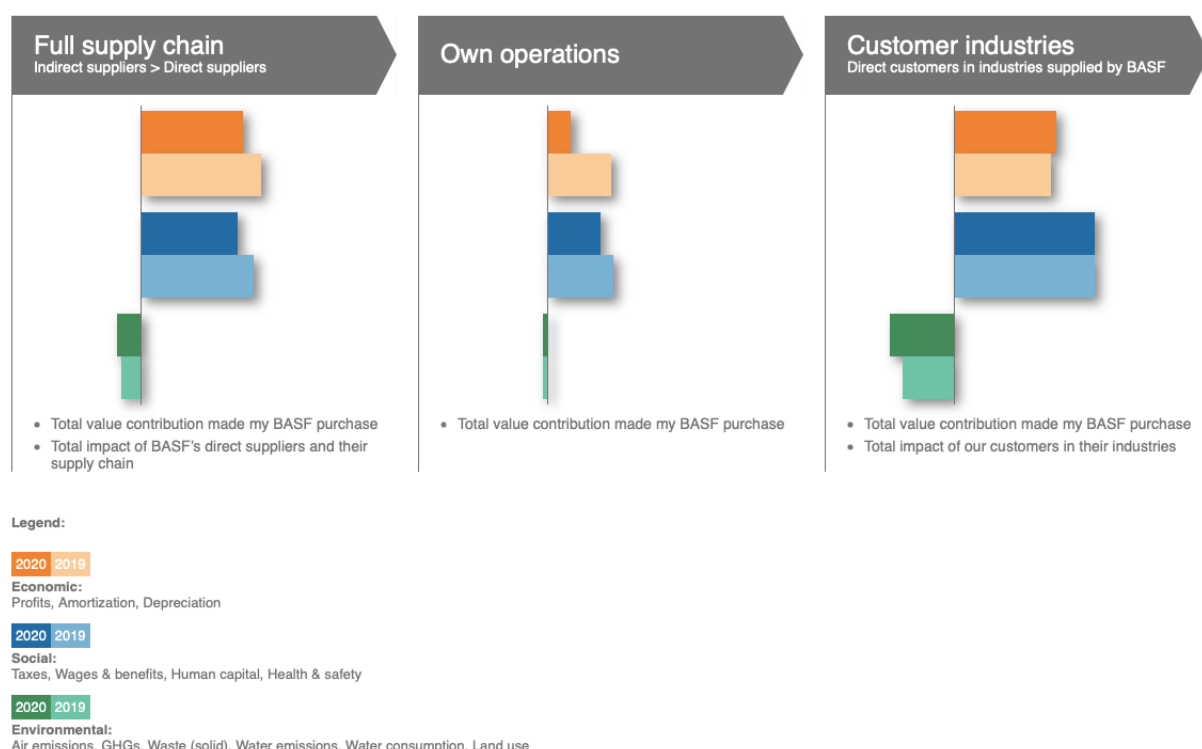
### 3.2.6. Application to a company: BASF Value-to-Society

BASF (2018) developed its own approach, called Value-to-Society. BASF is a German group specialised in chemistry, with €78.6 billion in revenues in 2021. Value-to-Society is built on PwC’s Total Impact Measurement and Management (TIMM) approach. BASF’s framework is meant to be adapted to all scales within the company: corporate, business unit, project, product. Its core principle is to accurately measure all material impacts (economic, social, and environmental),

positive or negative. It pursues the same goals as previous frameworks. The data is first collected in physical quantities. When possible, it uses publicly available information such as industry averages, to guarantee transparency and verifiability. The monetisation coefficients are those of PwC. They are local coefficients that are adapted to the geographical and economic situation of each area. Input/output models are also used when direct data is not available. If BASF buys 10% of Supplier 1's output, who itself buys 25% of Supplier 2's output, then BASF's impact will be  $10\% * (\text{Impact Supplier 1}) + 10\% * 25\% * (\text{Impact Supplier 2})$ .

The impacts measured by the Value-to-Society framework are broken down into three categories. Economic impacts include the impact on the EBITDA and profits of BASF. Social impacts encompass tax contributions, wages and benefits, health, safety, and human capital. Finally, environmental impacts regroup GHG emissions, air pollution, land use, water use, water pollution and solid waste.

Beyond the direct outputs for the company, such as an expense for salaries or taxes, BASF looks at the outcome and the impact that these have on people and the planet. For example, higher wages and taxes have a positive impact on the employees' and communities' quality of life. The focus of the framework is mostly human life and well-being, rather than ecosystems per se. When reviewing its Value-to-society report, BASF concluded that results are "directionally correct" and accurate enough for reporting, but also for internal monitoring and decision-making. However, the monetisation results were shown to be less robust than the financial reports due to volatility in market prices and exchange rates that can distort the results to some extent.



## 9 – BASF Value-to-Society: 2020 results

### 3.2.7. An attempt at harmonisation: the Value Balancing Alliance

The Value Balancing Alliance (VBA) was founded in 2019 by large companies across different industries, led notably by BASF and German multinationals. Today, it is supported by 20 large European groups including Kering and Michelin, but also by the Big 4. It is backed by international

organisations such as the OECD and the World Economic Forum, and by academic institutions like the University of Oxford and Harvard Business School. Its goal is to create a harmonised framework to monetise environmental and social externalities. The first draft methodology was published in 2021 and tested in a pilot study. As member companies implement the recommendations, the methodology will be refined in an iterative fashion to adapt to the reality of different sectors. Eventually, VBA hopes to co-construct standards that could be brought to the European Commission and turned into regulation.

VBA's core assumption is that the economy is embedded in society, which itself is embedded in the biosphere. There are dependencies between those spheres, that affect the long-term performance of the economy. As a result, VBA identifies two perspectives on value: value to society is the impact of the company on the environment and society; value to business is the impact of dependencies on the long-term financial performance of the company. This conception is that of double materiality: corporations and their environment are inter-connected and influence each other. For the moment, the VBA methodology is still developing, and only the value to society aspect has been covered.

The general methodology sets itself four objectives to be accomplished in corporations.

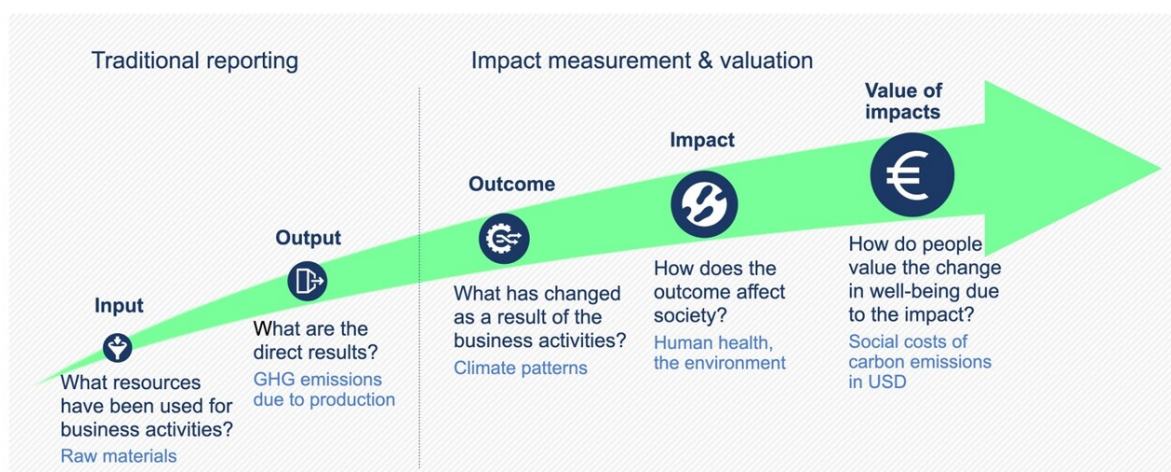
First, decision-relevance means that the results should help companies make better decisions. In that perspective, there is no offsetting of impacts in the VBA methodology. Having a positive impact on GHG, for instance, does not compensate for a negative impact on water pollution. A company cannot avoid making efforts in a certain area just because it does well in another. The use of monetisation and the notion of total impact provide a simple language that that decision-makers can use to quantify trade-offs between financial and extra-financial gains.

Second, achieving standardisation of topics, impact pathways, valuation approaches, data sources and modelling should ensure comparability across companies.

Third, connectivity means that the VBA approach aims at being compatible with existing frameworks like the GHG Protocol, TCFD, and more. It will not replace them, but provide harmonised and co-conceived solutions. As a result, the VBA methodology shares many common points with the EP&L or the methods proposed by EY and KPMG.

Fourth, feasibility and scalability are essential to make VBA a useful tool in corporations. To help companies in their experimentations, VBA experts provided guidance to apply the methodology.

Like EY and BASF, the VBA approach uses impact pathways.



10 – Value Balancing Alliance (2021): impact pathway

VBA focuses on 3 fields of impact: economic, human, and social, and environmental. Detailed methodologies are available for the last two categories.

<b>Economic</b>	Gross Value Added (GDP contribution): taxes, wages, profits, etc.
<b>Human and social</b>	Occupational health and safety
	Training
<b>Environmental</b>	GHG/climate change
	Air emissions
	Water consumption
	Water pollution
	Land use (biodiversity)
	Waste

11 – Value Balancing Alliance (2021): categories of impacts

Like all previous frameworks, VBA starts with quantifying impact drivers. Impact drivers are defined as a “measurable quantity of a natural resource that is used as an input to production (e.g., volume of sand and gravel used in construction) or a measurable non-product output of business activity (e.g., a kilogram of NOx emissions released into the atmosphere by a manufacturing facility). Environmental impact drivers are linked either to emissions to air, land, or water; or the use of land or water resources, and they are expressed in units which can be measured at the corporate level”. The company maps how these impact drivers cause changes in the natural environment and in human well-being, and finally monetises the impacts on human well-being. Sources of data may be more or less direct depending on feasibility.

Directly measured (primary) data	<ul style="list-style-type: none"> <li>Internal business data collected for the assessment</li> <li>Data collected from suppliers or customers for the assessment</li> </ul>	<p><b>More accurate / likely less complete or more effort</b></p> <p>↑</p> <p>To consider:</p> <ul style="list-style-type: none"> <li>Data availability</li> <li>Resolution</li> <li>Location of data</li> <li>Date of estimate</li> <li>Production technique</li> <li>Boundary /scope</li> </ul> <p>↓</p> <p><b>Less accurate / likely more complete or less effort</b></p>
Extrapolated from primary data	<ul style="list-style-type: none"> <li>Extrapolations</li> <li>Past assessments</li> </ul>	
LCA & Material flow analysis	<ul style="list-style-type: none"> <li>Estimates derived by modelling typical processes</li> <li>Range of sources and assumptions</li> </ul>	
Productivity modelling	<ul style="list-style-type: none"> <li>Estimates derived by using modelling techniques (e.g. productivity models)</li> </ul>	
Macroeconomic modelling (extended IO)	<ul style="list-style-type: none"> <li>Estimates derived by using macroeconomic modelling techniques (e.g. extended input-output models)</li> </ul>	
Industry data for sector impacts	<ul style="list-style-type: none"> <li>Published, peer-reviewed, and grey literature (e.g. life-cycle impact assessment databases; industry, government or internal reports)</li> </ul>	

Figure 3: Data sources for measurement

12 – Value Balancing Alliance (2021): Data sources

VBA draws attention to the different types of value that the environment holds. Use value corresponds to the goods, services and functions that are consumed directly or indirectly. It is relatively well accounted for in traditional reporting. The use value of a river can be approached

through the price of the water distributed, or the price for leisure activities like rafting. The non-use value is less obvious as it is not directly consumed in the economic sense. Ecosystems provide services like climate regulation, biodiversity, cultural enjoyment, and even value of preservation for future generations that are not exchanged on a market. Ideally, impact should be measured as the gains and losses to the total value of the environment, and not only its use value.

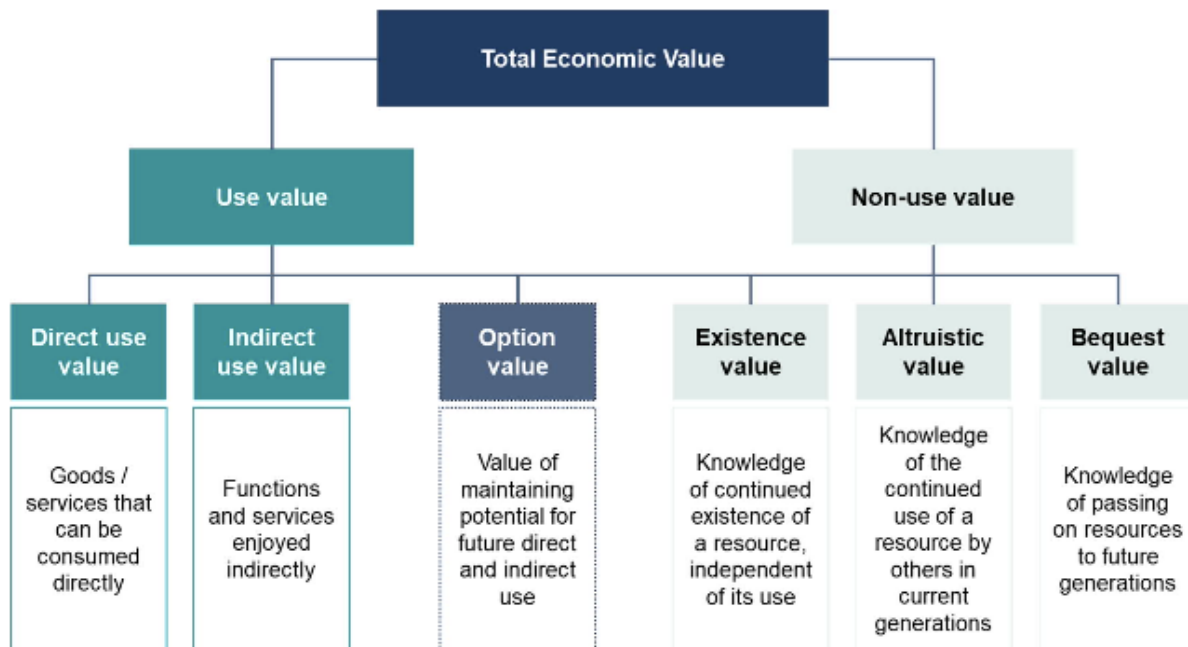


Figure 5: Total economic value framework<sup>12</sup>

13 – Value Balancing Alliance (2021): Total economic value framework

Like the EP&L/PwC framework, VBA specifies the impact pathways and calculation methods for the six categories of impact.

For GHG, the Social Cost of Carbon is used. It is a widely accepted way of valuing CO2 equivalents on international markets.

Air pollution impacts health, visibility, and agriculture, as stated in PwC’s framework.

For water consumption, VBA notes that if the basic human needs for water are not met, monetisation is irrelevant. Only once human livelihood is ensured can we calculate a marginal cost of water. The marginal cost depends on the water supply and sanitation infrastructures available in each area. Water consumption can reduce water availability for agriculture, thus increasing malnutrition, calculated in DALYs. It can increase water-borne disease, also calculated by DALYs. In addition, water scarcity affects ecosystem services, especially through the depletion of groundwater. For this last effect, VBA recommends using the marginal cost for the company to find an alternative water source that would make its consumption sustainable.

The water pollution guidance is aligned with that of PwC, with impacts on human health and ecosystem eutrophication.

Land use causes a decrease in ecosystem services. The gains and losses should be measured separately for each ecosystem type, as they cannot replace each other. The effect on human well-being is estimated by factoring in population density and reliance on ecosystems. Rural populations rely more heavily on ecosystem services than urban ones and are more affected by the loss of land. These estimates give us a marginal cost of converting and using land, that increases as scarcity of ecosystems increase.

The impacts of waste are the same as identify by PwC. A good approach to monetise them is the clean-up cost of landfill sites. The effect of recycling should be calculated as the difference



between the energy consumed in recycling processes and the savings in virgin materials from using recycled materials.

VBA suggests presenting the results in a graph format, as shown in this example:

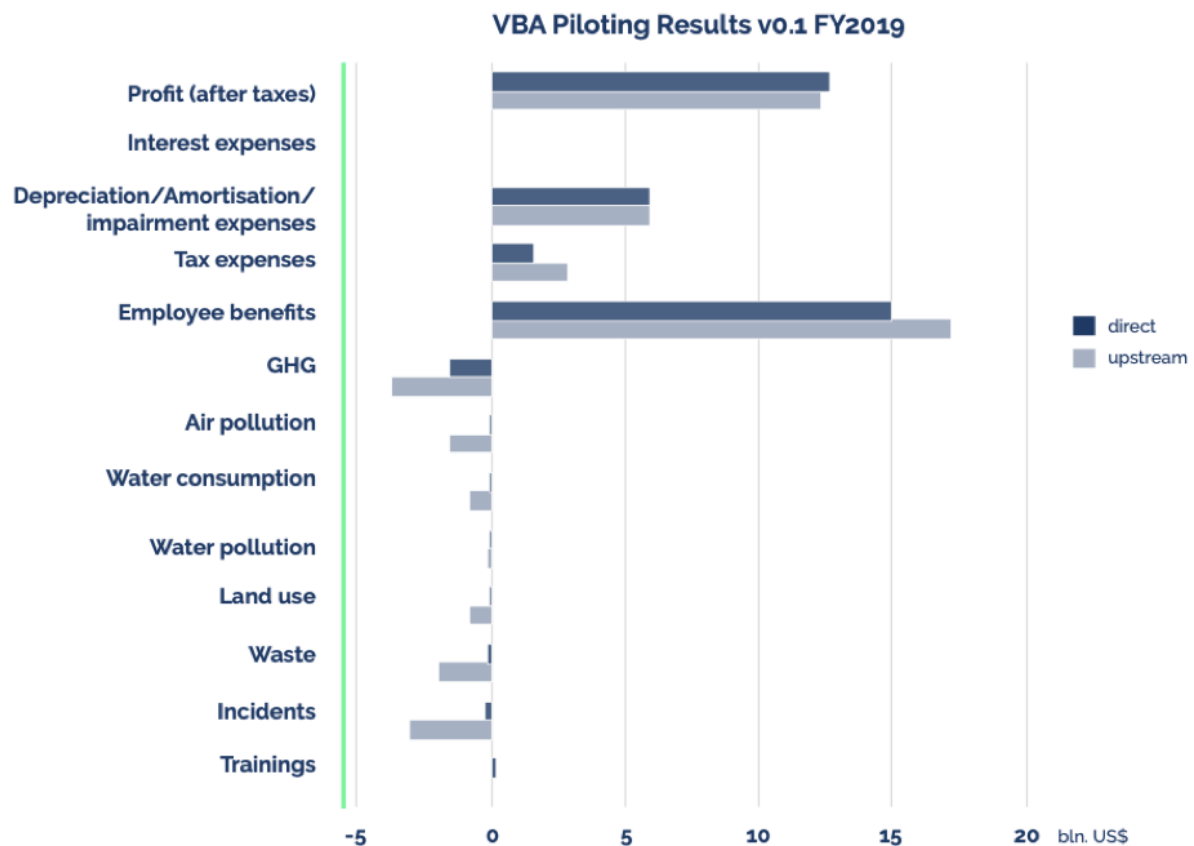


Figure 5: Calculated impacts of company A for fiscal year 2019 (own operations and upstream supply chain)

#### 14 – Value Balancing Alliance (2021): calculated impacts of a company

At the end of 2021, eleven companies had tested the feasibility, robustness, and relevance of the methodology. The participants had different levels of maturity: some were already valuing their impacts with other methods, others were newcomers. Companies tended to have more primary data available in the topics that were most material and relevant to them, which helped them calculate the impact of their own operations. However, VBA noted high levels of uncertainty on water pollution and land use. For the supply chain, primary data was often unavailable, so companies relied mostly on macroeconomic modelling.

The next step for participants is to apply the results from the VBA method to their decision-making to improve their environmental and social impact. They can establish alternative scenarios and potential trade-offs to improve their impact. However, participants must keep in mind that there is no offsetting across categories of impacts. As an example, switching from conventional livestock to sustainable farming would reduce GHG emissions but require larger use of land. Strategic choices need to be carefully made to account for these trade-offs.

Because of its cooperative nature, VBA can be seen as a synthesis of the previous methods. It uses Full Cost Accounting and monetisation to provide a consolidated environmental impact at group-level. It accounts for impact drivers and qualitative factors to estimate the short- and long-term

impacts of economic activities on human well-being. Like the EP&L, the VBA method is complex and requires multiple layers of estimates, extrapolations, and calculations.

VBA identified future developments it would like to explore to improve the methodology. It would like to add some use phase and end-of-life data to the indicators to obtain a complete life cycle, from cradle to grave. It also aims at further developing the social indicators, as they are limited for now (occupation health and safety, training). Finally, in the medium run, it wants to explore the value for business side of impacts, which is the way that the evolutions in society and the planet affect the profitability of businesses.


### 3.2.8. Michelin: adopting Value Balancing Alliance’s guidelines

Michelin is a French group that manufactures tires for a worldwide market, with revenues of €23.8 billion in 2021. The group has committed to an ESG strategic scorecard, that sets 2030 targets for people, planet, and profit. Michelin wants to reach carbon neutrality by 2050 and reduce its carbon emissions by 2030 by 50% on scope 1 and 2 (direct operations and purchased energy) and by 15% on scope 3 (suppliers). The group adheres to the Science-Based Targets initiative.

**4 DETAILED STRATEGIC SCORECARD: IN LINE WITH 2030 VISION**

	AMBITIONS	METRICS	2030 SUCCESS	RESULTS		
				2019	2020	2021
People	Be world-class in employee engagement	Engagement rate	>85%	80%	82% <sup>(1)</sup>	80%
	Be world-class in employee safety	TCIR <sup>(2)</sup>	<0.5	1.43	1.19	1.29
	Be a reference in diversities and inclusion of teams	IMDI <sup>(2)</sup>	80 pts over 100	-	62	67
	Be best-in-class in value created for customers	NPS <sup>(2)</sup> partners	+10 pts vs. 2020	38	40.5	38.9
Profit	Deliver substantial growth	Total sales (in €bn)	+5% CAGR 2023-2030	24,1	20,5	23,8
	Deliver continuous financial value creation	ROCE <sup>(2)</sup>	>10.5%	10.0%	6.0%	10.3%
	Maintain MICHELIN brand power	Brand vitality quotient	+5 pts vs. 2021	-	58	68
	Maintain best-in-class innovation pace in products and services	Brand vitality Index	>30%	30%	29%	31%
Planet	Reach carbon neutrality by 2050 (manuf. and energy)	CO <sub>2</sub> emissions scopes 1&2	(50%) vs. 2010	(24.8%) 2,919kt	(36.5%) 2,463kt	(29%) 2,764 kt
	Contribute to reaching carbon neutrality (usage)	Products energy efficiency (scope 3)	+10% vs. 2020	-	100	100.5
	Be best-in-class in environmental footprint of industrial sites	i-MEP <sup>(2)</sup>	-1/3 vs. 2019	100	-	92.6
	Reach full circularity of products by 2050	Sustainable Material Rate	40%	26%	28%	29%

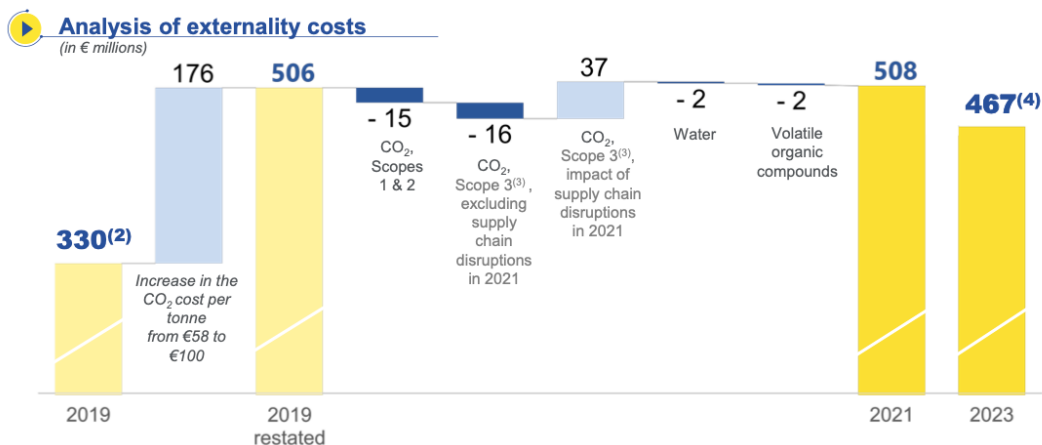
(1) Based on the 2021 scope of reporting, the 2020 rate was 82%, versus 83% as reported based on the 2020 scope.  
 (2) TCIR = Total Case Incident Rate; IMDI = Inclusion and Diversities Management Index; NPS = Net Promoter Score; ROCE = Return on Capital Employed; i-MEP = Industrial - Michelin Environmental Performance, see p.150 of the 2020 Universal Registration Document

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#### 15 – Michelin’s 2021 ESG strategic scorecard

To measure its environmental performance, Michelin publishes a valuation of its environmental externalities at consolidated level, with reduction targets.





(1) Volatile Organic Compounds

(2) Including €3m from adjustments in the method of calculating transportation-related CO<sub>2</sub> emissions

(3) Covers only the inbound and outbound transportation and distribution of natural rubber, semi-finished products and finished product

(4) Corresponds to the 2023 target of approximately €300m announced at the CMD on April 8, 2021, adjusted for the ton of CO<sub>2</sub> valued at €100/t and the change in method mentioned in (2)

### 16 – Michelin's 2021 valuation of externality costs

For internal guidance and site-level impact, Michelin has developed the Michelin Environmental Footprint indicator. It is an aggregated score that measures the evolution of the group's environmental impact against a 2005 baseline. This indicator is a weighted sum of energy use, water withdrawal, emissions of volatile organic compounds (release of chemicals from solvents), CO<sub>2</sub> emissions, waste generated, and waste landfilled. It provides a commensuration of impacts on Michelin's own operations. The Environmental Footprint indicator has decreased by 50% per ton between 2005 and 2020, and Michelin aims at reducing it by an additional 33% by 2030.

70 to 95% of the impact of tires is generated during use phase, as rolling resistance is responsible for fuel consumption, although it is necessary for safety. The second largest challenge is the sourcing of raw materials, particularly natural and synthetic rubber, and the treatment of these materials at end of life. In a perspective of increasing circularity, Michelin is exploring recycled materials, as well as increasing the lifetime and reparability of tires.

Michelin has a triple rationale for adopting a valuation of externalities.

First, it wants to increase transparency on ESG performance for stakeholders. Having a single, monetised indicator makes it easier to understand the overall performance than presenting each category in its own units.

Valuation of externalities is also a tool to track performance and set targets for business lines. A monetised indicator allows to calculate a single, enriched income that considers financial benefits and environmental externality costs. It should allow to strike a better balance between profit, people, and planet.

Finally, the assessment of externalities could be used in a M&A due diligence process. Michelin needs to evaluate the "trajectory convergence costs", which are the costs of aligning the target entity with the environmental goals of the group. The cost of externalities can be integrated to the pricing of the target.

In 2020, Michelin adopted a valuation of externalities relying on abatement costs, as suggested by the OECD. It measures the investments that would be necessary to eliminate emissions, consumptions, or withdrawal of resources. It includes investments like creating a closed circuit for water within a factory to limit water withdrawal. The cost of the investment is calculated as the cost of the asset amortised over twelve years, plus operational costs. It gives an abatement cost per m<sup>3</sup> of water. The reference values for abatement costs are derived from the tables of the University of Delft. Michelin takes higher value within the suggested range to avoid underestimations.

For carbon, Michelin observed the internal price of carbon of several companies, which gave a cost of €58 per ton in 2020 and €100 in 2021, aligned with the increase in European emissions trading market.

In 2021, Michelin started a partnership with Value Balancing Alliance to join the co-construction of a new model for externality valuation. VBA uses costs to society rather than abatement costs, which is a radical change of methodology, hence the results with VBA method have not been communicated yet. The targets and roadmap should not change, only the way of assessing performance and communicating it will change. The goal is to obtain more robustness in results and identify new levers to reduce negative externalities.

The new measurement of externalities should engage several teams and business lines within the group. Most impacts are under the responsibility of the operational head of manufacturing, and the operational head of supply chain. However, they cannot act on their own. Improving impacts means changing product design, which is the responsibility of research and development, and applying operational best practices, that are shared among teams.

Michelin will make each business line accountable for its own externality costs, so they have incentives to work together and make processes evolve. In 2022, each business line should receive a valuation of its externalities and understand the meaning and corresponding expectations behind that valuation. Each business line will then be responsible for finding the levers to reduce its externalities and starting to activate them.

As data is most often collected at factory or supplier level, most externality costs can directly be attributed to a business line. When data is only available at group level, costs will be attributed following a repartition key. The calculation methods will progressively be improved and adapted in an iterative fashion, to make them more precise.

In a further development, Michelin would like to have a valuation of impacts for each model of tires, by relying on the materials and suppliers used, the rolling resistance, and other characteristics of the model. The use of Life Cycle Assessment would allow to include use phase impacts of tires on 17 environmental criteria, including CO<sub>2</sub> from fuel consumption, of land use for roads and parking spots. Experimentations are being led with the research and development team to create a valuation of the entire life cycle, from cradle to grave.

By better accounting for externalities, Michelin is pursuing a goal of sustainable mobility, inspired by the “Sustainable Mobility for All” guidelines of the World Economic Forum. It defines sustainable mobility as being safe, accessible, efficient, and reliable, and respectful of the environment. For Michelin, it means improving its tires, but also extending the business model to services, such as route optimisation and tracking of pressure in tires. By 2030, 20 to 30% of revenues should be on non-tire products and services.

### 3.2.9. What do these approaches have in common?

We have seen several group-level methodologies, that report environmental externalities on a consolidated level to communicate them to internal and external stakeholders. They all use commensuration and monetisation to aggregate different types of inputs, outputs, and impacts in a single currency, which enables the calculation of a total impact. To achieve that goal, they all trace impact pathways that determine the relationship between the company’s activities, their impact on the environment, and their repercussions on human health and well-being. Monetisation coefficients are used to convert physical quantities into monetary units and achieve commensuration.

All methods except KPMG’s True Value are Full Cost Accounting, as they measure the cost of externalities for society, and not the cost of internalising for the company. They monetise the change in human well-being rather than a potential future investment. This value is anthropocentric, as it does not consider the value of ecosystem resources all other species, but only for human livelihood.

These methods give a holistic view of externalities, by considering GHG, air, water, land, and waste. They are used to rationalise decisions, as monetisation is justified by mathematical formulas and supported by independent research. The increased transparency in databases and calculations, the implication of experts, and the use of research signal a scientific and rational approach.

Commensuration, combined with a concern for exhaustivity, create highly sophisticated methods that use multiple layers of data, estimates and coefficients to reach their results. While the assumptions and calculations are explicit, their complexity makes them more uncertain and more difficult to understand, particularly for outsiders and non-expert stakeholders.

To be more approachable, externality reports imitate financial accounting through consolidation and formats resembling financial statements. Impact figures can be determined at a small scale and be consolidated, or, like Michelin, be determined at group level and then broken down at a smaller level. It enables to make decisions at the scale of a product, project, or business unit.

### 3.2.10. Where do these approaches differ?

The frameworks presented above have a major disagreement on one point: the substitutability of capitals. In KPMG's approach, the bridge makes it clear that a positive impact pushes up the true value, which can offset a negative impact in another area. On the other hand, the presentation suggested by the Value Balancing Alliance shows each category of impact on a different scale. While it still enables to visualise trade-offs, it is impossible to hide damage to a certain resource behind benefits to another type of resource. Approaches that assume substitutability do not give an answer to the issue of critical natural capital, that cannot be reconstituted nor replaced by other types of capital, such as endangered ecosystems. Commensuration consists in giving a relative value to heterogeneous items to facilitate trade-offs and decision-making, and none of the methods explain how to treat critical resources. However, a separate presentation for each type of capital affirms the uniqueness of each type of resources and encourages a reflection on impact mitigation per category.

Another difference is the target audience of the externality reports. Kering's EP&L is published yearly, available on the website, and promoted in conferences, webinars, and articles. It shows a concern for reaching outsiders, such as investors, clients, customers, or public authorities. The interactive and graphic format is easily readable and destined to non-expert audiences. Hence, the EP&L is a communication tool. On the other hand, while Michelin also communicates on its externalities, an important part of the information is kept private. In the future, externalities will be reported on at group level, and potentially on the main reporting segments to harmonise it with financial reporting. However, the assessment of business lines and products is destined to internal guidance. It is designed as a tool for operational managers to work on their environmental impact, and for research and development to improve product design. It is likely that these numbers will be more technical and presented in an operational way.

Finally, these externality reports can be associated to different sustainability strategies on behalf of the companies. Monetisation is a tool to make externalities visible and understand their magnitude, but mitigation of impacts is achieved by an environmental strategy. Once impacts have been made visible and measurable, it is up to company to pick targets and action plans. Hence, the same reporting may not lead to the same strategy, course of actions, nor results depending on the company's subsequent decisions.

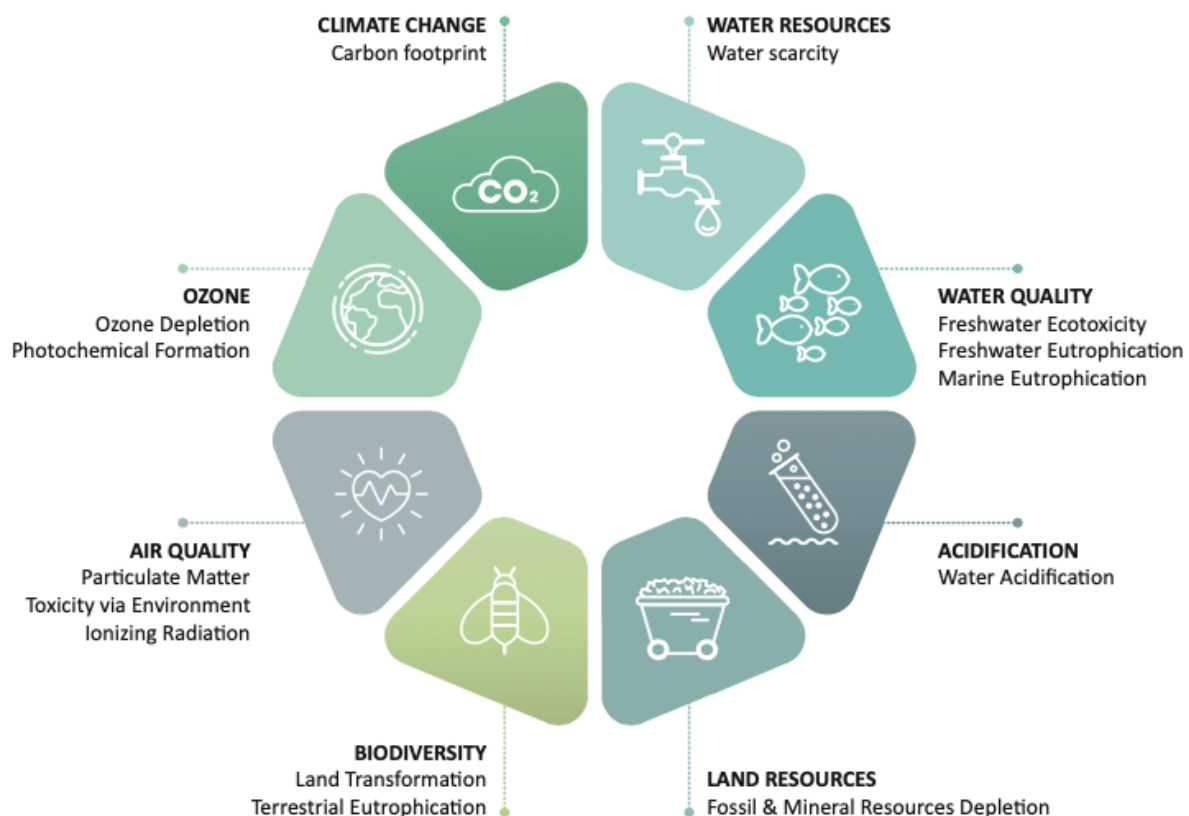
### 3.3. Targeted methodologies

The frameworks we have seen so far produce consolidated results, that can be communicated at group level. Although some of them can be broken down to a smaller level such as business unit, project or product, the guidelines are built around a group-wide reporting and external communication. Some other initiatives, on the contrary, have been developed to fit a smaller and more targeted scale. We will investigate three methodologies that have been developed at product or site level.

#### 3.3.1. L'Oréal SPOT

L'Oréal is a French group, leader of the cosmetic industry, with €32.3 billion in revenues. It developed a proprietary tool name Sustainable Product Optimisation Tool (SPOT). It calculates the social and environmental footprint of all products of the group. It was launched in 2017, with the objective of improving the environmental and social profile of all products by 2020 on the following criteria: packaging, formula, ingredient sourcing, and social benefits of the product. SPOT was developed thanks to the cooperation between the teams in sustainability, packaging, and research, by following the European product Environmental Footprint guidelines. All teams have been trained to use the tool, which is now systematically integrated to product design. SPOT relies on a Life Cycle Assessment of the product formula, packaging, and accessories (like combs or gloves). L'Oréal has collected data on all its packaging materials and 10 000 ingredients.

To determine the SPOT score, fourteen categories of impact are assessed. They are first measured as environmental metrics in physical units.



17 – L'Oréal: categories of environmental impact included in the SPOT score

The environmental metrics are then normalised. It consists in transforming physical quantities into footprint, an amount with no unit of measurement. Footprint divides each impact factor to a

reference value like European production or European consumption to obtain a ratio. These references come from the European Commission Joint Research Centre. For example, GHG are measured in kg of CO<sub>2</sub> equivalent and are then normalised to a footprint of 9220 per person.

Once all factors are expressed in the same unit, they are weighted according to the Planetary Boundaries, defined as “*the limits of the safe space in which the planet may remain a habitat suitable for human development*”. To follow up the previous example, GHG have a weight of 25.5% among the fourteen factors.

The weighted sum of all the footprints gives the overall environmental impact, expressed in footprint per user dose. The user dose is the maximum amount of product an individual is expected to consume at each use (for instance, 10mL for shampoo). It allows comparison between products that may not require the same dosage. To make the SPOT score more readable, it is also expressed in footprint per 1mL or per 10mL.

In addition to this total impact, L’Oréal estimates the carbon footprint and the water footprint of each product per user dose.

Since 2020, L’Oréal has started displaying the SPOT score of its products on Garnier shampoos in France. For this communication, the score is translated into a grade from A to E (A being good, E being poor). The grade is assigned relatively to the other products in the same category, as consumers want to compare offerings for each of their needs. Products within the top 10% get an A, those in the bottom 10% get an E. Those in the middle are spread between B and D. L’Oréal intentionally made the SPOT grading similar to the food “Nutriscore” (a score indicating nutritional value of food products in France) to make it easily understandable to customers.

SPOT is an instance of commensuration that does not resort to monetisation. Instead, the common unit is footprint, that is not compared to financial indicators. SPOT scores all impacts on a common scale and aggregates them without giving further indications about substitutability of capitals. It aims at identifying trade-offs to assist product design or re-design. L’Oréal also uses science-backed estimates to add legitimacy and credibility to its scoring.

The SPOT score is an approach by product that cannot be consolidated. A product-level indicator is ideal to target customers, who want to make purchase decisions, and for research and development teams who design and improve products. However, SPOT does not target investors, who seek high-level information.

While SPOT is presented as giving more decision power to customers, it is likely also a marketing strategy. This puts into question the objectivity of grades, as L’Oréal has an interest in pushing forward its newest or most profitable lines. This goal comes in direct conflict with the ideals of objectivity and neutrality of quantification.

### 3.3.2. Carrefour experiments with the CARE method

In 2020, Carrefour launched an experiment with the CARE method. CARE stands for *Comptabilité Adaptée au Renouvellement de l’Environnement* (Accounting Adapted to Renewal of the Environment) and was developed by researchers Jacques Richard and Alexandre Rambaud from Paris-Dauphine University. This method aims at applying the traditional accounting principles to natural and human capitals. Natural capital represents the ecosystems and resources that compose the natural environment, while the human capital encompasses employees, and surrounding populations and society.

CARE approaches valuation through the calculation of preservation costs, which are the costs that it would take the company to maintain capitals in a stable state. In the same way as liabilities and need for financing reflect what is needed to maintain financial capital, a social and environmental debt is recorded on the balance sheet and in the P&L.

The company starts with making a “material and social” assessment, where it quantifies how much human and natural capital is affected by its activities. It is the calculation of externalities of the company.

Next, the company measures the difference between its current usage of capitals, and the maximum usage to ensure their renewal. Using the concept of planetary boundaries, it estimates by how much its impacts exceed the capacity of the planet to absorb them. This assessment is led by using scientific data and the expertise of stakeholders. In the CARE mindset, are people with relevant expertise who can bring credible information and guidance to the table, “capitals spokespeople”.

Then, the company calculates the costs of restoration and renewal of natural and social capital. If it determines that it should use x% less groundwater to ensure the renewal of groundwater reserves, renewal cost is the investment needed to reduce groundwater consumption by x%. It might also include restoration costs to repair the damages on ecosystems. These costs are accounted for as a debt in balance sheet: the company owes nature and society some restoration and renewal action. This debt is then amortised depending on how much the company “refunds”, how much it reduces its negative impacts.

Placing human and natural capitals in the balance sheet means that the company should manage those capitals with the same attention as financial capital. The conservation of human and natural capitals is just as important as that of financial capital.

The CARE framework does not convert quantities into euros. It calculates an amount of investment, which by nature is in euros, in the form of an abatement cost. CARE does not want to put a price on nature, it measures the efforts needed to preserve it.

CARE has the same standards of reliability as financial accounting. Quantification should be performed with the help of ecologists, biodiversity specialists, agronomists, healthcare professionals, and other relevant experts. Estimates should be built with the rigour of scientific research. The results should be robust and aligned with existing frameworks like the Science-Based Targets. If scientific information is not available, CARE uses sectoral data to look for a consensus on the trajectory and average impact. If it is not available either, the company must collect the data itself with the help of experts and stakeholders.

Carrefour is a French retailer with revenues of €18,6 billion in 2020. It has started experimenting with the CARE method as part of its sustainable transformation, launched in 2018. The *raison d’être* of Carrefour is to offer high-quality products at accessible prices. With this goal in mind, the group reflects on the transformation of the food production model, in cooperation with its stakeholders. With the help of the accounting firm Compta Durable, it led two experiments.

The first field experiment was led at a supplier, to compare conventional and organic carrots. Carrefour organised a stakeholder group to create a model around the triple bottom line (people, planet, profit). The results obtained were promising but were only focusing on the easiest capitals to measure.

The second experiment was led at a store in Normandie. This project was more complex as it implied coordinating teams across all functions (ESG, operational, finance, HR, ...). The local teams needed to understand the stakes of the project and be willing to dedicate some time to it. The task force identified the topics and types of capital to work on, and the relevant KPIs to track them. Some indicators like carbon were already measured and it was easy to obtain data. Others, like biodiversity around the store, had never been apprehended and required the intervention of an ecologist. It means that not all capitals can be measured with scientific rigour yet, and that some of them are excluded of the CARE assessment so far because of the lack of reliable data. For measurements that are only partly reliable, limits are pointed out in a spirit of transparency.

Once results are obtained for the CARE method, they should be used at a strategic level to determine which investment projects to launch. Carrefour can also look within its sector for



comparable companies, to see their impacts and their investment projects. In this sense, CARE can become a benchmarking tool if it is employed by several actors in a sector.

Unlike previous methods, CARE is a Sustainable Cost Accounting method, that focuses on the cost to incur to resolve environmental damage. It assesses the investment needed to leave the biosphere's capacities intact. In that sense, CARE is a form of abatement cost method, that focuses on the actions that Carrefour should take to avoid damaging the environment.

In addition, while other initiatives report on environmental externalities separately from financial statements, CARE recommends presenting a triple bottom line, with people, planet, and profit on the same level. It puts environmental concerns on an equal footing with financial performance. Considering impact costs as a debt means that companies owe investments and action to the biosphere. Mitigation of impact is no longer seen as a voluntary advance, but as the reimbursement of what is due. As the different types of capitals are not substitutable in CARE, firms must "reimburse" their debt in each category of capital, without offsetting one category with another. CARE carries a stronger vision of sustainability and a commitment to scientific robustness. If quantification is performative, a strong sustainability tool could give rise to stronger sustainability action, especially when it appears directly on financial statements.

### 3.3.3. Veolia's attempt at valuing local impact

From 2010 to 2013, Veolia has led some pilot experiments on the valuation of ecosystem services and positive externalities. They attempted to address a discrepancy in the business model. Veolia provides environmental services, with a focus on efficiency and saving of resources. However, around 80% of payments for its contracts are variable remuneration for quantities delivered. It means that the more water Veolia treats and distributes, the more waste it recycles, or the more electricity it sells, the more it gets paid. These two aspects are in direct contradiction, because externalities have not been internalised in the business model.

To address this concern, Veolia led two pilot studies. The first one regarded a water sanitation system in Normandie, and the second was on a source of drinking water in Lyon. The goal was to obtain a local valuation of ecosystem services and understand the potential for positive externalities. Several methods have been used like the willingness to pay or avoided costs (cost reduction coming from better preserving the resource).

These studies showed the importance of law and taxation in internalisation of externalities. Subventions directed towards virtuous projects, specifications from local government to impose protection of resources, or taxation of polluting activities are incentives to internalise environmental externalities. On the other hand, the lack of regulation, or subventions granted to projects that damage the environment act against internalisation. While the company has a role in measuring and improving its environmental impact, the regulatory framework must make it possible and advantageous for the company to be virtuous.

The Lyon experiment has shown that protecting the resource upstream was making the production easier and less costly downstream. Preserving the drinking water source reduces treatment cost and improves service continuity. It means that Veolia has a direct interest in preservation, and that generating positive externalities benefits its activity. It would also benefit the client, through a better water quality with good service continuity.

However, water quality and preservation of the resource are not remunerated in contracts. There are minimum requirements for quality or continuity but improving them does not generate additional revenues. The benefits to the clients and local inhabitants are not considered in pricing. The local approach tested by Veolia has a quantitative dimension but also qualitative factors. For instance, non-use value of ecosystems or impacts on well-being may not be reflected in quantitative terms but will be considered from a qualitative angle.



While Veolia's approach monetises impacts, the calculation is destined to remain local, at the scale of a site, activity, or contract. It aims at revising pricing and contract terms on a case-by-case basis but cannot give the total impact of the group. The valuation of externalities gives indications to improve the business model and the relationship of Veolia to natural capital, it is not directly targeted to accounting.

In addition, impact measurement and consolidated financials may not give the same results. For instance, if Veolia decreases the quantity of water distributed but increases the quality, for a stable contract price, its revenues do not change. If Veolia signs contracts with more stringent specifications on resource preservation, nothing will happen in financial terms. If it invests in preserving resources but operational costs are reduced by the same amount, there is no net effect on income. Only investment in new activities or a change in production processes would be reflected in group-wide accounting. The experiments are not aimed at reporting nor orienting the whole group's strategy, it investigates local preoccupations.

However, these experiments have not been generalised nor adopted as a model at Veolia. The topic of externalities had been left aside until recently. Veolia is now leading working groups and benchmarking to identify which approach would be best suited to measure externalities. It wants to make its business model more sustainable and circular. It would like to attain convergence between financial and environmental data, to cover both external communication and internal decision-making. There would still be a strong local dimension to the new model, as Veolia has a "multi-local" approach centred on its local public clients.

Veolia also needs to answer growing client demand for greener offers, notably on water and waste. Business units aim at enriching the dialogue with customers by presenting a quantified and justified measurement of externalities. Negotiations should include energy and resource efficiency and quality of service, to answer clients' concerns for improving their environmental footprint. *"The novelty is the way of making environmental and economic data interact, to produce an argumentation that relates the financial business plan and the quantified environmental impacts"*.

Because there is no standard approach yet, the implementation of externality valuation will require time and some trial and error. The approach will most likely be empirical and pragmatic. For indicators like carbon, relying on the standard market value is risky, as the market is often lagging compared to the real impact.

Because of its major activity in recycling, Veolia is interested in circular economy. While a circular model saves resources, it is not as profitable as the traditional economy. Recycling also consumes energy and emits GHG. In addition, the willingness to pay for sustainable and circular products may be lower than the investment needed to remediate environmental damage.

Veolia must also consider the pressure from ESG rating agencies and investors. Companies are pressured to show only their positive impacts to satisfy rating. It might lead to a lighter vision of sustainability where it only highlights its progress against its previous performance. However, it does not measure the absolute distance to a target or trajectory, nor does it guarantee the preservation of natural capital.

Veolia's case shows that the quantification of environmental externalities is not obvious and requires to agree on what needs to be measured, how to measure it, and to forge assumptions. Quantification or monetisation are defined based on the needs and strategy of the company. Here, site-level experiments make sense as it corresponds to the scale of Veolia's contracts.

### 3.3.4. What do these approaches have in common?

Like their group-wide counterparts, targeted methodologies rely on commensuration. They measure different types of impact associated with a product or site and convert them into a single

unit to identify trade-offs and prioritise investments. They also aim for precision, objectivity, and accuracy.

Targeted approaches have empirical and experimental dimensions. They are based on field observation rather than on pre-determined formulas or databases. However, they still try to ensure credibility by resorting to experts or scientific research to validate their calculations or provide supplementary data. These frameworks are co-constructed with local stakeholders, who provide their expertise and points of view. Stakeholders can have a role in giving more visibility to some issues or bringing a critical perspective into the debate. It participates in a democratisation of decisions about externalities.

While targeted approaches are heterogeneous, they have in common that they do not aggregate nor consolidate results. They intend to act at a smaller scale rather than altering the strategy of the whole group. The SPOT score is used to improve conception of specific products or ranges, the CARE method helps select investments at the level of one supplier or one store, Veolia's experiments seek to adapt the business model on a site-by-site basis. These frameworks are more action-driven, as they identify actionable priorities and investment opportunities. In the Carrefour case, the local approach fosters more engagement of operational teams and more appropriation of the method by those who will implement the changes. Making environmental challenges visible on a local scale is also a way of fostering accountability at all levels of the group, especially at operational level. Indeed, implementation of environmental projects both requires support from the group's strategy and implication of local and operational teams. In L'Oréal's case, the "Sharing Beauty with All" sustainability strategy emphasised on improving products' sustainability profile. The coherence between the tool and the strategy enabled L'Oréal to reach 96% of products with improved social or environmental profile in 2020. On the other hand, Veolia's experiments were not picked up on a broader scale. This shows that implementation partly depends on the alignment between the tool and the strategy.

Targeted approaches tend to be less geared towards external communication to investors or the greater public, and more destined to internal teams. However, they all include cooperation and communication with stakeholders, particularly at Veolia, where the preservation of water resources is a matter of public health and well-being that involves local governments and citizens.

### 3.3.5. How do these approaches differ?

The SPOT approach is the only framework here that does not resort to monetisation. It uses a different unit of commensuration, called footprint, to capture externalities. The footprint calculated by SPOT is meant to compare different L'Oréal products. It does not establish a link with financial profitability nor other impacts of the group. The use of a score is simpler and more adapted to product improvement, as monetisation would add a step to the process. Reducing indicator complexity can improve transparency and understandability, while reducing uncertainty and errors. The less elaborate an indicator is, the more difficult it is to manipulate, because stakeholders and auditors can more easily verify the data and calculation.

The decision-making unit differs across methodologies. L'Oréal focuses on products rather than geographies because of its worldwide manufacturing structure. Carrefour focuses on stores as they are the core of its activity and the place where a lot of operational decisions are made. Veolia analyses sites as they correspond to the scale of its contracts and the natural resources are impacted in a very localised way.

Each of them works with the relevant stakeholders at the selected scale, but the CARE method is the only one that defines stakeholders as "capitals spokespeople", who must have a relevant expertise to participate in constructing the indicator, and not just as parties affected by the firm's activities.

In addition, Veolia is the only initiative to focus mainly on positive externalities and how it can enhance its positive impact. It shows the positioning of the company, that provides public services and resource preservation. However, solely accounting for positive externalities is taking the risk of missing on opportunities to reduce negative impacts.

As we have seen, companies can choose among a variety of frameworks and methodologies to commensurate their externalities, both at group level and for targeted projects. We will now explore the rationales that push companies to choose one method over another and to implement quantification of externalities or not.

### 3.4. Current state of initiatives to value externalities

We have seen several companies have a proactive stance and develop methods to quantify, commensurate and monetise externalities. A few others have followed suit, like the eleven companies testing the VBA method. However, quantification of externalities is still emerging, and only a minority of corporates have tested or implemented it.

According to a specialist of ESG audit at EY, the most developed tool to measure environmental impact is the internal price of carbon. It has been implemented in many companies with a real repercussion on decisions. Among Fortune 500 companies, the most used framework is the GHG Protocol, that measures GHG emissions on scopes 1, 2, and 3 of the supply chain to help identify mitigation opportunities. The GHG protocol has been widely adopted because it provides a harmonised way of establishing a GHG inventory, in a simplified and cost-efficient way, and to report on it. Accounting for GHG is also a prerequisite to enter carbon emissions trading markets, that have developed internationally. Thus, quantification of GHG is the most mature branch in externality accounting because it meets regulatory and market needs.

However, according to EY, what matters is that the ESG indicators be put in perspective with further context and vision. Only measuring GHG emissions gives limited insight into the strategy to adopt. Calculating the intensity of the metric ( $\text{metric} \div \text{revenue}$ ) is more meaningful as it relates impact to the activity level. Understanding the externalities on climate, health, or biodiversity gives even more meaning to the indicators.

The Task Force on Climate-Related Financial Disclosures (TCFD), founded in 2015 by the G20's Financial Stability Board, is the most relevant analytical tool for climate. It uses scenario analysis to reflect on the consequences of different trajectories of climate change and regulation. It does not aim at understanding how a company impacts the environment, but rather how climate change is likely to increase risks for the company. This includes physical risks (destruction of facilities, changes in demand resulting from new climatic conditions...) and transition risks (impacts of the environmental transition on revenue, Capex, Opex...). It helps companies reflect on how to limit or avoid climate risks, rather than on how to reduce their ESG impacts, even though both are linked.

TCFD metrics are monetised, because they represent the amount of investment a company needs to make to avoid a risk, which is monetary. It is more intuitive than quantifying externalities that are in part qualitative and do not directly correspond to monetary transactions.

In that sense, TCFD is closer to the abatement cost method described in Life Cycle Assessment. It only differs in that the investments are made to avoid a risk and not directly to reverse environmental damage. TCFD is also less exhaustive than other abatement cost methods like CARE, as it only focuses on climate-related risks and not all environmental risks.

Many of the theoretical valuation frameworks published by independent organisations or consultancies remain on paper and are not very implemented in real life. Even Kering's EP&L,

which pioneered externality reporting, was not followed much, besides a few exceptions like Philips. Only a minority of corporates perform externality accounting.

The lack of harmonisation makes it harder for companies to identify the most relevant framework, formulas, and data. Among social indicators, for instance, the rate of work incidents may differ depending on which events are classified as incidents and whether the frequency is calculated on business days or civil days. If monetisation coefficients are also heterogeneous, it creates a double layer of uncertainty around valuation. This limits accuracy and comparability, but also requires additional effort from companies to define the right set of raw data, formulas, and coefficients. If they choose a pre-existing model like EP&L, VBA, or CARE, they must still reflect on which one is best suited to their needs. Some companies are not willing to engage the financial and human means to select, develop or implement a framework to quantify externalities.

For those who already monetise their externalities, the methods are still maturing. Some initiatives like VBA are still in experimental phase, while others like the EP&L are relatively stable but keep improving as Kering gains experience and knowledge. As a result, quantification rules are evolving, which leaves room for improvement but also for potential bias depending on the firms' interests. Indeed, less institutionalisation can be positive as it leads to more open discussion on the definitions of indicators, that are not taken for granted; but it can also increase the risk of manipulation as the indicator is not set in stone.

The science behind impact evaluation is an active research field that keeps evolving too. Parameters like the persistence of certain pollutants in air, soil, and water, their long-term cumulative effect on health, or the trajectories to limit climate change are still being researched and discussed within the scientific community, which means that impact valuation is likely to evolve as knowledge extends.

To convey a strong vision of sustainability, externality valuation should reflect the finite capacities of the planet. According to the GRI (Global Reporting Initiative of the United Nations), companies should assess their sustainability "*in the context of the limits and demands placed on environmental or social resources at the sector, local, regional or global level*". Monetisation of externalities should consider the absolute limits to what the earth can provide. The incremental cost of resources should increase as they become scarcer. The last cubic metre of renewable water should be given a higher valuation than the first one. The marginal cost of resources should not be linear, as reaching a certain level of damage can cause a threshold effect, such as drastic biodiversity losses or changes in weather patterns.

If a company reaches the threshold where its activities become unsustainable, valuation stops making sense. Depleting water at an unsustainable rate means that it will eventually become unavailable in the area, preventing any economic activity or human life altogether. Hence, the cost of depleting the resource should be infinite. Not all approaches include the increase in incremental cost, and even fewer have a model for the absolute limits of environmental resources. Those methods may still be a useful decision-making tool to compare alternative projects or investments, but they do not capture the absolute sustainability of the company.

Hence, quantification of environmental externalities could be defined as a research and experimentation field, rather than a definite and established practice.

### 3.5. Investors pressure encourages implementation

Among stakeholders, the ones with the most influence are usually investors. Because companies need financing, they prioritise the demands of their investors. Recently, firms have been facing a multiplication of ESG screenings from investment funds, banks, and rating agencies. Specialised actors like Vigeo Eiris are exclusively centred on ESG, while others have in-store investment criteria. It can explain why most of the frameworks presented here are group-level. Investors

usually seek consolidated data to have an overview of the group and its sustainability. Smaller scale quantification for sites, projects, or products is less likely to be reported publicly, because it is directed towards internal, and often confidential, decision-making.

According to EY, the choice between quantification and monetisation is also a cultural matter. In Anglo-Saxon countries, ESG rating agencies like the Dow Jones Sustainability Index tend to require a quantification of companies' ESG risks. Most of these questionnaires focus on a few indicators like water, waste, GHG or energy consumption, but they take a financial approach to ESG. In Europe, with the recent European Union taxonomy (a framework that classifies activities as green or not), the focus is on categorising activities and investments, without quantifying their impact. Some companies prefer using scorecards, like L'Oréal with its SPOT score. This shows that quantification tools do not arise spontaneously but are the result of a societal and cultural context, that dictates what is important and what needs to be measured.

To respond to investors' demands, Danone implemented a specific metric: the carbon-adjusted earnings per share. Since 2020, Danone has been calculating the cost of carbon emissions per share and subtracting it from its EPS. It informs investors in a way that is easy to understand for them while tracking Danone's progress towards carbon neutrality, that should be reached by 2050. Integrating carbon in a financial metric also ensures that it is reflected in managers' bonuses, and thus provides them with an incentive to act in favour of climate.

In 2019, Danone emitted 27 million tons of CO<sub>2</sub>. The carbon-adjusted EPS was €2.38, in comparison with a €3.85 EPS (-38%). It selected a cost of carbon of €35 per ton, which was used internally since 2015. Danone estimates that it has reached a peak in carbon emissions, and that carbon-adjusted EPS will improve over the years. In 2021, carbon-adjusted EPS was of €1.97, with a price per ton of carbon still set at €35. This valuation seems low, given that the carbon ETS market reached €80 at the end of 2021.

The carbon-adjusted EPS is a case of commensuration, where GHG emissions and financial earnings are expressed in a common unit and aggregated in a single indicator. For Danone, it is an incentive to become more competitive on carbon emissions since EPS is used by investors to compare companies within a sector. While the initiative denotes a commitment to sustainability, it may also have the side effect of pushing investors away from "virtuous" companies who disclose an adjusted EPS, as it is lower than the financial EPS.

One of the virtues of carbon-adjusted EPS is its simplicity: it only considers one type of impact, that has a well-established measurement method, and monetises it with a single coefficient of 35€. EPS is a well-known metrics among finance professionals, with a simple formula (adjusted earnings / number of shares). This simplicity guarantees greater transparency and objectivity. Hence, Danone probably cannot create an adjusted EPS for all types of environmental impacts as it would create an extremely complex, composite indicator that would rely on multiple estimates. Danone is working on other types of metrics to report on, notably to capture the water footprint of its agri-food activities. However, as of 2021, nothing was formally published to explain the new methods or propose a valuation of externalities. The extra-financial reporting reflects environmental and social indicators in physical quantities an intensity in a "traditional" way.

The importance given to investors requirements shows that the quantification of externalities is not always a dialogue with all stakeholders. While other groups of stakeholders carry different interests and critical views that can challenge investors' interests, they are not directly represented here. As we have seen, the "voices" of stakeholders have a role in shaping quantification and the way that reality is represented by indicators. The predominance given to shareholders is likely to preserve the focus on profitability and to certain impacts like GHG over other types of environmental concerns.

While investors demands can be a reason to report on externalities, companies can have other motivations and draw several advantages from it.

### 3.6. [What are other motivations for valuing externalities?](#)

All the frameworks presented enlarge measurement beyond the entity itself, to scopes 2 and 3. They focus on the value chain, rather than the company's own operations. In many cases, the sourcing and processing of raw materials, the selection of suppliers, the transport of materials and goods, or the usage and disposal of products by customers are more impactful than the production process itself. Frameworks also enlarge the scope of impacts to be considered. Beyond the traditional measurement of GHG, they account for other environmental concerns to try and capture natural capital in its entirety.

A broader scope is useful in decision-making. Companies do not only make strategic and operational decisions in their own production, but they also choose sourcing, transportation, and distribution. Having data on the whole value chain helps rationalise decisions regarding upstream and downstream supply chain. Knowing the impact from use and disposal by final customers also impacts product design. Better knowledge of impacts at all stages of the value chain, on all types of ecosystem services, promotes better trade-off identification and decision-making in those areas. Even if quantification is not perfectly accurate, bringing attention to different sorts of impact and uncovering levers to reduce them is a step forward. Internalising externalities and being accountable for them can be the first step towards compensating those affected by them and repairing damages made to the natural capital. The externalities that are considered and the scope of damages that are accounted for are key determinants for potential indemnification.

Quantitative externality reports are built with fixed formulas and coefficients, that are explicitly defined. Because of its structured nature, quantification promotes consistency of reporting over the years. While the EP&L method keeps evolving, the pro-forma result is still calculated, and it would be difficult for Kering to change its method overnight. While a qualitative view can be reassessed freely, a change in quantitative methodology would have to be justified. Stakeholders, and in particular investors, expect consistency in indicator definition, whether they be financial indicators like the EBITDA, or environmental indicators like the EP&L. If some methods become harmonised across companies or at the market level, they can be expected to become more rigid and somewhat more difficult to manipulate.

Using stable and transparent quantification, with explicit data and calculations, facilitates verification and audit. When information is published as in Kering's case, auditors and other stakeholders can review the indicators and the narrative. Audit firms like EY and KPMG are currently investing in strengthening their environmental audit. The use of numbers and coefficients to capture impact enables auditors to trace the source of the data and verify the relevance of the selected values. When quantification relies on databases from institutions like the European Union, WWF, or universities, the data is verified by the institutions' experts. As audit firms participate in forging new methodologies like that of the Value Balancing Alliance, they are likely to gain a deeper understanding of the methods used and be more efficient at verifying them compared to company-specific frameworks.

For the company, better auditability means higher credibility and legitimacy of the indicators and avoids accusations of greenwashing or manipulation. The objectivity and rationality sought in quantification are validated by independent reviewers, which strengthens the authority of numbers.

Opening reporting to external verification also means that stakeholders can give their opinions and criticise the results, challenge the underlying ideas and assumptions, or propose improvements. Most initiatives mention the dialogue with stakeholders and co-construction of indicators and action plans. Companies like Veolia lead working groups to conceive a method, but it is unclear what is or will be the place of stakeholders once the framework and strategy are adopted.

Aggregated scores and impact costs, such as the total impact in Kering's EP&L, make environmental reporting more understandable to stakeholders without technical expertise. In



particular, the managers and teams operating the changes are usually not experts of the environment, and often have little time to get into the topic. Using a financial language that they are already familiar with or constructing clear and concise graphs and dashboards can improve communication. In cases like Michelin where the data is collected at business line level, it may also give a greater sense of accountability and thus incentivise people to act.

The combination of a more holistic approach, and a more transparent and auditable reporting are beneficial to reduce regulatory risks. Future regulations at national, European, or international level are likely to require a reporting on the value chain, that encompasses different types of impact, with a standardised and transparent accounting process. For instance, the European Union Taxonomy uses six environmental objectives, regarding climate change, water, circular economy, pollution, and biodiversity. Anticipating the future demands from governments, investors and stakeholders gives companies more time to adjust and improve. While the accuracy of the models is not perfect, most of them use an iterative approach to progressively improve data and calculation quality. The Value Balancing Alliance does so by gathering feedback from its members in pilot studies and incorporating it to its methodology. It would eventually like to propose its framework to the European Commission to pass it as a regulation. Companies who are part of the initiative early on have more time to adapt and anticipate the potential future regulation. They also give themselves more chance of influencing new laws in their favour.

As we can see, implementing a credible quantification of externalities can be beneficial to firms. It promotes better decision-making on the value chain, more transparency and auditability, more legitimacy in the eyes of stakeholders, and a reduction in regulatory risks. However, we know that only a minority of companies have implemented this type of initiative, which leads us to wonder what the drawbacks and limits are to valuing externalities.

### 3.7. What limits the relevance of externality valuation?

Valuation of externalities is resource-intensive: it requires a lot of financial resources, time, and human resources to develop and maintain. Kering had to dedicate a full team to the conception of the EP&L, and still needs a few people per House to keep it up to date and exploit the results. Not all companies dispose of enough resources, so they either remain at a physical indicator level or use estimates and sector averages for valuation. Data collection in the value chain requires coordination with upstream and downstream partners, and an efficient system to transmit and treat information. Automation could be envisioned once the tools are mature, but the development and automation phase would still require important means.

Externality quantification and reporting is a tool that is meant to serve a purpose, usually the mitigation of environmental impacts. If firms manage to better preserve natural capital without valuing externalities, they have little incentive to invest resources in a sophisticated method.

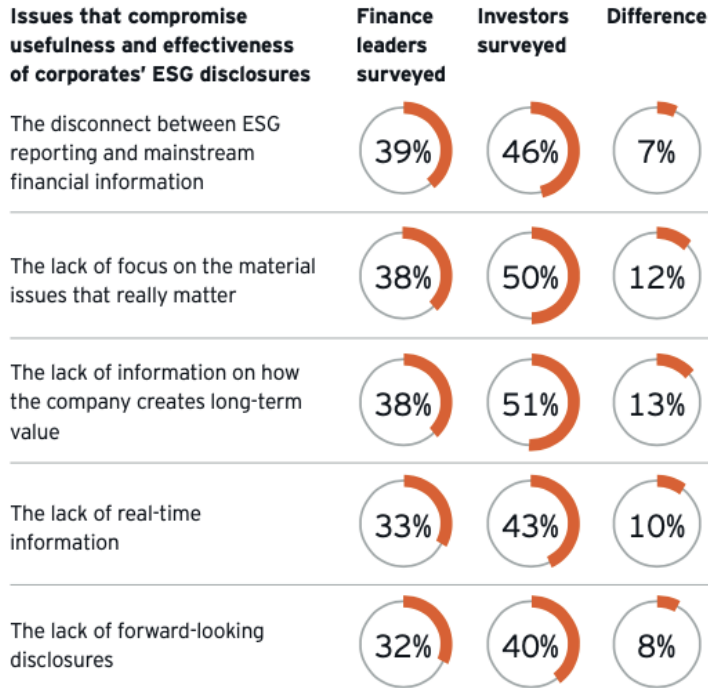
In addition, most frameworks are destined to external communication with reporting and internal communication for decision-making. This double goal might pose tensions in the measurement method to adopt. On the one hand, investors and other external stakeholders tend to favour standardised reporting, composed of easily understandable indicators like EPS. They are mostly looking for consolidated information at the group or entity level that they can compare to competitors. Unified standards have the advantage of limiting manipulation and greenwashing by imposing a set of precise rules. They also bring about a pre-made framework that can accelerate the implementation of environmental accounting, compared to the experimental approach of Kering or Veolia. On the other hand, internal indicators are usually very customised to the company's needs, through sector- or entity-specific metrics. They are built around existing internal reporting practices and sustainability targets. The time horizon of impacts may also differ, as a single product or project does not have the same horizon as the whole entity.



Having a double set of indicators would be costlier and probably too heavy for most companies. Michelin is developing an approach that is calculated at a small scale and consolidated to cover both aspects with the same tool, but it may not be adapted to all sectors and situations. Adding complexity to frameworks to make them cover different scales may also hinder clarity, transparency, and understandability by internal and external stakeholders, so there is a trade-off between completeness and simplicity.

Even without a double model, the complexity of current methods poses the question of their transparency. Some calculations, like abatement costs, are relatively simple conceptually, as they correspond to an amount to be invested in a solution. On the other hand, approaches like the EP&L are very complex, as it is an aggregation of six categories of impact, each divided in several subsets of consequences (on health, agriculture, amenity...). Each of these valuations is the product of four factors, namely the quantity of output, the consequence on the environment, the consequence on human well-being, and the monetisation coefficient. Understanding the meaning behind the indicators is increasingly difficult and poses the risk of creating a “black box” that lacks transparency. Not only does it defeat the purpose of efficient internal and external communication, but it also creates room for discretion and potential greenwashing. Measurements that are too complex may also be less actionable. To make substantial changes, teams across the organisation must appropriate the tool, including those that have no specific expertise in environmental matters.

EY (2021) surveyed institutional investors to understand their opinions and concerns about corporate ESG reporting. They found a disconnect between the way that companies perceive the usefulness of their reporting, and investors’ opinion. 72% of investors said they conduct a “structured, methodical evaluation of non-financial disclosures”. To help in their assessment, 89% of them think it would be useful to report ESG against a set of “globally consistent standards” such as the TCFD or the upcoming ISSB (International Sustainability Standards Board, an initiative set up by the International Accounting Standards Board to provide a frame to ESG reporting). 83% consider formal frameworks to be necessary in assessing long-term value, and 82% say independent assurance on green investments would be useful. In the same survey, EY identified the main issues that institutional investors face when analysing corporate ESG reporting.



Note: data is compared with the EY 2021 Institutional Investor survey.<sup>3</sup>

#### 18 – EY (2021): Issues that compromise usefulness and effectiveness of corporates' ESG disclosures

Investors are mainly concerned about the lack of information on long-term value and the lack of focus on material issues. For every topic identified, a lower proportion corporate finance leaders consider it as an issue compared to investors. To instore a true long-term vision, investors will need access to long-term data and methodologies. Current frameworks are not fully satisfactory and still need adjustments.

We have seen some of the existing methodologies to value environmental externalities, either at group level or for targeted products and sites. They resort to commensuration to express various types of impacts in a common unit, most of the time in a monetary one. They aim at giving a holistic view of environmental impacts and communicating it to internal and external stakeholders. They are also a tool for strategic and operational decision-making. However, externality valuation is less common than GHG accounting, because it is more complex and requires a lot of resources to develop and maintain. Companies that have implemented these frameworks are still experimenting and improving them. Quantifying externalities meets a growing demand from investors who seek transparency on ESG, but also the need of companies to facilitate their decision-making on environmental matters. Those that are proactive in this field respond to stakeholder concerns while anticipating future regulations and standards. However, the need for financial and human resources, and the complexity of methods is a limiting factor for many organisations, and externality valuation is still in a research and development phase.

## 4. Discussion

We have seen the advantages and drawbacks of the systems of valuation of externalities. We will now discuss what vision of the environment do these models reflect? What do they say about the interests, ideas and ambitions of companies who make them? Do they constitute a real advance towards greater preservation of the environment?

## 4.1. Does externality valuation improve ESG reporting?

### 4.1.1. Valuing externalities strengthens reporting legitimacy

Externality valuation shows a willingness to make environmental accounting more like financial accounting, as denoted by terms like “Environmental P&L”. One of the core features of financial accounting is giving a faithful picture of the situation of a company, by focusing on objective facts and substance. Accounting norms are defined with an ideal of accuracy and neutrality. Commensuration, that uses quantitative data and pre-defined formulas, appears more rigorous and objective than qualitative assessments. Externality valuation is concerned with reflecting reality in a faithful and rigorous way, which can be validated by independent organisations like the Science-Based Targets.

Reporting includes not only the impact results, but also the methodology and raw data used. Greater visibility and explicitness in construction of indicators limits the discretion of the companies who build them and guarantee more stability over time (Espeland and Stevens, 1998). Indeed, while initiatives like the EP&L keep evolving, pro-forma results are reported to ensure comparability over time. Decisions are justified and traceable, so managers cannot decide to change the indicators without a valid reason.

Most frameworks offer a consolidated report, which is particularly useful to external stakeholders like shareholders and regulators, who want an overview of the group’s externalities. Monetisation, used in most cases, provides a common currency that enables comparison with financial statements. It also constitutes a widely accepted and understood language, that facilitates communication with managers, boards, and shareholders (Gray, 1992).

As companies report on environmental externalities, they accept external review and criticism on their methods and results. Commensuration is a technical process that depends less on managerial leadership and more on technical expertise (Espeland and Stevens, 1998). As a result, quantitative reporting democratises the discussion around indicators, and stakeholders can play an active role in challenging or criticising environmental reporting and decisions. Most of the companies reviewed, such as Kering, Veolia, Carrefour or Danone explicitly claim that they want to strengthen the dialogue with stakeholders and include them in measuring and managing environmental externalities. In the CARE method, stakeholders are experts who not only defend their interests but also bring technical and scientific knowledge to the table, which can be beneficial for both parties. In financial accounting, the International Accounting Standards Board (IASB) opens new standards to public discussion and criticism by publishing drafts and letting stakeholders respond. Similar systems could be envisioned for environmental reporting. Inclusion of stakeholders could lead to a greater democratisation of decisions where influence is shared among different groups (Mennicken and Espeland, 2019) and no longer the prerogative of shareholders.

As quantification and commensuration advance transparency, they can provide greater credibility and legitimacy to environmental reporting. In the face of accusations of greenwashing and bias, a more explicit and mathematical process is a way for companies to justify their assessment of their environmental impacts. This shift from qualitative to quantitative responds to society’s preference for “scientificisation” (Chiapello and Desrosières, 2006), which is the increasing legitimacy given to quantitative assessment and mathematical models.

### 4.1.2. Quantification methods contain uncertainty and bias

Unlike financial accounting, environmental accounting is not ruled by norms. Companies choose the types of impact and indicators they disclose. Independent organisations like the Sustainability Accounting Standards Boards (SASB) that aims at creating harmonised environmental accounting standards, recommend the use of sector-specific indicators, depending on the most material impacts in each industry. For example, Michelin is the only one measuring volatile organic

compounds, and fuel consumption in use, because these are specific to the tire industry. Firm-specific standards can even be defined to capture the unique characteristics of a company.

In the absence of harmonisation, firms can choose the metrics they find most relevant. Quantification is always influenced by pre-existing political and social representations (Chiapello and Gilbert, 2013). The choice of indicators is not neutral, as it depends on the people involved, the underlying social conventions, and the priorities and interests put forward. For companies, the freedom in defining their methodology gives them discretion in what they show and makes it easier to present their environmental performance in a positive light. For instance, some types of pollution, like light and noise pollution, are not included in any framework, while being potentially detrimental to biodiversity.

The choice of environmental metrics is also guided by public awareness of certain environmental matters. Most companies have developed GHG assessments because it has been the first area of environmental reporting to become mandatory (2014 in France) and GHG are a major focus of many organisations and agreements like the IPCC or the Paris agreement. Other topics like biodiversity, air pollution or waste have come to the attention of the public more recently, so models to measure those externalities are only emerging. Quantification can only happen when we agree on what is to be measured, and when we collectively recognise the categories and classifications needed to perform quantification (Mennicken and Espeland, 2019). Hence, we can see a relationship between the evolution of public perception and the development of externality valuation. However, it is unsure whether the priorities set by society are aligned with the most important environmental impacts from a preservation point of view.

Beyond the subjectivity in the selection of indicators, there might also be bias in the way the calculation is done. For instance, Danone uses an internal price of carbon of €35, in disconnect from the ETS market that priced carbon at €80 at the end of 2021. This discrepancy inflates Danone's carbon-adjusted EPS, and the group's justification is that it is "*a figure that Danone has used internally since 2015 as well as in its reporting to the Carbon Disclosure Project*". All the presented methods rely on assumptions and estimates. Some of them are supported by independent organisations like the Science-Based Targets initiatives, or drawn from robust, scientifically approved databases. However, the aggregation of multiples layers of estimates significantly increases the risk of inaccuracies.

As an example, within the EP&L framework, let's estimate the impact of water consumption caused by a tannery in India. First, we must estimate how much water is consumed by the tannery. If we do not have direct data, we must use sectoral and geographical databases to obtain an average. Next, we must quantify factors like weather patterns, population density, agricultural use of water, and sanitation infrastructure to understand the environmental impact. Again, if we do not have primary data, we must derive an estimate from databases and existing studies. After that, we must quantify the losses in human health using DALYs, and losses in agricultural revenues. If these numbers are not available for India, we must use studies from another country, and a benefit transfer function to adjust the results to India. This gives us the total impact of the tannery. After that, we use an input-output model that calculates Kering's part in the supplier's output. It will eventually give us Kering's water consumption impact from the Indian tannery. As we can see, especially for small and foreign suppliers, many estimates are approximative, and sometimes derived from observations on different partners or geographies. After summing such approximative data for all suppliers, numbers risk being significantly. In addition, given the technicality and the complexity of the model, slightly altering estimates would likely go unnoticed or could be easily justified, which gives room for manipulating numbers.

To prevent manipulation, the environmental reporting of large groups is audited, which helps reduce bias. However, while auditors can trace the source of the numbers and coefficients used, environmental estimates cannot always be verified against concrete proofs, equivalent to an invoice or a bank account balance. It can be ascertained that the estimates are realistic but not that they are accurate or neutral. Environmental reporting is undergoing an evolution towards institutionalisation, which gives a perspective for more consistency and improved audits. As audit

firms and public institutions participate in the co-construction of new methodologies, as in the Value Balancing Alliance case, we can expect more verifiability.

#### 4.1.3. The difficulties of aggregated indicators

As we have seen, the valuation of externality is complex and covers a broad scope of value chain activities and impacts. Commensuration allows to come up with consolidated figures that aggregate different types of impact. Aggregation facilitates comprehension but can also be a source of error or over-simplification if not done correctly (Mennicken and Espeland, 2019).

One of the simplifications operated by the methods presented is that they do not effectively account for planetary boundaries. Most of them picture impacts as linear, by multiplying the quantity of impact by a fixed monetary coefficient. To capture the increasing scarcity of ecosystem services, the incremental cost should be higher as resources become scarcer. In the case of critical natural capital, the incremental cost should even be infinite, as there it is unique and not commensurable with any replacement (Gray, 1992). Commensuration does not properly capture the uniqueness of some parts of natural capital. If a model wanted to consider the incommensurability of some capitals like endangered ecosystems, it would have to refuse to monetise it, and give it infinite value (Espeland and Stevens, 1998). With some of the components being infinite, aggregated impact could not be calculated, and externality valuation would become pointless. For instance, if a land is sanctuaried, it cannot be traded off for anything else, and assigning it a monetary value becomes irrelevant.

Instead, the use of commensuration implies that the environment and its functions are given a relative value, while planetary boundaries are absolute limits. Using relative values avoids putting a price tag on the planet, but leaves room for a lighter vision of sustainability, that looks at relative improvement rather than preservation in absolute terms. Ratios like impact intensity or progress against a target reflect the company's efforts compared to its previous situation rather than the absolute level of sustainability of the business model. A company that was lagging behind on sustainability can have great progress and still be behind its competitors.

In this perspective, the substitutability of capitals assumed by some models can be questioned. In representations like KPMG's True Value bridge, a positive impact in one area can offset a negative impact on another type of capital. Presenting a bridge is appealing because of the simplicity and visual clarity of the results. It is also a format that is commonly used in financial accounting and seems intuitive to managers and shareholders. However, aggregating positive and negative impacts supposes that the loss of a natural resource can be replaced by preserving another, or by having positive economic and social impacts.

To affirm non-substitutability, firms have two main solutions. The first one is summing all negative impacts and presenting them separately from positive impacts. This method avoids offsetting, but also fails to represent real mitigation projects, like carbon capture that reduces GHG emissions. The second solution is that of the Value Balancing Alliance, which consists in presenting each category of impact separately. It reduces offsetting issues, although for instance preservation of water in one place does not make up for hydric stress in another. However, this method does not allow to present a consolidated total impact. While all categories of impacts are monetised and comparable, they are not aggregated. In addition, if categories of impacts are not to be compared, the benefit of expressing them in a common currency becomes questionable. It would be simpler to use the physical unit inherent to each type of natural capital, like m<sup>3</sup> for water, or to each impact, like DALYs for health damages.

As we can see, the willingness of coming up with a consolidated cost of externalities denies the possibility of some natural capitals being incommensurable and assumes at least some level of substitutability among capitals.

This light vision of sustainability is reflected in companies' strategies, that promote growth and profitability. Kering states explicitly that it wants to maintain revenue growth while reducing its EP&L total impact. Michelin also wants to maintain growth, with a planned 5% CAGR of revenues between 2023 and 2030. While it wants to boost its non-tire segment, tires should still account for 70 to 80% of sales in 2030, most of them still being used on fossil fuel vehicles. While a more sustainable growth is possible, with a reduction in intensity of impact, and potentially in absolute impacts, it is physically impossible to achieve infinite output growth while continually decreasing externalities. Even if a company like Kering adopts recycled or synthetic alternatives to replace high-impact materials like leather, it does not change the fundamental value creation model.

It is worth noting that growth can come from increasing market shares against competitors or leading mergers and acquisitions activities. In this case, a company can grow while the total market output remains stable. However, companies also pursue absolute output growth, as is shown by continued increase in global GDP. This confrontation between unlimited growth and finite planetary resources is not fully reflected in externality reporting for now.

While externality valuation is a way of legitimising environmental reporting because of its quantitative nature, the methods proposed still contain some uncertainty and subjectivity in their construction and results. Most of them promote a light vision of sustainability where different areas of natural capital are at least partly substitutable, and planetary boundaries are either disregarded or only partially accounted for.

## 4.2. [Does valuing externalities enhance preservation of the environment?](#)

### 4.2.1. [A perspective for solving the externality issue](#)

Despite the imperfections in measurement, quantification can have a performative dimension and become a lever for action (Chiapello and Gilbert, 2013). In firms, reporting guides strategic and operational decisions, and determines the allocation of financial and human resources. Highlighting environmental issues through quantification can become a tool for criticising the current state of things and shaping a new reality (Mennicken and Espeland, 2019). In this case, valuing environmental externalities could be a key to greater preservation of the planet, even if the results are inaccurate. The shared goal behind environmental accounting is to make business models evolve to reduce negative impact, enhance positive impact, and participate in solving the environmental crisis. Raising awareness and taking commitments in that direction does not always require exact numbers.

The methods presented here encourage broader accountability. They consider the whole life cycle of products and services, and a wide array of impacts. Companies that used to be accountable only for their own operations now take responsibility for the selection of their raw materials, suppliers, distributors, and for the use and disposal of their products. In consequence, they can make strategic and operational decisions that will foster greater preservation of the environment upstream and downstream in the supply chain.

Accounting for externalities also opens the possibility for compensation of the affected populations (Fourcade, 2011). This compensation can take the form of private transactions (Coase, 1960), on markets such as carbon emissions trading schemes that put a price on the right to emit more GHG. Once externalities are internalised, they stop being externalities and become part of the economy through new markets. In future legislation, compensation could also take the form of "polluter-payer" taxes (Pigou, 1924) calculated based on companies' externality reports, or subsidies for companies with positive impacts.



#### 4.2.2. Preservation of the environment is not guaranteed

To fulfil their transformative roles, externality valuation frameworks need to be actionable. However, as we have seen, most of them are highly complex. As they aggregate impacts from several activities and geographies, they can be difficult to interpret to drive change. Sophistication can hinder transparency and understandability (Espeland and Stevens, 1998). Targeted initiatives such as that of L'Oréal, Carrefour and Veolia partly solve this issue by focusing quantification on smaller scales, where operational decisions are made. However, Carrefour insists that it can be hard for teams to find the time to receive training and focus on environmental issues while continuing their daily tasks. Additional human resources may be necessary to drive effective changes. Given that externality reporting itself is already resource-intensive, finding additional means to implement change can be challenging for some firms.

Hence, unlike Chiapello and Gilbert (2013) we can argue that quantification is not automatically a self-fulfilling prophecy. Change in business model and operational processes does not necessarily follow quantification if quantification is not understood or if means are insufficient.

In addition, we could argue that environmental strategies exist independently from quantification. Danone reports on environmental inputs and outputs in physical quantities and monetises carbon but does not publish a quantification of other externalities. Yet, the group has been committed to improving its environmental footprints for years. It was a pioneer in the emission of green bonds and puts forward its sustainability strategy. Hence, it is difficult to establish a clear connection between valuation of externalities and sustainable strategy. A strong strategy can also rely on qualitative assessments or quantification of environmental inputs and outputs, without quantifying externalities per se.

If valuing externalities does not drive change by itself, it adds credibility and legitimacy to environmental concerns. Higher legitimacy can push firms and regulators to take environmental action towards an internalisation of externalities. A solution for environmental preservation that is closer to what already exists in our current economy is more likely to be accepted and implemented (Gray, 1992). Hence, we could say that giving a financial dimension to environmental impacts is a way of incorporating them in the "system" and advancing towards better preservation. If companies with the most negative externalities have lower revenues or higher costs because they compensate for the damages made, being environmentally virtuous becomes a competitive advantage, and thus becomes profitable.

However, the rise in monetisation of externalities may eventually cause a commodification of the environment (Gómez-Baggethun and Ruiz-Pérez, 2011). If companies can value the ecosystem services they protect or the positive externalities they generate, would they try to sell them for profit? Veolia's experiments point in that direction. Changing the pricing of contracts from remuneration for quantity to remuneration for quality and preservation is a way of pricing environmental services. Selling environmental services does not destroy them and could potentially be a way of improving their preservation, as the private owner can control the use of the resource. However, this freedom in exploitation also entails a risk of over-exploitation. In addition, commodification runs the risk of exacerbating inequalities by requiring people to pay for what was previously a public good.

Internalisation appears to be a double-edged sword. On the one hand, valuing externalities opens the possibility for compensation, and appropriation of ecosystem services can promote better management of resources. On the other hand, natural capital stops being incommensurable and can be traded-off (Espeland and Stevens, 1998). Not only does it deny the uniqueness and absolute value of some parts of the environment, but private appropriation also opens the possibility for over-exploitation by the owner. Commodification and merchant exchange of resources may deprive some populations of essential resources like clean water and air. Creating a market for environmental services is a form of economisation (Mennicken and Espeland, 2019) that often leads to the adoption of competitive and capitalistic behaviours. The ambition for



wealth accumulation and unlimited growth, that is inherent to today's capitalism, seems incompatible with preservation of the planet's limited resources.

Hence, it is unclear whether valuing externalities will lead to greater preservation of natural capital or enhance its over-exploitation. Given that initiatives are still at an early stage and evolving quickly, it is probably too early to draw firm conclusions on the evolution of business models and preservation of natural capital.

## Conclusion

From reviewing corporate attempts at valuing externalities, we can see that group-level, "value to society" methods seem predominant. These approaches provide a consolidated environmental reporting that resembles traditional financial statements. They use monetisation to communicate in a single currency, in the same language as investors and stakeholders, and to facilitate comparison with financial metrics.

Most are instances of Full Cost Accounting, that translate the magnitude of companies' impacts on human well-being into a monetary equivalent. They are holistic, as they try to capture all types of activity inputs, outputs, and environmental impacts, at all stages of the value chain, including scopes 1, 2 and 3. They consider multiple types of impact drivers and identify multiple consequences on the environment and humans for each. These approaches have the merit of going beyond input and output to capture impacts on people and the planet. Figures are weighted according to qualitative factors like geography, living conditions and other activities in the area to better capture the repercussions on human wellbeing.

Like financial accounting, these methodologies support decision-making at the scale of a project, a business unit, an entity, or a whole group. However, their sophistication and technicality can make them harder to grasp for non-expert audiences. Initiatives like the EP&L rely on multiple layers of estimates and monetisation coefficients, that can be difficult to understand and verify. When models are too complex, they risk becoming "black boxes" that lack transparency and auditability, especially in a context where each company creates its own reporting guidelines. A high level of sophistication can make the initiatives less actionable, as teams have more difficulty appropriating them. A change towards a more environmentally sustainable business model is a cooperative endeavour, with implication of functions like research and development, manufacturing or purchasing. Hence it is important that teams understand the metrics they are evaluated on and feel accountable.

As an alternative, some firms developed local and targeted approaches to value externalities at product or site level. Like group-wide methods, they commensurate impacts of the value chain on the environment to obtain aggregated indicators and identify trade-offs. However, they are not meant to be consolidated as they seek to account for local specificities and give a voice to local stakeholders. They adopt a more empirical and experimental approach, adapted to a smaller decision-making level. As a result, they are directed towards internal teams rather than shareholders and other outsiders that seek an overview of the group's performance.

The CARE method has the specificity of adopting a Sustainable Cost Accounting approach, that focuses on the magnitude of the investment to be made rather than of the externality itself. It is conceptually simpler as it does not monetise physical quantities, but also requires an in-depth evaluation of environmental impacts.

Commensuration of externalities provide a common currency for all impacts, and a common language approachable by all stakeholders. The use of formats like bridges, P&Ls, or graphs, makes reading more intuitive and resembles the traditional presentation of financial accounting.

Thus, commensuration fosters discussion with internal and external stakeholders, beyond managers and shareholders who are the predominant decision-makers. The consolidated presentation, using monetised indicators, is helpful to communicate to a non-expert audience, making reports like the EP&L good communication tools.

While companies like Kering have taken a proactive stance and implemented externality valuation, this type of method has only been adopted by a minority of companies. Indeed, quantifying externalities is resource intensive as it demands time, human expertise, and financial means to be carried out, especially in the implementation phase. Not all companies have the required resources, and if they do, it can be difficult to answer both to group-level and local concerns. Data collection, estimates building, analysis, and reporting constitute a sophisticated process that requires expertise and time to obtain meaningful results. Parts of it may be automated at a later stage but experimentation takes time, as is shown by Kering who took four years between the first pilot test and the first group reporting. In other companies, externality valuation is still at a research and development stage, while a majority keeps preferring a simpler “input output” reporting, in physical units. While newcomers can choose from existing frameworks such as the Value Balancing Alliance, there is no real harmonisation yet, meaning each firm must choose and develop what is most relevant to its needs. This freedom allows companies to shape their narrative and present themselves in a positive light, but also requires more effort to define, categorise and develop a methodology.

A growing number of investors and rating agencies push for an improved ESG reporting, for investment screening purposes. While some of them use qualitative questionnaires and assessments, others require a quantified reporting. Future regulations are also likely to go in the direction of more exhaustive and quantified ESG disclosures. While reporting used to be focused on GHG due to public awareness of climate change, concerns are broadening to other types of environmental impacts. Hence, companies have an interest in developing externality valuation to anticipate these demands.

Resorting to quantification, commensuration or monetisation is a way of increasing the credibility and legitimacy of environmental reporting. Indeed, these initiatives foster transparency by using well-defined datasets and calculation methods, that are auditable and, in some cases, made public. The mathematical nature of commensuration is associated with objectivity and rationality. It follows the principles of financial accounting, which are faithfulness, accuracy, neutrality, and completeness.

However, the quality of externality valuation is limited by the high number of estimates and assumptions needed to obtain an aggregated indicator. Uncertainty is due to the limits in scientific knowledge about ecology, and to the limited resources a company can put in collecting data and forming estimates. In addition, the choice of classifications, indicators, and calculations are influenced by the social contexts, interests, and priorities of the firm, which means that perfect neutrality is impossible in externality reporting. The complexity of the results and the lower development of environmental audit compared to financial audit limit the verifiability of the reporting. As a result, externality valuation contains at least some level of uncertainty and bias.

The aggregated or consolidated nature of many indicators also pose the question of the substitutability of capitals. If commensuration can sum different types of natural capitals and impacts in a single impact number, it implies that one type can be substituted for the other or that a negative impact can be mitigated by another positive impact. While it is sometimes true, as in the case of carbon capture offsetting GHG, critical natural capital cannot be replaced, and not all types of environmental resources are equivalent. Most methods do not reflect planetary boundaries, which give an absolute limit to the environmental resources that can be consumed until human basic needs are no longer met, or the planet undergoes radical climatic and ecosystem damage. In a strong sustainability vision, the cost of critical capital or the incremental cost of resource when planetary boundaries are crossed are infinite and incommensurable. Commensuration of all types of capitals and impacts allows for consolidated indicators but is

incompatible with the idea that some ecosystem services are incommensurable and should be sanctuaried.

Even with these inaccuracies, quantification has the potential of being a self-fulfilling prophecy: by giving importance to a topic, it directs resources towards that concern and accelerates progress. What is pointed out in commensuration becomes more visible, more legitimate, and more prioritised in decision-making, triggering awareness, discussion, and concrete changes.

Valuing externalities enables to price them, and to internalise them either through private transactions or through a potential tax scheme. If firms start paying for their negative externalities, reducing them becomes a source for competitive advantage in a capitalistic perspective. In addition, well-defined rights on natural resources can be a tool for better preservation, as it makes their owner accountable for their exploitation, and prevents the overexploitation observed in public goods.

However, we do not see radical changes in the business models and aspirations of companies who have implemented externality valuation. Even with greener goods and services, they still promote revenue growth and profit accumulation in a traditional capitalistic perspective. While infinite output growth can be achieved while reducing impact intensity, it eventually increases absolute impact. In addition, the complexity and lack of maturity of the frameworks does not allow for immediate actionability.

If changes occur towards internalisation, making environmental services commensurable runs the risk of commodifying them. While monetisation does not systematically translate in capitalistic appropriation, it paves the way for environmental services to become tradeable on markets and exploited for private interests. In this case, internalisation would promote capitalistic exploitation of natural resources in the interest of private actors rather than that of people and the planet.

As a result, the contribution of externality valuation to preservation of the environment is uncertain and ambiguous. On the other hand, some companies with strong sustainability strategies do not monetise their externalities. They act on the basis of qualitative assessment or quantification of physical input and output, like Danone. While externality reporting is related to environmental commitments, it is not a prerequisite to craft an ESG strategy.

Externality valuation is a recent practice that is still undergoing developments and has not had time to show its full effects yet. While it can be a useful form of reporting and an incentive towards environmental preservation, its effects on companies' business models are still unclear. Other factors like regulation, or ESG strategy and targets also play a role in firms' environmental action.

It would have been useful to follow companies on a longer time span to observe the process for developing and implementing these new valuation models. It would have also allowed to better evaluate which strategic and operational changes stem from the quantification of externalities, and the actual changes in environmental impacts that arise from them.

In addition, besides Veolia and Michelin that I interviewed, I only had access to public information for other companies. Since some externality frameworks are more local or are still in development, they are not published. More observation on the internal indicators and research initiatives by companies would have given a complementary view to what is exposed here.

Finally, it is worth restating that this study is not exhaustive, and the field of ESG reporting is evolving fast. Other companies have either adopted existing methods like the EP&L or are creating their own. International frameworks and regulation attempts like the GRI, SASB or TCFD are still developing and being adopted by new actors. Many companies who adopt new ESG reporting methods use an iterative process to refine their metrics year after year, so it is likely that models become more complete as the years and iterations go on.

We can expect more development in the field of environmental externalities in the upcoming years, both at a regulatory level, and at a voluntary, corporate level. Qualitative communication on ESG matters is also used a lot and could be studied separately.

## List of Abbreviations

CARE	Comptabilité Adaptée au Renouvellement de l'Environnement (Accounting Adapted to the Renewal of the Environment)
CSRD	European Union Corporate Sustainability Reporting Directive
DALY	disability-adjusted life years
EFRAG	European Financial Reporting Advisory Group
EPS	earnings per share
ESG	Environmental, Social, and Governance
GAAP	Generally Accepted Accounting Principles
GHG	greenhouse gases
GRI	Global Reporting Initiative
IASB	International Accounting Standards Board
IPCC	International Panel on Climate Change
ISSB	International Sustainability Standards Board
LCA	life cycle assessment
NFRD	European Union Non-Financial Reporting Directive
NPV	net present value
OECD	Organisation for Economic Cooperation and Development
QALY	quality-adjusted life years
SASB	Sustainable Accounting Standards Board
SPOT	Sustainable Product Optimisation Tool
TCFD	Task force on Climate-related Financial Disclosures
TEEB	The Economics of Ecosystems and Biodiversity report
TIMM	Total Impact Measurement and Management
VBA	Value Balancing Alliance
VSL	value of a statistical life

## Appendices & exhibits

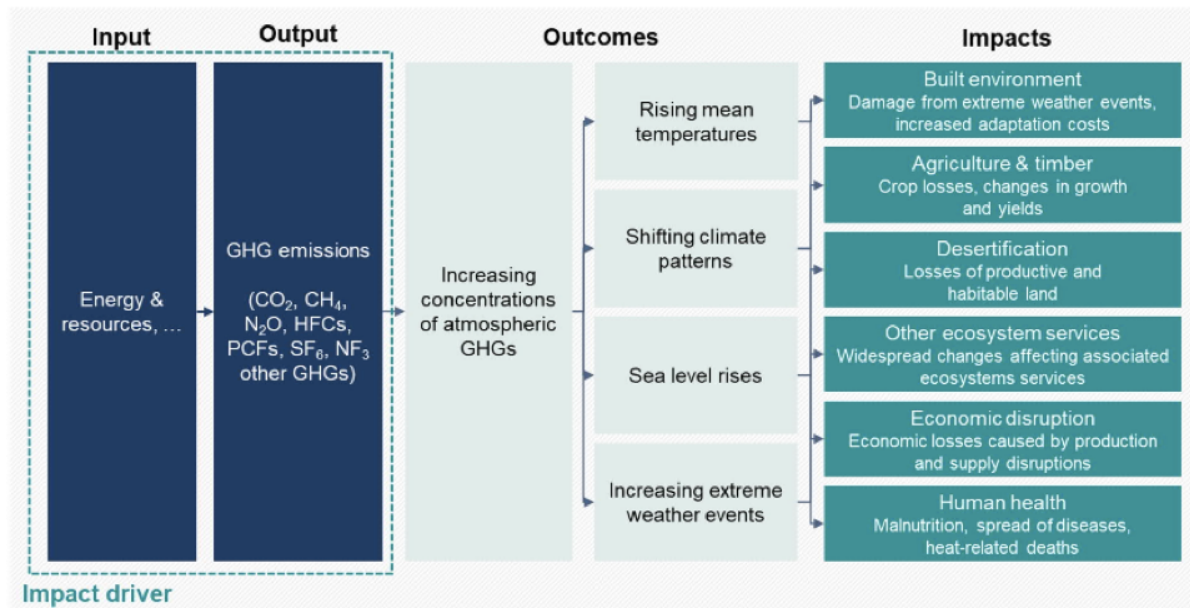
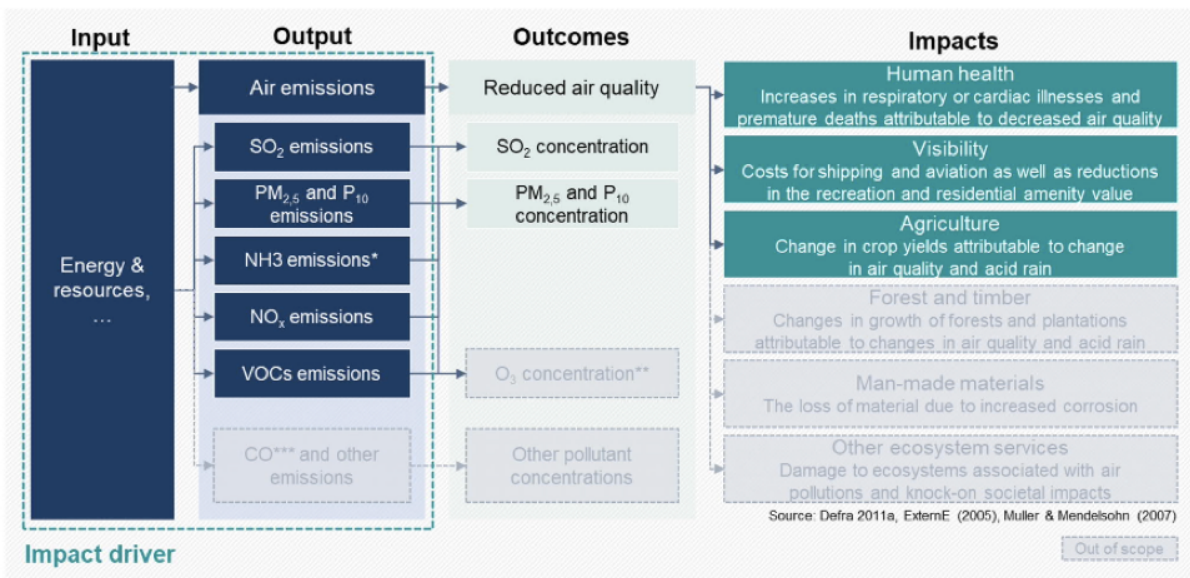


Figure 1: Simplified impact pathway GHGs

1 – Value Balancing Alliance (2021): Simplified impact pathway GHGs



\*Ammonia (NH<sub>3</sub>) has a short lifetime in the atmosphere and most (by weight) is quickly deposited. While this process can have localized impacts on areas close to the emissions source, the impacts are minor compared to impacts on health. Given the low materiality, this secondary deposition in soil and water is omitted from this methodology.

\*\* Ozone (O<sub>3</sub>) is formed via a non-linear reaction between VOCs and NO<sub>x</sub> in the presence of sunlight.

\*\*\*The close relationships between CO, NO<sub>x</sub>, and VOC pathways to O<sub>3</sub> formation make it difficult to avoid double counting of secondary impacts.

Therefore, CO is excluded from Muller and Mendelsohn's (2007) analysis, Defra's (2011a) air emissions damage cost methodology and ExternE (2005) analyses.

Figure 2: Simplified impact pathway other air emissions

2 – Value Balancing Alliance (2021): Simplified impact pathway air emissions



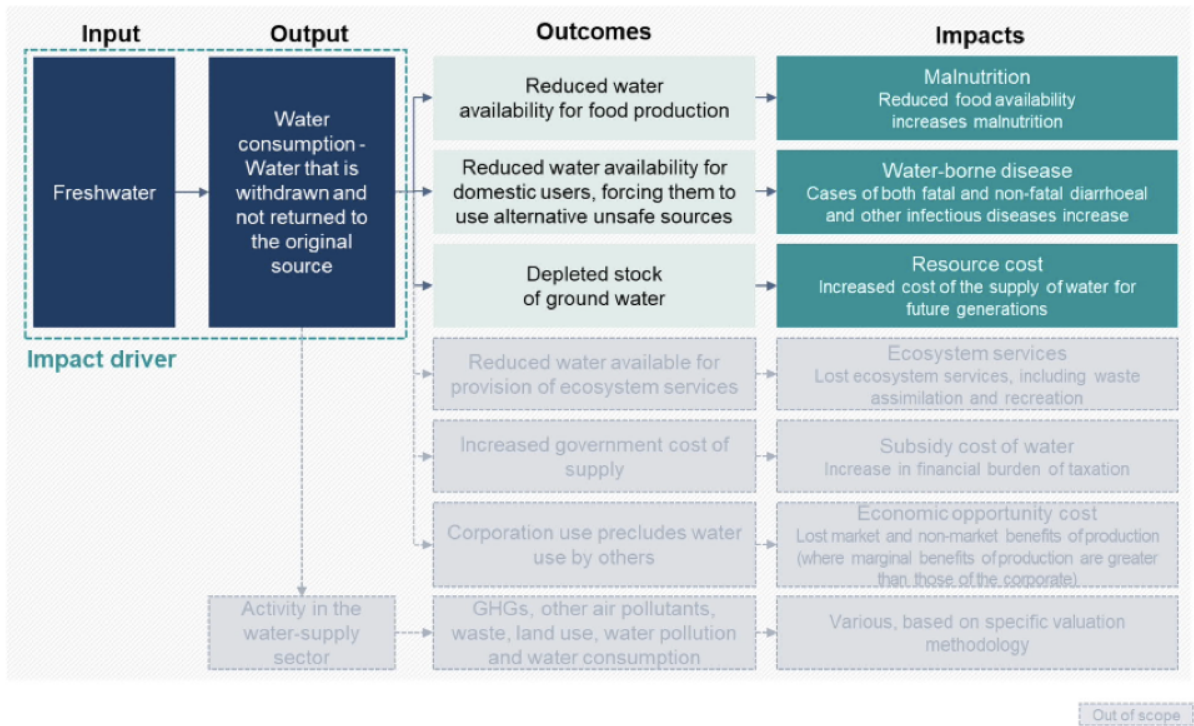


Figure 3: Simplified impact pathway water consumption

3 – Value Balancing Alliance (2021): simplified impact pathway water consumption

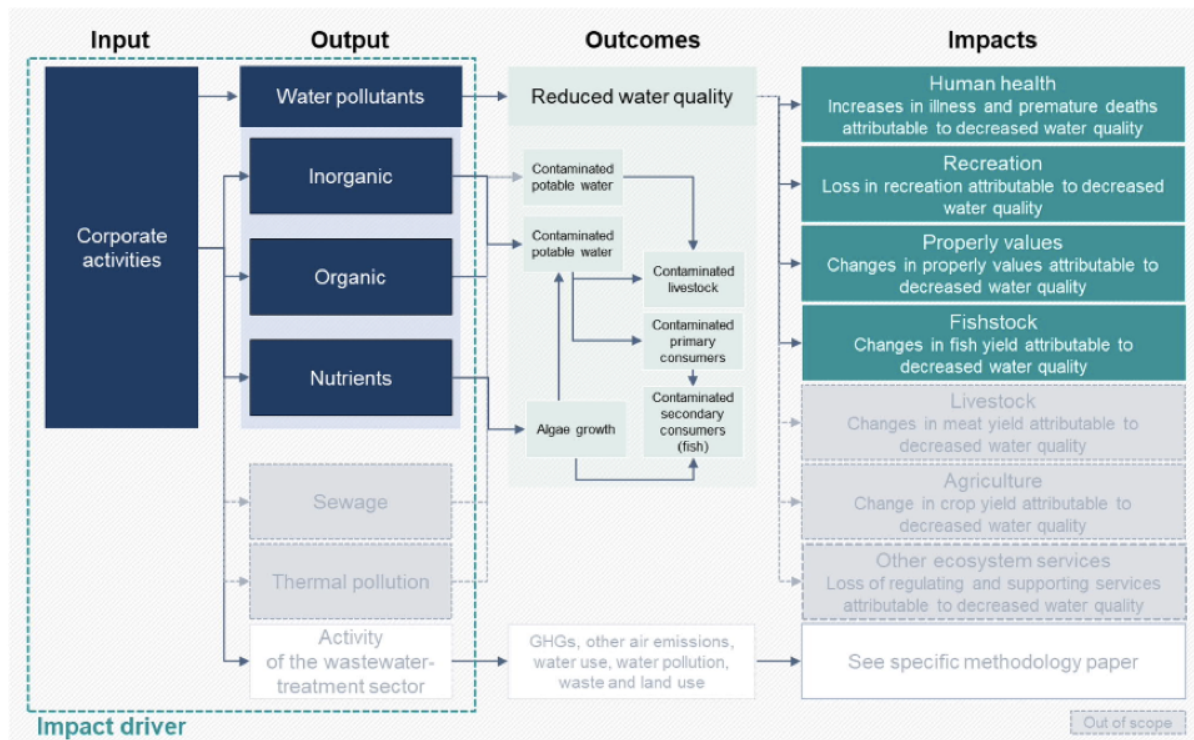


Figure 5: Simplified impact pathway water pollutants

4 – Value Balancing Alliance (2021): simplified impact pathway water pollutants



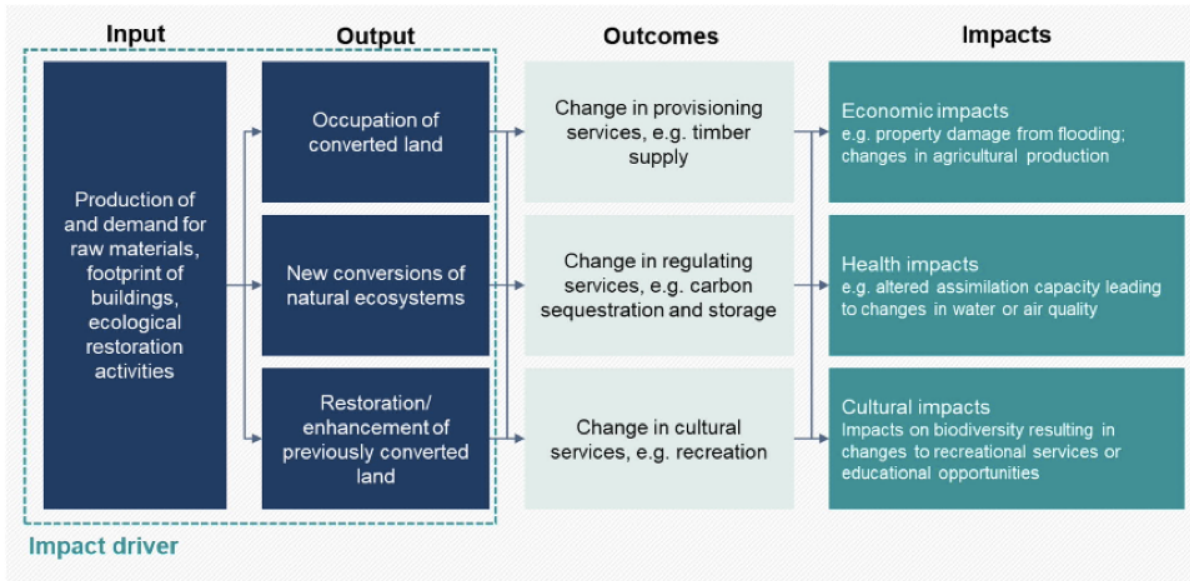


Figure 9: Simplified impact pathway land use

5 – Value Balancing Alliance (2021): simplified impact pathway land use

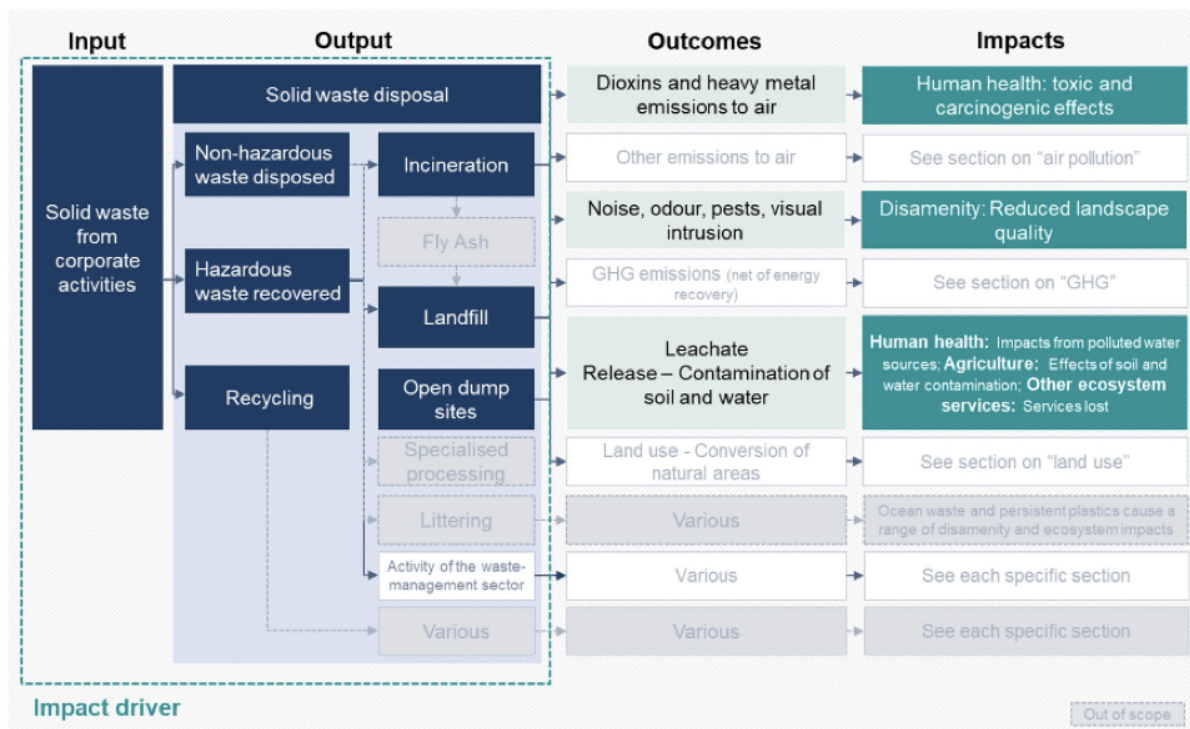
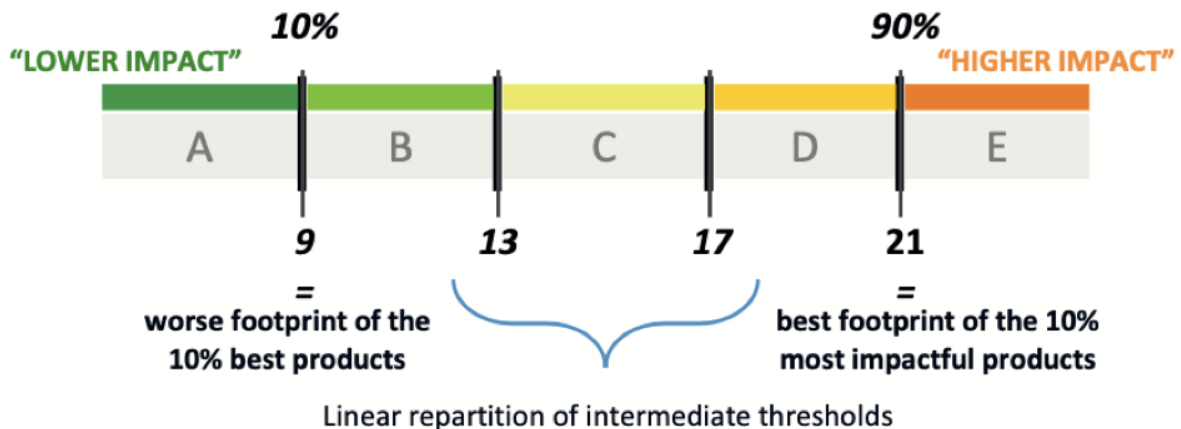


Figure 13: Simplified impact pathway waste

6 – Value Balancing Alliance (2021): simplified impact pathway waste

IMPACT	WEIGHING VALUE	UNIT
Climate Change	25.497%	dimensionless (%)
Water Scarcity	1.397%	dimensionless (%)
Freshwater Ecotoxicity	2.314%	dimensionless (%)
Freshwater Eutrophication	8.778%	dimensionless (%)
Marine Eutrophication	1.500%	dimensionless (%)
Water Acidification	1.449%	dimensionless (%)
Fossil & Mineral Resources Depletion	11.125%	dimensionless (%)
Land Transformation	25.427%	dimensionless (%)
Terrestrial Eutrophication	0.829%	dimensionless (%)
Particulate Matter	16.250%	dimensionless (%)
Toxicity via Environment	3.167%	dimensionless (%)
Ionising Radiation	0.040%	dimensionless (%)
Ozone Depletion	0.755%	dimensionless (%)
Photochemical Ozone Formation	1.471%	dimensionless (%)

7 – L'Oréal: weighting of factors in SPOT



8 – L'Oréal: repartition of grades in SPOT

$$\text{MEF} = \frac{\text{Reporting year energy use (GJ/t)} \times 15}{\text{Group energy use 2005 (GJ/t)}} + \frac{\text{Reporting year water withdrawals (m}^3\text{/t)} \times 15}{\text{Group water withdrawals 2005 (m}^3\text{/t)}} + \frac{\text{Reporting year VOC emissions (kg/t)} \times 25}{\text{Group VOC emissions 2005 (kg/t)}} + \frac{\text{Reporting year CO}_2\text{ emissions (t/t)} \times 15}{\text{Group CO}_2\text{ emissions 2005 (t/t)}} + \frac{\text{Reporting year waste generated (kg/t)} \times 15}{\text{Group waste generated 2005 (kg/t)}} + \frac{\text{Reporting year waste landfilled (kg/t)} \times 15}{\text{Group waste landfilled 2005 (kg/t)}}$$

9 – Michelin (2020): formula of Michelin Environmental Footprint indicator

Norm/framework	Date	Country of origin	Issued by	Core focus	Target organisations
ISO 14001	1996, last revised 2015	International	International Organisation for Standardisation (ISO)	Implementation of an environmental management system by defining a policy, setting goals, mobilising resources and leading continuous improvement	All: companies, NGOs, administrations...
Global Reporting Initiative (GRI)	1998	International	Independent nonprofit	Standardise ESG reporting to make it comparable and transparent through Universal standards, Sector standards and Topic Standards	Private corporations
B-Corp Certification	2006	United States	Independent nonprofit	Evidence-based certification covering all dimension of ESG including governance, employees, communities, environment and clients	Mostly medium to large private corporations
The Economics of Ecosystems and Biodiversity (TEEB)	2007	International	Study by Pavan Sukhdev (2007-2011)	Accounting for impacts on natural capital and ecosystems	Policy makers and companies
Sustainable Accounting Standard Board (SASB)	2011	United States	Independent organisation	Identify the most material ESG metrics by industry to achieve quantitative reporting on 6 types of capitals: human, social, business model & innovation, leadership & governance, environment	Private corporations
System of Environmental Economic Accounting (SEEA)	2012	International	UN	International standard on accounting for natural capital and ecosystems. Mapping of services offered by ecosystems and valuation	Any users of statistics
Integrated Reporting (IR) Framework	2013	International	IIRC	Principles for integrated reporting focused on value creation, mostly destined to financing providers. Focuses on interactions between the company and 6 types of capital: financial, manufactured, intellectual, human, social & relationship, natural.	Private corporations
Directive on Non-Financial Reporting	2014	European Union	European Union	Report on non-financial risks & opportunities in 5 topics: environmental, social & treatment of employees, human rights, anti-corruption & bribery, diversity on company boards	Large corporations (listed or over 500 employees)
Principles for Responsible Investment (PRI)	2015	International	UN	Guidance on the way to integrate ESG in investment decisions and ownership policies	Institutional investors and financial institutions
Task Force on Climate Related Disclosure (TCFD)	2015	G20	G20 Financial Stability Board	Disclosure on climate-related metrics and targets, assessment of risks & opportunities, scenario analysis, adaptation of governance	Private corporations
EU Taxonomy	2020	European Union	European Union	Science-based classification identifying activities that are environmentally sustainable (climate, water, pollution, biodiversity, circular economy)	Public authorities, financing providers, stakeholders

9 – Brief overview of some international frameworks and certifications

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## Interviews

### **Veolia**

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