A Framework for Sustainable Finance

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A FRAMEWORK FOR SUSTAINABLE FINANCE

Abstract

To guide the transformation towards a sustainable and inclusive economy, the United Nations has developed the Sustainable Development Goals (SDGs). Sustainable development is an integrated concept with three aspects: economic, social and environmental. This paper starts by reviewing the environmental and social challenges that society is facing. Why should finance contribute to sustainable development? The main task of the financial system is to allocate capital to its most productive use. Financial institutions have started to avoid unsustainable companies from a risk perspective, which we label as Sustainable Finance 1.0 and 2.0 in our new framework. The frontrunners are now increasingly investing in sustainable companies and projects to create long-term value for the wider community (Sustainable Finance 3.0).

JEL Classification: G11, G21, H23, H41, Q01

Keywords: Sustainable Development, Environmental, Social and Governance (ESG) Risks, Sustainable Finance, corporate governance, Short-termism

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1. Introduction

The Industrial Revolution, and the development of production processes dependent on fossil fuels that it triggered, has brought prosperity in the form of economic and population growth. At the same time, this evolution away from a previously 'empty' world[1] with abundant natural resources has intensified social and environmental challenges (Daly and Farley, 2011). Mass production in a competitive economic system has led to long working hours, underpayment and child labour, first in the developed world and later relocated to the developing world. Social regulations have been increasingly introduced to counter these practices and to promote decent work and access to education and healthcare. Mass production and consumption is also stressing the Earth system through pollution and depletion of natural resources. Climate change is now the most pressing ecological constraint (Stern, 2008).

There is broad acknowledgement on the need for a transition to a low-carbon, circular economy to overcome these environmental challenges. While an early transition – with substantial cuts in carbon emissions starting in 2020 – would allow for production and consumption patterns to be gradually adjusted, a late transition – starting in 2030 – is likely to cause sudden shocks and lead to the stranding of assets that have lost their productive value (ASC, 2016). Many natural resources companies are still in denial, irrationally counting on a late and gradual transition. To guide the transformation towards a sustainable and inclusive economy, the United Nations (2015) has developed the 2030 Agenda for Sustainable Development, which will require behavioural change.

Sustainable development is an integrated concept with three aspects: economic, social and environmental. This paper starts by reviewing the sustainability challenges that society is facing. On the environmental front, climate change, land-use change, biodiversity loss and depletion of natural resources are destabilising the Earth system. Next, poverty, hunger and lack of healthcare are signs that many people live below minimum social standards. Sustainable development means that current and future generations should have the resources they need, such as food, water, healthcare and energy, without stressing the Earth system (Raworth, 2017).

Why should finance contribute to sustainable development? The main task of the financial system is to allocate funding to its most productive use. Finance can play a leading role in allocating investment to sustainable companies and projects and thus accelerate the transition to a low-carbon, circular economy. Sustainable finance considers how finance (investing and lending) interacts with economic, social and environmental issues. In the allocation role, finance can assist in making strategic decisions on the trade-offs between sustainable goals. Moreover, investors can exert influence over the companies they invest

[1] In the empty world scenario, the economy is very small relative to the larger environmental ecosystem and the environment is thus not scarce. Continued growth of the physical economy into a non-growing ecosystem will eventually lead to the 'full world economy' (Daly and Farley, 2011).

in. Long-term investors can thus steer companies towards sustainable business practices. Finally, finance is good at pricing risk for valuation purposes and can thus help to deal with the inherent uncertainty about environmental issues, such as the impact of carbon emissions on climate change. Finance and sustainability both look at the future.

The thinking about sustainable finance has gone through different stages over the last few decades. The focus is gradually shifting from short-term profit (Friedman, 1970) towards long-term value creation (Tirole, 2017). This paper analyses these stages and provides a new framework for sustainable finance. Financial and non-financial firms traditionally adopt the shareholder model, with profit maximisation as the main goal. A first step in sustainable finance (Sustainable Finance 1.0) would be for financial institutions to avoid investing in companies with very negative impacts, such as tobacco, cluster bombs or whale hunting. Some firms are starting to incorporate social and environmental considerations in the stakeholder model (Sustainable Finance 2.0).

This paper highlights the tension between the shareholder and stakeholder models. Should policymakers allow a shareholder-oriented firm to take over a stakeholder-oriented firm? Or do we need to protect firms that are more advanced in sustainability? Another key development is the move from risk to opportunity. While financial firms have started to avoid (very) unsustainable companies from a risk perspective (Sustainable Finance 1.0 and 2.0), the frontrunners are now increasingly investing in sustainable companies and projects to create value for the wider community (Sustainable Finance 3.0), which Tirole (2017) defines as the common good.

This paper is organised as follows. Section 2 reviews the sustainability challenges on the environmental and social front. Section 3 introduces our framework for sustainable finance. Next, Section 4 provides an application of the framework in the case of a company take-over. Finally, Section 5 concludes.

2. Sustainability challenges

Our economic models were developed in an empty world with an abundance of goods and services produced by nature (Daly and Farley, 2011). That was at the onset of the Industrial Revolution in the 19th century. Labour and capital were the scarce production factors to optimise in economic production, while nature and its services were freely available. The famous Cobb-Douglas production function thus uses only labour input and capital input for the production of goods (Cobb and Douglas, 1928).

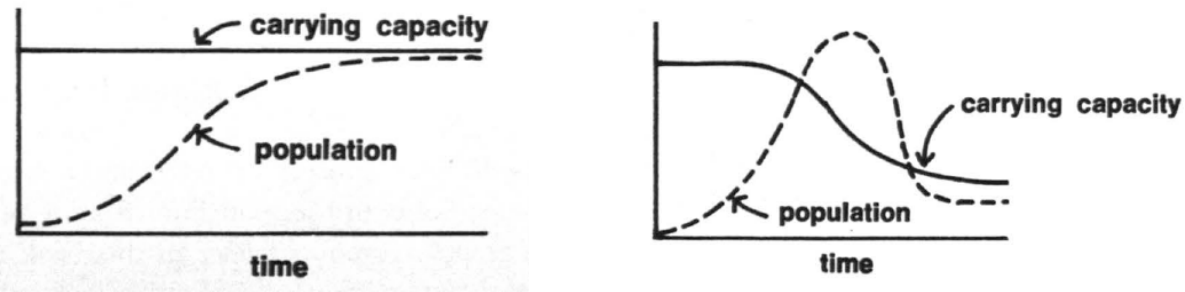
But the Industrial Revolution had profound impacts on the economy, society and the global ecosystem. Human society became largely dependent on fossil fuels and other non-renewable resources, partly in response to the depletion of forests as fuel. This increased energy use provided access to other raw materials. Technological advances, dependent on fossil fuel (starting with the steam engine), allowed unprecedented production of consumer

goods, spurring economic and population growth. Urbanisation led to a reduction of arable land, driving further deforestation.

Back in the early 1970s, the Club of Rome was the first to highlight that the Earth system cannot support these rates of economic and population growth much beyond the year 2100, even with advanced technology. In their aptly titled report *Limits to Growth*, the Club of Rome examines five basic factors that determine and, in their interactions, limit growth on this planet: i) population increase, ii) food production, iii) non-renewable resource depletion, iv) industrial output, and v) pollution generation. They also suggest that humankind can create a society in which it can live indefinitely on earth if it imposes limits on itself and its production of material goods to achieve a state of global equilibrium with population and production in carefully selected balance (Meadows, *et al*, 1972).

To illustrate the limits to growth, the Club of Rome developed a world model that analyses the carrying capacity of the planet and population growth. Population growing in a limited environment can approach the ultimate carrying capacity of that environment in several possible ways. It can adjust smoothly to an equilibrium below the environmental limit by means of a gradual decrease in growth rate, as shown in the left panel of Figure 1. It can also overshoot capacity by consuming some necessary non-renewable resource or causing pollution, as shown in the right panel. This behaviour has occurred in many natural systems. A major purpose in constructing the world model has been to determine which, if any, of the behaviour modes will be most characteristic of the world system as it reaches the limits to growth.

Figure 1: The world model



Source: Limits to Growth (Meadows, *et al*, 1972).

While the Club of Rome was a private initiative, the United Nations (UN) installed the Brundtland Commission, formally known as the World Commission on Environment and Development, to unite countries to pursue sustainable development together. The Brundtland Report (1987) argues that "...the "environment" is where we live; and "development" is what we all do in attempting to improve our lot within that environment. The two are inseparable." The report defines sustainable development as “development that

meets the needs of the present without compromising the ability of future generations to meet their own needs". The Brundtland report thus reinforces the fact that sustainability is about the future.

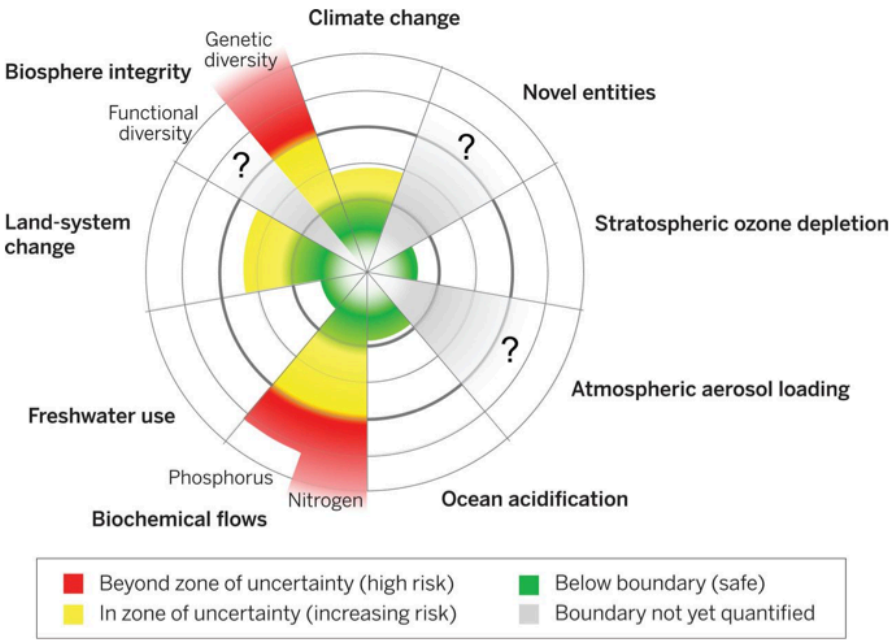
Climate change is one the largest environmental risks affecting society (Stern, 2008). In the 2015 Paris Agreement on climate change (COP21), countries confirmed the target of limiting the rise in global average temperatures relative to those in the pre-industrial world to 2°C two degrees Celsius, and to pursue efforts to limit the temperature increase to 1.5°C (UNFCCC, 2015). Doing this would ensure that the stock of carbon dioxide and other greenhouse gases in the atmosphere does not exceed a certain limit. The Intergovernmental Panel on Climate Change estimates that the remaining carbon budget amounts to 900 gigatonnes of CO_2 from 2015 onwards. The speed with which the limit is reached depends on the emissions pathway. If current global carbon emissions at about 40 gigatonnes a year are not drastically cut, the 2°C limit would be reached in two decades.

2.1. Environmental challenges

The aim is to keep the planet liveable for current and future generations. There is increasing evidence that human activities are affecting the Earth system, threatening the planet's future liveability. The planetary boundaries framework of Steffen *et al* (2015) defines a safe operating space for humanity within the boundaries of nine productive ecological capacities of the planet. The framework is based on the intrinsic biophysical processes that regulate the stability of the Earth system on a planetary scale. The green zone in Figure 2 is the safe operating space, yellow represents the zone of uncertainty (increasing risk) and red indicates the zone of high risk. Table 1 specifies the control variables and quantifies the ecological ceilings.

Applying the precautionary principle, the planetary boundary itself lies at the intersection of the green and yellow zones. To illustrate how the framework works, we look at the control variable for climate change, the atmospheric concentration of greenhouse gases. The zone of uncertainty ranges from 350 to 450 parts per million (ppm) of carbon dioxide. We crossed the planetary boundary of 350 ppm in 1995, with a level of 399 ppm in 2015. The upper limit of 450 ppm is consistent with the goal (at a fair chance of 66 per cent) to limit global warming to 2° Celsius above the pre-industrial level and lies at the intersection of the yellow and red zones.

Figure 2: The planetary boundaries



Source: Steffen *et al* (2015).

The current linear production and consumption system is based on extraction of raw materials (take), processing into products (make), consumption (use) and disposal (waste). Traditional business models centred on a linear system assume the ongoing availability of unlimited and cheap natural resources. This is increasingly risky because non-renewable resources, such as fossil fuels, minerals and metals, are increasingly under pressure, while potentially renewable resources, such as forests, rivers and prairies, are declining in their extent and regenerative capacity.

With this linear economic system, we are crossing planetary boundaries beyond which human activities might destabilise the Earth system. In particular, the planetary boundaries of climate change, land-system change (deforestation and land erosion), biodiversity loss (terrestrial and marine) and biochemical flows (nitrogen and phosphorus, mainly because of intensive agricultural practices) have been crossed (see Figure 2). A timely transformation towards an economy based on sustainable production and consumption, including use of renewable energy, reuse of materials and land restoration, can mitigate these risks to the stability of the Earth system.

Table 1: The ecological ceiling and its indicators of overshoot

Earth system pressure	Control variable	Planetary boundary	Current value and trend
Climate change	Atmospheric carbon dioxide concentration; parts per million (ppm)	At most 350 ppm	399 ppm and rising (worsening)
Biosphere loss	Genetic diversity: rate of species extinction per million species per year	At most 10	Around 100-1,000 and rising (worsening)
	Functional diversity: biodiversity intactness index (BII)	Maintain BII at 90%	84% applied to southern Africa only
Land-system change	Area of forested land as a proportion of forest-covered land prior to human alteration	At least 75%	62% and falling (worsening)
Freshwater use	Blue water consumption; cubic kilometres per year	At most 4,000 km^3	Around 2,600 km^3 and rising (intensifying)
Biochemical flows	Phosphorus applied to land as fertiliser; millions of tons per year	At most 6.2 million tons	Around 14 million tons and rising (worsening)
	Reactive nitrogen applied to land as fertiliser; millions of tons per year	At most 62 million tons	Around 150 million tons and rising (worsening)
Ocean acidification	Average saturation of aragonite (calcium carbonate) at the ocean surface, as a percentage of pre-industrial levels	At least 80%	Around 84% and falling (intensifying)
Air pollution	Aerosol optical depth (AOD); much regional variation, no global level yet defined	_	_
Ozon layer depletion	Concentration of ozon in the stratosphere; in Dobson Units (DU)	At least 275 DU	283 DU and rising (improving)
Novel entities (e.g. chemical pollution)	No global control variable yet defined	_	_

Source: Steffen *et al* (2015).

2.2. Social foundations

Mass production in a competitive economic system has led to long working hours, underpayment and child labour, first in the developed world and later relocated to the developing world. Human rights provide the essential social foundation for all people to lead lives of dignity and opportunity. Human rights norms assert the fundamental moral claim each person has to life's essentials, such as food, water, healthcare, education, freedom of

expression, political participation and personal security. Raworth (2017) defines the social foundations as the twelve top social priorities, grouped into three clusters, focused on enabling people to be: 1) well: through food security, adequate income, improved water and sanitation, housing and healthcare; 2) productive: through education, decent work and modern energy services; and 3) empowered: through networks, gender equality, social equity, having political voice and peace and justice.

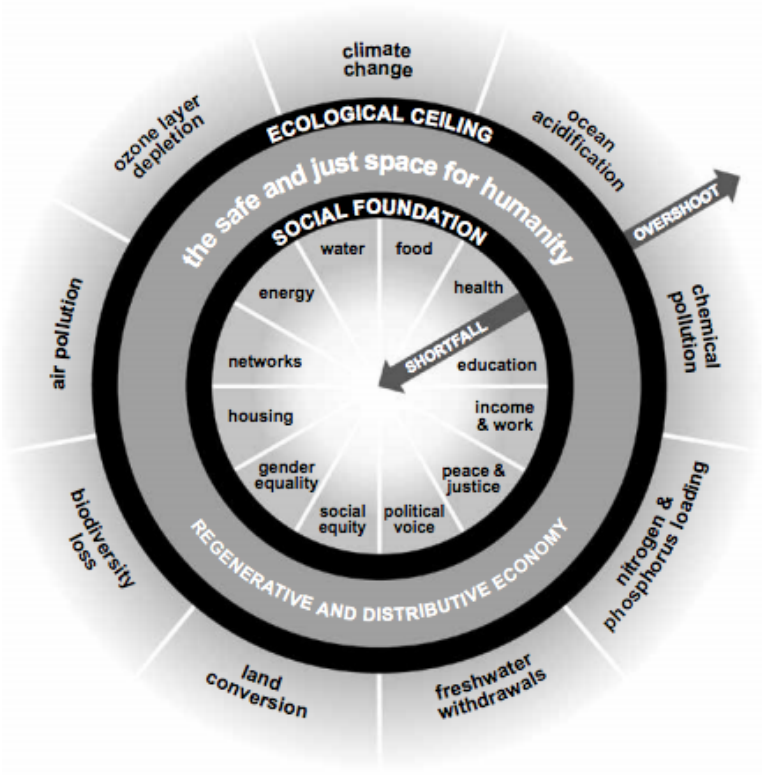
While these social foundations only set out the minimum of every human's claims, sustainable development envisions people and communities prospering beyond this, leading lives of creativity and fulfilment. Sustainable development combines the concept of planetary boundaries with the complementary concept of social foundations or boundaries. Sustainable development means that current and future generations have the resources needed, such as food, water, healthcare and energy, without stressing processes within the Earth system (Raworth, 2017).

But many people are still living below the social foundations of no hunger, no poverty (a minimum income of $3.10 a day), access to education and access to clean cooking facilities (see Table 2). More broadly, political participation, which is the right of people to be involved in decisions that affect them, is a basic value of society. The UN's Universal Declaration of Human Rights states that "recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world". Human rights are an important social foundation. Next, decent work can lift communities out of poverty and underpins human security and social peace. The 2030 Agenda for Sustainable Development (see Section 2.3) places decent work for all people at the heart of policies for sustainable and inclusive growth and development. Decent work has several dimensions: a basic living wage (which depends on a country's basic living basket), no discrimination (e.g. on gender, race or religion), no child labour, health and safety, and freedom of association.

From a societal perspective, it is important for business to respect these social foundations and to ban underpayment, child labour and human right violations. Social regulations have been introduced in developed countries, but these practices are still happening in developing countries. A case in point is the use of child labour in factories in developing countries producing consumer goods, like clothes and shoes, to be sold by multinational companies in developed countries. These factories often lack basic worker safety features, as witnessed by the Rana Plaza factory collapse in Bangladesh (Schoenmaker, 2017). Another example is the violations of the human rights of indigenous people, often in combination with land degradation and pollution, by extractive companies in the exploration and exploitation of fossil fuels, minerals and other raw materials.

Kate Raworth (2017) has summarised the social foundations and planetary boundaries in the Doughnut, which shows how the safe and just space for humanity lies between the social foundation of human well-being and the ecological ceiling of planetary pressure (see Figure 3). Table 1 specifies the ecological ceiling and Table 2 the social foundation.

Figure 3: The Doughnut: the safe and just space for humanity



Source: Raworth (2017).

Table 2: The social foundation and its indicators of shortfall

Dimension	Illustrative indicator (percent of global population unless otherwise stated)	%	Year
Food	Population undernourished	11%	2014-16
Health	Population living in countries with under-five mortality rate exceeding 25 per 1,000 live births	46%	2015
	Population living in countries with life expectancy at birth of less than 70 years	39%	2013
Education	Adult population (aged 15+) who are illiterate	15%	2013
	Children aged 12-15 out of school	17%	2013
Income and work	Population living on less than the international poverty limit of $3.10 a day	29%	2012
	Proportion of young people (aged 15-24) seeking but not able to find work	13%	2014
Water and sanitation	Population without access to improved drinking water	9%	2015
	Population without access to improved sanitation	32%	2015
Energy	Population lacking access to electricity	17%	2013
	Population lacking access to clean cooking facilities	38%	2013
Networks	Population stating that they are without someone to count on for help in times of trouble	24%	2015
	Population without access to the Internet	57%	2015
Housing	Global urban population living in slum housing in developing countries	24%	2012
Gender equality	Representation gap between women and men in national parliaments	56%	2014
	Worldwide earnings gap between women and men	23%	2009
Social equity	Population living in countries with a Palma ratio of 2 or more (the ratio of the income share of the top 10% of people to that of the bottom 40%)	39%	1995-2012
Political voice	Population living in countries scoring 0.5 or less out of the 1.0 in the Voice and Accountability Index	52%	2013
Peace and justice	Population living in countries scoring 50 or less out of 100 in the Corruption Perceptions Index	85%	2014
	Population living in countries with a homicide rate of 10 or more per 10,000	13%	2008-13

Source: Raworth (2017).

2.3. Sustainable development

To guide the transformation towards a sustainable and inclusive economy, the United Nations has developed the 2030 Agenda for Sustainable Development (UN, 2015). The 17 UN Sustainable Development Goals (SDGs) stimulate action over the 2015-2030 period in areas of critical importance for humanity and the planet. Following Rockström and Sukhdev (2015), we classify the SDGs according to the levels of the economy, the society and the environment:

Economic goals

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 12. Ensure sustainable consumption and production patterns

Societal goals

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Environmental goals

Goal 6. Ensure availability and sustainable management of water and sanitation for all

Goal 13. Take urgent action to combat climate change and its impacts

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss

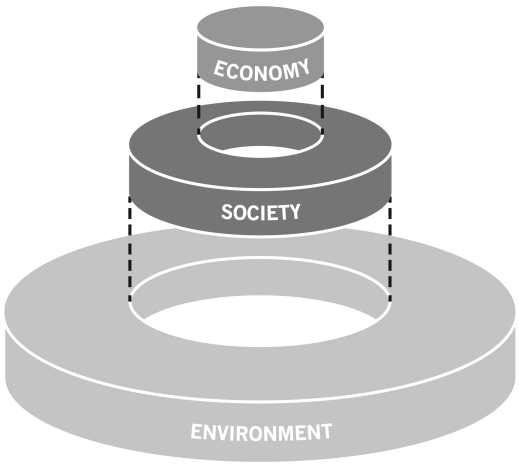
Overall goal

Goal 17. Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

The SDGs are interrelated. A case in point is the move to sustainable consumption and production (economic goal 12) and sustainable cities (societal goal 11), which are instrumental to combat climate change (environmental goal 13). Another example is an appropriate income and decent work for all (economic goal 8), which is instrumental in attaining the societal goals 1 to 4. Through a living wage (i.e. a wage for a full-time worker sufficient to provide his or her family's basic needs for an acceptable standard of living), households can afford food, healthcare and education for their family.

Figure 4 illustrates the three levels and the ranking between them. A liveable planet is a precondition or foundation for humankind to thrive. Next, we need a cohesive and inclusive society to organise production and consumption in order to ensure enduring prosperity for all. Acemoglu and Robinson (2012) show that political institutions that promote inclusiveness generate prosperity. Inclusiveness allows everyone to participate in economic opportunities. Next, there can be resource conflicts: unequal communities may disagree over how to share and finance public goods. These conflicts, in turn, break social ties and undermine the formation of trust and social cohesion (Barone and Mocetti, 2016).

Figure 4: Sustainable development challenges at different levels



Source: Adapted from Rockström and Sukhdev (2015).

Gladwin, Kennelly and Krause (1995) define five principles of sustainable development:

1. Comprehensiveness: the concept of sustainable development is holistic or all-embracing in terms of space, time and component parts. Sustainability embraces both environmental and human systems, both nearby and far-away, in both the present and the future;
2. Connectivity: sustainability demands an understanding of the world's challenges as systemically interconnected and interdependent;
3. Equity: a fair distribution of resources and property rights, both within and between generations;

4. Prudence: keeping life-supporting ecosystems and interrelated socio-economic systems resilient, avoiding irreversible actions, and keeping the scale and impact of human activities within regenerative and carrying capacities;
5. Security: sustainable development aims at ensuring a safe, healthy, high quality of life for current and future generations.

Although sustainable development is a holistic concept, Norström *et al* (2014) argue to address trade-offs between the ambition of economic, social and environmental goals and the feasibility of reaching them, recognising biophysical, social and political constraints.

System perspective

While it is tempting to start working on partial solutions at each level, the environmental, societal and economic challenges are interlinked. It is important to embrace an integrated social-ecological system perspective (Norström *et al*, 2014). Such an integrated system perspective highlights the dynamics that such systems entail, including the role of ecosystems in sustaining human wellbeing, cross-system interactions, and uncertain thresholds.

Holling (2001) describes the process of sustainable development as embedded cycles with adaptive capacity. A key element of adaptive capacity is the resilience of the system to deal with unpredictable shocks (which is the opposite of the vulnerability of the system). An adaptive cycle that aggregates resources and periodically restructures to create opportunities for innovation is a fundamental unit for understanding complex systems, from cells to ecosystems. But some systems are maladaptive and trigger, for example, a poverty trap or land degradation (i.e. the undermining of the quality of soil as a result of human behaviour or severe weather conditions). Holling (2001) concludes that ecosystem management via incremental increases in efficiency does not work. For transformation, ecosystem system management must build and maintain ecological resilience as well as social flexibility to cope, innovate and adapt.

As we have argued, the economic, social and environmental systems interact. A well-known example of cross-system interaction is the linear production of consumption goods at the lowest cost contributing to 'economic growth', while depleting natural resources, using child labour and producing carbon emissions and other waste. In this book, we use carbon emissions as shorthand for all greenhouse gas emissions, which include carbon dioxide CO_2 , methane compounds containing CH_4 , and nitrous oxide N_2O.

Another cross-system interaction is climate change leading to more and more intense disasters, such as storms, flooding and droughts. The low- and middle-income countries around the equator are especially vulnerable to these extreme weather events, which could damage a large part of their production capacity. The temporary loss of tax revenues, and increase in expenditure to reconstruct factories and infrastructure, might put vulnerable countries into a downward fiscal and macro-economic spiral with an analogous increase in poverty (Schoenmaker and Zachmann, 2015). Social and environmental issues are thus

interconnected, whereby the poor in society are more dependent on ecological services and are less well protected against ecological hazards.

An example of an uncertain threshold combined with feedback dynamics is the melting threshold for the Greenland ice sheet. New research has found that it is more vulnerable to global warming than previously thought. Robinson, Calov and Ganopolski (2012) calculate that a 0.9°C of global temperature rise from today's levels could lead the Greenland ice sheet to melt completely. Such melting would create further climate feedback in the Earth's ecosystem, because melting the polar icecaps could increase the pace of global warming (by reducing the refraction of solar radiation, which is 80% from ice, compared with 30% from bare earth and 7% from the sea) as well as rising sea levels. These feedback mechanisms are examples of tipping points and shocks, which might happen.

Summing up, we cannot understand sustainability of organisations in isolation from the socio-ecological system in which they are embedded: what are the thresholds, sustainability priorities, and feedback loops? Moreover, we should not only consider the socio-environmental impact of individual organisations, but also the aggregate impact of organisations at the system level. The latter is relevant for sustainable development.

3. The role of the financial system

How can the financial system facilitate decision-making on the trade-offs between economic, social and environmental goals? Levine (2005) lists the following functions of the financial system:

- Produce information *ex ante* about possible investments and allocate capital;
- Monitor investments and exert corporate governance after providing finance;
- Facilitate the trading, diversification, and management of risk;
- Mobilise and pool savings;
- Ease the exchange of goods and services.

The first three functions are particularly relevant for sustainable finance. The allocation of funding to its most productive use is a key role of finance. Finance is therefore well positioned to assist in making strategic decisions on the trade-offs between sustainable goals. While broader considerations are guiding an organisation's strategy on sustainability, funding is a requirement for reaching sustainable goals.

Finance plays this role at different levels. In the financial sector, banks, for example, define their lending strategy regarding which sectors and projects are eligible for lending and which not. Similarly, investment funds set their investment strategy, which directs in which assets the fund invests and in which assets not. The financial sector can thus play a leading role in the transition to a low-carbon, circular economy. If the financial sector chooses to finance sustainable companies and projects, they can accelerate the transition.

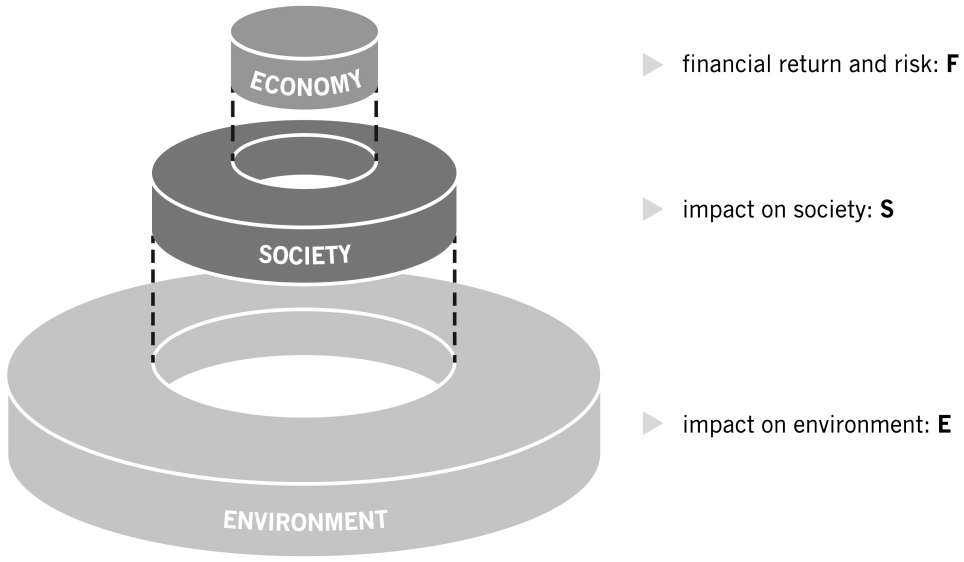
In terms of monitoring their investments, investors can also influence the companies in which they invest. Investors thus have a powerful role in controlling and directing corporate boards. The governance role also involves balancing the many interests of a corporation's stakeholders, including the interests of the environment and society (see Section 3.4). A rising trend in sustainable investment is engagement with companies in the hope of reducing the risk of adverse events occurring in those companies.

Finance is good at pricing the risk of future cash flows for valuation purposes. As there is inherent uncertainty about environmental issues (e.g. exactly how rising carbon emissions will affect the climate, and the timing and shape of climate mitigation policies), risk management can help to deal with these uncertainties. Scenario analysis is increasingly used to assess the risk and valuation under different scenarios (e.g. climate scenarios; see Bianchini and Gianfrate, 2018). When the potential price of carbon emissions in the future becomes clearer, investors and companies have an incentive to reduce these emissions. The key challenge is to take a sufficiently long horizon, because sustainability is about the future.

3.1. Three stages of sustainable finance

How can finance support sustainable development? Figure 5 shows our framework for managing sustainable development. At the level of the economy, the financial return and risk trade-off is optimised. This financial orientation supports the idea of profit maximisation by organisations and economic growth of countries. Next, at the level of society, the impact of business and financial decisions on the society is optimised. And finally at the level of the environment, the environmental impact is optimised. As we have argued, there are interactions between the levels. It is thus important to choose an appropriate combination of the financial, social and environmental aspects.

Figure 5: Managing sustainable development



The concept of sustainable finance has evolved as part of the broader notion of business sustainability over the last decades (Dyllick and Muff, 2016)). Table 3 shows our typology for sustainable finance on four aspects: i) the value created; ii) the ranking of the three factors; iii) the optimisation method; and iv) the horizon. The evolution highlights the broadening from *shareholder value* to *stakeholder value* or triple bottom line: people, planet, profit. The final stage looks at the creation of common good value (see also Tirole, 2017). To avoid the dichotomy of private versus public goods, we use the term common good referring to what is shared and beneficial for all or most members of a given community. Next, the ranking indicates a shift from economic goals first to societal and environmental challenges (the common good) first. Importantly, the horizon is broadened from short term to long term along the stages.

Table 3: Framework for Sustainable Finance

Sustainable Finance Typology	Value created	Ranking of factors	Optimisation	Horizon
Finance-as-usual	Shareholder value	F	Max F	Short term
Sustainable Finance 1.0	Refined shareholder value	F >> S and E	Max F subject to S and E	Short term
Sustainable Finance 2.0	Stakeholder value (triple bottom line)	T = F + S + E	Optimise T	Medium term
Sustainable Finance 3.0	Common good value	S and E > F	Optimise S and E subject to F	Long term

Note: F = financial value; S = social impact; E = environmental impact; T = total value. At Sustainable Finance 1.0, the maximisation of F is subject to minor S and E constraints.

In traditional finance, shareholder value is maximised by looking for the optimal financial return and risk combination. Table 3 labels this the finance-as-usual approach. Although shareholder value should also look at the medium to long term, there are built-in incentives for short-termism, such as quarterly financial reporting and monthly/quarterly benchmarking of investment performance. Finance-as-usual is consistent with the argument of Friedman (1970) that 'the business of business is business'. The only social responsibility of business is to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game. Friedman (1970) argues that it is the task of the government to take care of social and environmental goals and set the rules of the game for sustainability.

However, product demand ultimately derives from societal needs. Moreover, externalities are not perfectly separable from production decisions (Hart and Zingales, 2017). While there is a good case against corporate philanthropy, there is not a case against integration of sustainability into strategy and finance.

The three stages of our Sustainable Finance (SF) typology in Table 3 are discussed one after another below. The stages moves from finance first, to all aspects equal, and finally to social-environmental impact first (the ranking of factors in the third column of Table 3).

3.2. SF 1.0 - profit maximisation, while avoiding 'sin' stocks

A first step in sustainable finance is that financial institutions avoid investing in, or lending to, so-called 'sin' companies. These are companies with very negative impacts. In the social domain, they include, for example, companies that sell tobacco, anti-personnel mines and cluster bombs or that exploit child labour. In the environmental field, classic examples of very negative impacts are waste dumping and whale hunting. More recently, some financial institutions have started to put coal and even the broader category of fossil fuels on the exclusion list because of carbon emissions. These exclusion lists are often triggered under pressure from non-governmental organisations, which use traditional and social media for their messages (Dyllick and Muff, 2016).

But the effects of exclusion and divestment are limited (Skancke, 2016). From a general equilibrium perspective, there is a willing buyer for every share a financial institution sells. Divestment by a growing number of investors might reduce a company's share price, which might in turn make raising new capital through issuing shares more expensive for the company. However, this source of funding is smaller than retained earnings and debt financing. Another effect is that divestment may stigmatise a sector or companies to the point where they lose their social license to operate (see Section 3.4 below). This might lead to less investment in that sector. An exclusion criterion targeted at a sector or the worst performers within a sector could have an effect by setting a norm for acceptable standards.

A slightly more positive variant of the refined shareholder value approach is if financial institutions and companies put systems in place for energy and emissions management, sustainable purchasing, IT, building and infrastructure to enhanced environmental standards, and all kinds of diversity in employment. The underlying objective of these activities remains economic. Though introducing sustainability into business might generate positive side-effects for some sustainability aspects, the main purpose is to reduce costs and business risks, to improve reputation and attractiveness for new or existing human talent, to respond to new customer demands and segments, and thereby to increase profits, market positions, competitiveness and shareholder value in the short term. Business success is still evaluated from a purely economic point of view and remains focused on serving the business itself and its economic goals (Dyllick and Muff, 2016). Shareholder value or profit maximisation is still the guiding principle for the organisation, though with some refinements.

The formal objective function for the refined profit maximisation approach of investors can be derived. Investors optimise the financial value FV of their portfolio by increasing profits and decreasing their risk (i.e. the variability of profits), while avoiding excessive negative social and environmental impact by setting a minimum level SEV^{min}. The objective function is given by:

$$\max\ FV = F(\text{ profits, risk }) \quad subject\ to\ F'_{\text{profits}} > 0, F'_{\text{risk}} < 0, SEV \geq SEV^{min} \qquad (1)$$

Where FV = financial value = expected current and discounted future profits, and SEV = social and environmental value. F'_{profits} is the partial derivative of F with respect to the first term, and F'_{risk} with respect to the second term. This optimisation can be used by investors in a mean-variance framework to optimise their portfolio and by banks and corporates in a net present value framework to decide on financing new projects

3.3. SF 2.0 - internalisation of externalities to avoid risk

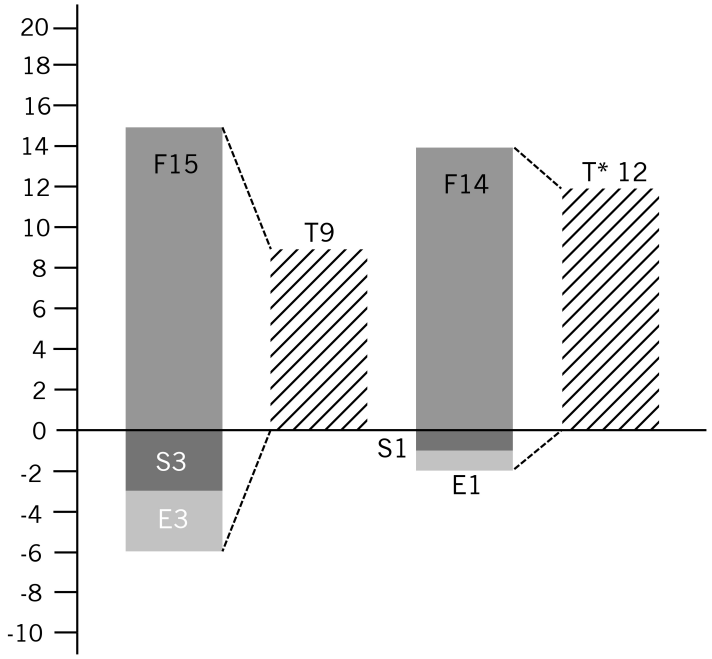
In Sustainable Finance 2.0, financial institutions explicitly incorporate the negative social and environmental externalities into their decision-making. Over the medium to long-term horizon, there are governmental forces (future regulation and taxation) and societal forces at work (see Section 3.4), which put pressure on investors and business to internalise social and environmental externalities. Incorporating the externalities thus reduces the risk that financial investments become unviable. This risk is related to the maturity of the financial instrument, and is thus greater for equity (stocks) than for debt (bonds and loans). On the positive side, internalisation of externalities helps financial institutions and companies to restore trust, which is the mirror image of reputation risk.

Attaching a financial value to social and environmental impacts facilitates the optimisation process among the different aspects (F, S, E). Innovations in technology (measurement, information technology, data management) and science (life-cycle analyses, social life-cycle analyses, environmentally extended input-output analysis, environmental economics) make the monetisation of social and environmental impacts possible (True Price, 2014). In this way, the total or true value T can be established by summing the financial, social and environmental values in an integrating way. Financial institutions and companies use a private discount rate (which is higher than the public discount rate because of uncertainties) to discount future cash flows. Stern (2008) argues that the public discount factor should be very small or zero in sustainable development, because the government should value current and future generations equally. Because social and environmental impacts are particularly felt in the long term, private discounting leads to insufficient effort from a social welfare perspective.

The methodology for calculating the total value involves measuring, monetising and balancing financial and non-financial values (True Price, 2014; KPMG, 2014). Figure 6 illustrates the four steps to calculate the total value:

1. We start by calculating the financial value and quantifying and monetising the social and environmental impacts (bar 1);
2. We then internalise the social and environmental externalities and calculate the total value as the sum of the values (bar 2);
3. Next, we adjust to account for the combination of the three factors. As explained in section 2, there are several non-linear trade-offs between the economic, social and environmental aspects of corporate investment. The monetisation helps corporations to find the optimal combination of the three factors. In our example, the corporation is able to reduce both the social and environmental impact from 3 to 1 at an extra cost of 1 (bar 3) by adapting its production process[2];
4. Finally, we calculate the total value T^* (bar 4).

Figure 6: From financial value to total value



Note: F = financial value; S = social value; E = environmental value; T = total value; T* = optimised total value. The first two bars illustrate the values based on the original production process; the final two bars show the values based on the optimised production process.

However, total value optimisation can lead to perverse outcomes: the negative environmental impact of deforestation, for example, can be offset by large economic gains; in other words legitimising destruction. To avoid these outcomes, we incorporate in equation 2 the constraint that the social-environmental value cannot be worsened compared to its initial value. Another caveat is the inherent uncertainty (e.g. underlying

[2] It should be noted that reducing the social and environmental impact is not always costly. With the rapidly declining cost of solar energy for example, we are getting close to the point where the use of renewable energy can reduce carbon emissions without extra cost.

climate scenarios) that makes pricing difficult. A final issue is participation (Coulson, 2016). Producers could involve stakeholders in the application of the total value methodology to form a more inclusive and pluralist conception of risk and values for social and environmental impacts.

The formal objective function of investors for optimising the total value of their portfolio can be derived. To internalise the social and environmental externalities, investors optimise the total or true value TV of their portfolio. The total value is the sum of the financial value, the social value and the environmental value: $TV = FV + SV^p + EV^p$. The superscript p stands for the privately discounted value of the social and environmental impacts.

Investors thus optimise the total value TV of their portfolio by increasing their total profits, and decreasing their risk (i.e. the variability of total profits), while not worsening their social and environmental impact SEV^p. The objective function is given by:

$$\max\ TV = F(\text{total profits, total risk})\ s.t.\ F'_{\text{tot profits}} > 0, F'_{\text{tot risk}} < 0, SEV^p_{t+1} \geq SEV^p_t \quad (2)$$

Where SEV^p_{t+1} = next period social and environmental impact. In line with the total value methodology, not only profits but also risk is assessed in an integrated way (i.e. integrated across the three values), which includes the covariance between the profits.

Sustainable Finance 2.0 comes in different shapes. Examples are triple bottom line (people, planet, profit) and integrated profit and loss accounting. Within corporate governance, we can speak of an extended stakeholder approach, whereby not only direct stakeholders, such as shareholders, suppliers, employees and customers, but also society and environment, as indirect stakeholders, are included. Nevertheless, Dyllick and Muff (2016) claim that corporates still adopt an inside-out perspective by asking how they can reduce their social and environmental impact. While this is helpful, it also restricts their potential to address social and environmental challenges.

3.4. SF 3.0 - contributing to sustainable development, while observing financial viability

Sustainable Finance 3.0 moves from risk to opportunity. Rather than avoiding unsustainable companies from a risk perspective, financial institutions invest only in sustainable companies and projects. In this approach, finance is a means to foster sustainable development, for example by funding healthcare, green buildings, wind farms, electric car manufacturers and land-reuse projects. The starting point of SF 3.0 is a positive selection of investment projects on their potential to generate social and environmental impact; creating an inclusion list instead of an exclusion list as in SF 1.0. In this way, the financial system serves the sustainable development agenda in the medium to long term.

The question that then arises is how the financial part of the decision is taken. An important component of sustainable development is economic and financial viability. Financial viability,

in the form of a fair financial return (which at the minimum preserves capital), is a condition for sustainable investment and lending; otherwise projects might need to be aborted prematurely because of financial shortfalls.

The formal objective function for this approach can be derived. To foster sustainable development, investors optimise the social-environmental impact or value SEV of their portfolio, which is the sum of the social and environmental value $SEV = SV + EV$, by increasing their impact, and decreasing their risk (i.e. the variability of impact), subject to a minimum financial value FV^{min}. The objective function is given by:

$$\max\ SEV = F(\text{ impact, risk })\ \ s.t.\ F'_{\text{impact}} > 0, F'_{\text{risk}} < 0, FV_{t+1} \geq FV_{t+1}^{min} \qquad (3)$$

The financial viability or minimum financial value can be presented as follows: $FV_{t+1}^{min} = \left(1 + r^{fair}\right) FV_t^{min}$, where $r^{fair} \geq 0$ is a fair financial return for one period. The key change is that the role of finance FV turns from primacy (profit maximisation in equation 1) to serving (a means or condition to optimise sustainable development in equation 3).

What is a fair financial return? Of the respondents to the Annual Impact Investment Survey (GIIN, 2016), 59 per cent primarily target risk-adjusted, market-rate returns. Of the remainder, 25 per cent primarily target returns below market-rate that are closer to market-rate returns, and 16 per cent target returns that are closer to capital preservation. So the great majority pursues returns at market rate or close to it, while a small group accepts lower returns for sustainability reasons.

More broadly, the question is whether investors including the ultimate beneficiaries, such as current and future pensioners are prepared to potentially forego some financial return in exchange for social and environmental returns (e.g. enjoying their pension in a liveable world). Social preferences play an important role for investors in socially responsible investment (SRI) funds, while financial motives appear to be of limited importance (Riedl and Smeets, 2017). SRI investors expect to earn lower returns from SRI funds than from conventional funds, suggesting that they are willing to forego financial performance in order to invest according to their social preferences. However, *ex ante* it is not clear what the ultimate effect of impact investing is on financial return. If investor coalitions, for example, could accelerate the transition towards sustainable development, there would be less chance of negative financial returns because of extreme weather events or stranded assets (Schoenmaker, 2017). This argument depends on sufficiently large amounts of investment moving to sustainable finance (see Section 4 for an initial assessment).

On investment performance, there is a mixed picture on the relationship between corporate social-environmental performance and financial performance. Reviewing several studies, Busch, Bauer and Orlitzky (2016) conclude that, at the very least, there is no clear indication of a negative relationship, or trade-off, between corporate social-environmental performance and corporate financial performance. While the evidence on financial performance of companies that pay attention to general environmental, social and

governance (ESG) factors is mixed, Khan, Serafeim and Yoon (2016) find that companies that focus on material ESG issues (i.e. these ESG issues that are relevant for the company or the industry in which it operates) show a superior financial performance.

In banking, the Global Alliance for Banking on Values (2016) compares a group of 25 sustainable banks with the group of 30 global systemically important banks (selected and published by the Financial Stability Board). The sustainable banks maintained their financial return through the global financial crisis with a return on equity fluctuating between 4 and 10 percent over the 2005-2015 period. At the same time, the median return on equity for the global banks fluctuated between 0 and 15 percent over the same period (see ECB (2015) for a similar result for the euro-area banks). While the average return on equity for the group of sustainable banks is slightly lower at 8.3 percent compared to 8.7 percent for the global banks over the 2006-2015 period, the variance is lower for the sustainable banks at a standard deviation of 4.9 percent compared to 7.7 percent for the global banks. The smaller variance of the return on equity can be explained by two factors: stable return on assets (around 0.5 to 0.7 percent for sustainable banks versus 0.2 to 0.8 percent for the global banks over the 2006-2015 period) and a higher capital ratio[3] (1 to 1.5 percent higher for sustainable banks). High leverage with more debt and less equity - which is equivalent to a lower capital ratio - contributes to variability in banks' return on equity and thus increases bank risk, as found in the case of the global banks.

Ortiz-de-Mandojana and Bansal (2016) investigate the short and long-term benefits of organisational resilience through sustainable business practices. In the long run, a higher survival rate of sustainable organisations is expected, as resilience helps companies to avoid crises and bounce back from shocks. They show that companies that adopt responsible social and environmental practices, relative to a carefully matched control group, have lower financial volatility, higher sales growth and higher chances of survival over a 15-year period. Yet, they do not find any differences in short-term profits. This suggests that there is no short-term cost to adopting sustainability practices.

However, the evidence on socially responsible investing (SRI), which incorporates environmental, social and governance issues in investment decisions, is mixed. In a meta-study on the performance of SRI funds, Renneboog, Ter Horst and Zhang (2008) report that existing studies at the portfolio level hint but do not univocally demonstrate that SRI investment funds perform worse than conventional funds. But Bauer, Koedijk and Otten (2005) find little evidence that the average performance of SRI in the USA and UK is different from that of conventional funds. More recently, Ferrell, Liang and Renneboog (2016) find a positive relation between corporate social responsibility and value (measured by Tobin's Q, which stands for the market value divided by the book value). Corporate social responsibility can thus generate more returns for investors through enhanced firm value. Although results have been mixed, the majority of the research suggests a positive relationship between

[3] We refer here to the unweighted capital ratio, also known as the Basel leverage ratio, which is defined as Tier 1 equity divided by total assets.

corporate environmental performance and corporate financial performance (Dixon-Fowler *et al*, 2013).

Moving to corporate governance, legitimacy theory underpins Sustainable Finance 3.0, which targets long-term value creation for the common good. Legitimacy theory indicates that companies aim to legitimise their corporate actions in order to obtain approval from society and thus, to ensure their continuing existence (Omran and Ramdhony, 2015). This social licence to operate represents a myriad of expectations that society has about how an organisation should conduct its operations. The corporation thus acts within the bounds and norms of what society identifies as socially responsible behaviour, including meeting social and environmental standards.

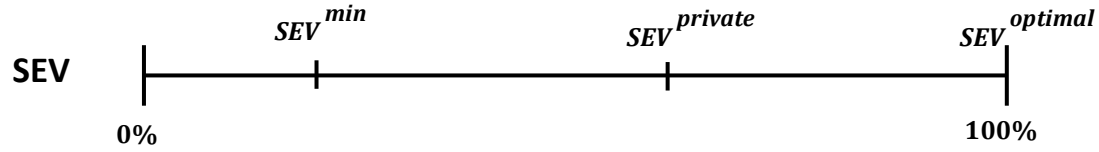
Finally, Dyllick and Muff (2016) argue that corporates need to develop an outside-in perspective by asking how they can contribute effectively to solving social and environmental challenges (instead of looking inside-out by asking how they can reduce their social and environmental impact). This outside-in perspective allows corporates to take a system approach towards sustainability at the macro level. As indicated in Section 2, an integrated social-ecological system perspective is needed to address the discrepancy between the emerging practices in sustainable investments and business at the micro level and the outcomes or impacts at the macro level. On the environmental aspect, this system approach starts with the planetary boundaries or ecological limits. So, natural resources are not depleted, waste is reused and carbon emissions stay within the available carbon budget to limit global warming. In short, the available or sustainable 'budgets' respect the closed cycles of the natural environment and thus point to a circular or closed-loop economy (Busch, Bauer and Orlitzky, 2016).

4. Application of the framework

The three stages of sustainable finance lead to different levels of realised social-environmental value. Sustainable Finance 1.0 introduces a minimum level, SEV^{min}, below which investors cannot go. Corporates or investment projects that do not meet this minimum level are on an exclusion list. The next stage, Sustainable Finance 2.0, balances the privately discounted financial, social and environmental value in an overall approach optimising the total value. We label this $SEV^{private}$. For illustration purposes we incorporate this privately discounted social-environmental value halfway between the minimum and optimal level on our social-environmental value scale in Figure 7. Finally, Sustainable Finance 3.0 optimises the social-environmental value, $SEV^{optimal}$. Companies and projects that deliver this this optimised social-environmental value are eligible for investment or lending and are on an inclusion list.

The first two stages aim to avoid reputation risk, because the public demands a minimum level of corporate social responsibility and externalities are expected to be priced-in at some stage. The third stage aims to grasp the opportunities of realising social-environmental impact through investment and lending.

Figure 7: Levels of social-environmental value (SEV)



Note: SEV^{min} = minimum level of social and environmental value; $SEV^{private}$ = optimised total value (= privately discounted financial, social and environmental value); and $SEV^{optimal}$ = optimised social and environmental value.

Where are we currently on the social-environmental axis? The majority of firms are at the Sustainable Finance 1.0 level, putting financial value first. Schoenmaker (2017) estimates that about 30 to 40 percent of financial institutions and 20 to 30 percent of corporates adopt sustainable principles in their investment and business practices. But these firms are only partly (fraction α) maximising total value. They are somewhere between Sustainable Finance 1.0 and 2.0, which can be expressed as $\max\ V = (1-\alpha)\ FV + \alpha\ TV = FV + \alpha\ (SV + EV)$, in which *V* stands for the overall value maximised by the firm, *FV* for financial value, *TV* for total value (*TV* = *FV* + *SV* + *EV*), *SV* for social value and *EV* for environmental value.

A fair approximation is that financial value is dominant and social-environmental value is incorporated for about 10 percent (α = 0.1). This implies that we are just above, but still quite close to, SEV^{min}. To increase the social-environmental value, the real issue is to switch from the shareholder model in Sustainable Finance 1.0 to the stakeholder model of Sustainable Finance 2.0. This is similar to the dichotomy of Hart and Zingales (2017), who distinguish between shareholder value (SF 1.0) and shareholder welfare (SF 2.0). Finally, the group of financial institutions adopting Sustainable Finance 3.0 is tiny at less than 1 percent (Schoenmaker, 2017).

The framework is dynamic. Non-governmental organisations (NGOs) put pressure on investors to raise the minimum level by expanding the number of exclusions. The introduction of government regulation or taxation on social and environmental externalities can cause an upward shift of the social-environmental component in the total value calculation.

4.1. A societal test for take-overs

The shareholder model (SF 1.0) and stakeholder model (2.0) can clash, in particular during take-over contests. We illustrate this point with reference to a recent example. In February 2017, Kraft Heinz, the US food company, attempted a takeover of Unilever, the European food company (Financial Times, 2017). A deal would have brought together two companies with radically different business models and cultures. With a portfolio of slower-growing brands, Kraft Heinz is heavily concentrated in the US and underpinned by debt-financed

deals. It implemented aggressive cost-cutting strategies to generate margin expansion that allowed it to repay the debt and bolster shareholder returns; this is the shareholder model framework. Meanwhile, Unilever is better known for strong brands and its presence in some of the biggest emerging markets. Under its chief executive, Paul Polman, Unilever attempted to focus on better balancing of profitability with social and environmental sustainability – the stakeholder model.

This was a big takeover battle. Kraft Heinz offered $143 billion for Unilever, but Unilever did not want to give up its sustainable business model. In the end, Warren Buffett, the financier behind Kraft Heinz, did not approve a hostile takeover and halted Kraft Heinz from further bidding for Unilever.

The aftermath of the aborted takeover generated a debate on the 'protection' of companies with stakeholder models against the aggressive bids of shareholder-model companies. Without protection, financial consideration (F) would always dominate over social and environmental considerations (S+E). This would imply a bias towards SF 1.0. General defences against takeovers, such as certified shares or priority shares with friendly shareholders, can reduce market discipline on the management, which in turn might decrease the stock price of the company.

De Adelhart Toorop, De Groot Ruiz and Schoenmaker (2017) propose a societal cost-benefit analysis, including financial, social and environmental factors, based on the total or true value methodology, described in Section 3.3. It is the responsibility of the management of both the acquiring and target company to conduct this test. Similar to the way that an investment bank decides whether the terms of a merger or acquisition are fair, an independent advisor would give a fairness opinion on the outcome of the societal cost-benefit test. A Commercial Division of the Court (as in the Netherlands) or a Take-Over Panel (as in the United Kingdom) would only approve a take-over or merger if and when this cost-benefit test showed a positive value for society. When necessary the Court or Panel could appoint experts to re-calculate the societal cost-benefit test.

5. Conclusions

This paper evaluates the sustainability challenges, both environmental concerns coming from the natural sciences (Steffen *et al*, 2015) and social concerns from development economics (Raworth, 2017). To address these social and environmental challenges in our economic system, the United Nations has developed the Sustainable Development Goals for 2030. Sustainable development means that current and future generations have the resources needed, such as food, water, healthcare and energy, without stressing the Earth system processes.

Sustainable finance looks at how finance (investing and lending) interacts with economic, social, and environmental issues**.** This paper develops a new framework for sustainable finance and shows how sustainable finance has the potential to move from finance as a goal

(profit maximisation) to finance as a means facilitating sustainable development. In his book *Finance and the Good Society*, Shiller (2012) provides some stimulating examples of how finance can serve the society and its citizens. The same could be done to address the environmental challenges.

We are in the transition to a low-carbon, circular economy. The externalities of the current carbon-intensive economy are becoming increasingly clear to the wider public. Examples are more catastrophic weather events, droughts and flooding in countries close to the equator, and air pollution. A case in point is California, where air pollution from heavy traffic in the 1990s prompted environmental regulations and stimulated innovations, such as electric cars of Tesla and solar technology. China, India and Mexico, for example, face similar, or even worse, air pollution today, which may prompt at some point environmental regulations in these countries. Finance is about anticipating such events and incorporating expectations in today's valuations for investment decisions. Finance can thus contribute to a swift transition to a low-carbon economy.

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