Principles of Sustainable Finance

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Abstract

Finance is widely seen as an obstacle to a better world. *Principles of Sustainable Finance* explains how the financial sector can be mobilized to counter this and provides many examples and tools. Using finance as a means to achieve social goals we can divert the planet and its economy from its current path to a world that is sustainable for all.

Written for undergraduate, graduate, and executive students of finance, economics, business, and sustainability, this textbook combines theory, empirical data, and policy to explain the sustainability challenges for corporate investment. It shows how investors and bankers can steer funding to sustainable companies and projects without sacrificing return and thus speed up the transition to a sustainable economy.

Tailored for students, *Principles of Sustainable Finance* starts each chapter with an overview and learning objectives to support study. It includes suggestions for further reading, definitions of key concepts, and extensive use is made of figures, boxes, and tables to enhance educational goals and clarify concepts.

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Contents

Chapter 1

Sustainability and the transition challenge

Overview

Our economic models were developed in the age of *resources abundance*, when natural resources were plenty and carbon emissions were limited. No environmental concerns were factored into these models; only labour and capital. Likewise, financial theory does not account value to natural resources beyond their near term cash flows. Possibly fatal depletion of resources is ignored. These models are still widely used, but no longer tenable. We are now in a transition to a low carbon and more circular economy to overcome environmental challenges. While an early transition allows for a gradual adjustment of our production and consumption patterns, a late transition will cause sudden shocks and lead to stranded assets, which have lost their productive value. Many natural resources companies are still in denial, irrationally counting on a late and gradual transition.

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. To guide the transition towards a sustainable and inclusive economy, the United Nations 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 chapter starts by explaining 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 show that many people live below minimum social standards. *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.

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 corporates and projects and thus accelerate the transition to a low carbon and more circular economy. *Sustainable finance* looks at 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 on the corporates in which they invest. In this way, long-term investors can steer corporates towards sustainable business practices. Finally, finance is good at pricing risk for valuation purposes and can thus help

dealing 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 decades, whereby the focus is gradually shifting from short-term profit towards long-term value creation. This chapter analyses these stages and provides a framework for sustainable finance. In addressing social and environmental challenges, a key development is the move from risk to opportunity. While financial firms started to avoid unsustainable companies from a risk perspective, the front-runners are now increasingly investing in sustainable companies and projects.

Learning objectives

After you have studied this chapter, you should be able to:

- explain the planet's social and environmental challenges
- list and understand the United Nations Sustainable Development Goals
- understand the transition of the economic system
- explain the main functions of the financial system and how to apply them to sustainability
- explain the various stages of sustainable finance

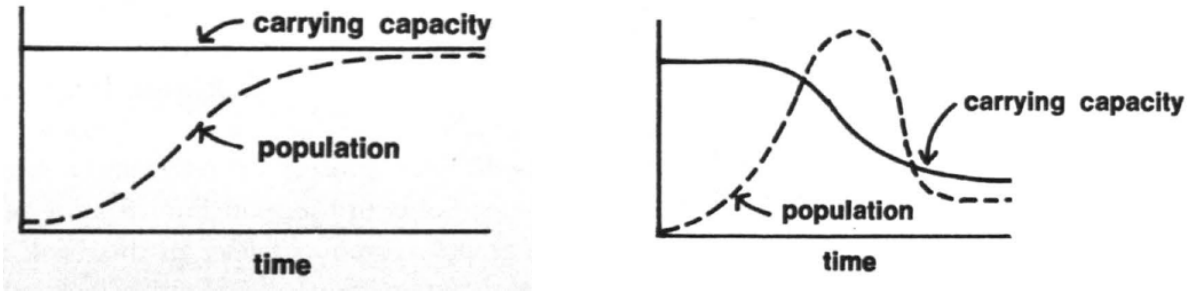
1.1. Why does sustainability matter?

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. 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 1.1. 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 1.1: 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. Gro Harlem Brundtland, former Prime Minister of Norway, was chosen as chair due to her strong background in the sciences and public health. 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. Starting at the Earth Summit in Rio de Janeiro in 1992, the United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty to 'stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'. The parties to the convention have met annually from 1995 in Conferences of the Parties (COP) to assess progress in dealing with climate change. In the 2015 Paris Agreement on climate change (COP21), countries reconfirmed 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 (2014) 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.

Section 1.2 discusses that climate risk, land system change, biodiversity loss, nitrogen and phosphorus flows, poverty, food, fresh water and health form the most pressing environmental and social challenges. Our economic system, organised through business firms, creates these environmental and social impacts on society; these externalities are thus not separable from production decisions. To highlight the tension between unbridled economic growth and sustainable development, we provide two examples. Box 1.1 describes the Deepwater Horizon oil spill in the Gulf of Mexico. Box 1.2 shows the impact of the collapse of a factory building in Bangladesh. These examples have in common an underinvestment in safety to increase short-term profits.

Box 1.1: The Deepwater Horizon oil spill

Oil began to spill from the Deepwater Horizon drilling platform on 20 April 2010, in the British Petroleum-operated Macondo Prospect in the Gulf of Mexico. An explosion on the drilling rig killed 11 workers and led to the largest accidental marine oil spill in the history of the petroleum industry. The US Government estimated the total discharge at 4.9 million barrels. After several failed efforts to contain the flow, the well was declared sealed on 19 September 2010.

A massive response ensued to protect beaches, wetlands and estuaries from the spreading oil using skimmer ships, floating booms, controlled burns and oil dispersant. Oil clean-up crews worked on 55 miles of the Louisiana shoreline until 2013. Oil was found as far from the Deepwater Horizon site as the waters off the Florida Panhandle and Tampa Bay, where the oil and dispersant mixture was embedded in the sand. The months-long spill, along with adverse effects from the response and clean-up activities, caused extensive damage to marine and wildlife habitats and the fishing and tourism industries.

Numerous investigations explored the causes of the explosion and record-breaking spill. Notably, the US government's September 2011 report pointed to defective cement on the well, laying the fault mostly with BP, but also rig operator Transocean and contractor Halliburton. Earlier in 2011, a National Commission (2011) likewise blamed BP and its partners for a series of cost-cutting decisions and an inadequate safety system, but also concluded that the spill resulted from *"systemic"* root causes and that without *"significant reform in both industry practices and government policies, might well recur"*.

Box 1.2: Rana Plaza factory collapse

The Rana Plaza collapse was a disastrous structural failure of an eight-storey commercial building on 24 April 2013 in Bangladesh. The collapse of the building caused 1,129 deaths, while approximately 2,500 injured people were rescued alive from the building. It is considered the deadliest garment factory accident in history and the deadliest accidental structural failure in modern human history.

The building contained clothing factories, a bank, apartments, and several shops. The shops and the bank on the lower floors were immediately closed after cracks were discovered in the building. The building's owners ignored warnings to evacuate the building after cracks in the structure appeared the day before the collapse. Garment workers, earning €38 a month, were ordered to return the following day, and the building collapsed during the morning rush-hour.

The factories manufactured clothing for brands including Benetton, Bonmarché, the Children's Place, El Corte Inglés, Joe Fresh, Monsoon Accessorize, Mango, Matalan, Primark and Walmart.

1.2. Sustainability challenges

"There can be no Plan B, because there is no Planet B."

Former United Nations Secretary-General, Ban Ki-moon

Environmental challenges

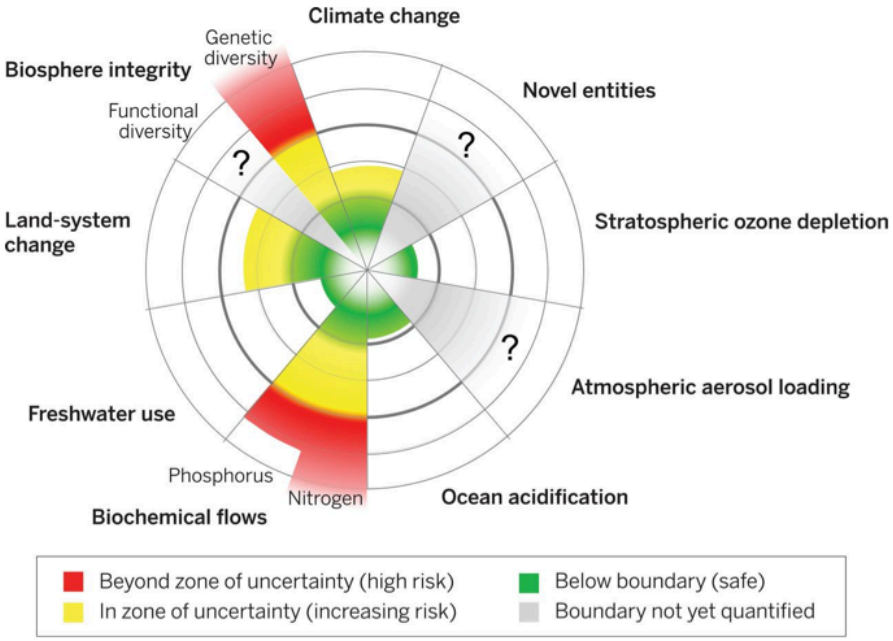
The aim is to keep the planet liveable for current and future generations. There is increasing evidence that human activities are affecting the Earth system, threatening the planet's future liveability. The planetary boundaries framework of Steffen *et al.* (2015) defines a safe operating space for humanity 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 1.2 is the safe operating space, yellow represents the zone of uncertainty (increasing risk) and red indicates the zone of high risk. Table 1.1 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 and adding at a rate of around 3 ppm every year. 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.

Another example in the yellow zone of increasing risk is land-system change. The control variable is the area of forested land as a proportion of forest-covered land prior to

human alteration. The planetary boundary is at 75 per cent, while we are currently at 62 per cent and the percentage is falling.

Figure 1.2: 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.

Moreover, the use of fossil fuels in the linear production and consumption system overburdens the Earth system as natural sink (absorbing pollution). Baseline scenarios (i.e. those without mitigation) for climate change result in global warming in 2100 from 3.7° to 4.8° Celsius compared to the pre-industrial level (Intergovernmental Panel on Climate Change, 2014). Figure 11.6 in Chapter 11 depicts this high emission scenario.

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 1.2). A timely transition 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 1.1: 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).

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).

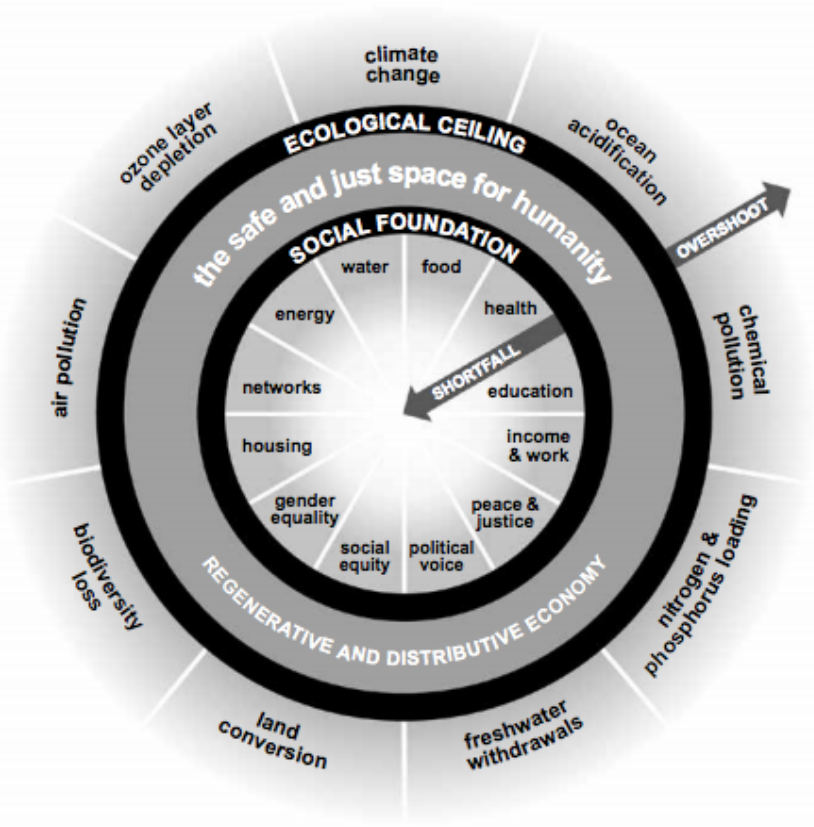
But many people are still living below the social foundations of no hunger, no poverty (a minimum income of $3.10 a day), access to education and access to clean cooking facilities (see Table 1.2). More broadly, political participation, which is the right of people to be involved in decisions that affect 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 at sustainable development below) 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 (Box 1.2). 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 1.3). Table 1.1 specifies the ecological ceiling and Table 1.2 the social foundation.

Figure 1.3: The Doughnut: the safe and just space for humanity



Source: Raworth (2017).

Table 1.2: 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).

Sustainable development

To guide the transition 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 stimulate action over the 2015-2030 period in areas of critical importance for humanity and the planet. To facilitate implementation, the 17 high level goals are specified in 169 targets (see https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals).

Following Rockström and Sukhdev (2015), we classify the Sustainable Development Goals (SDGs) according to the levels of the economy, the society and the environment. Nevertheless, we stress that 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, households can afford food, healthcare and education for their family.

The 17 UN Sustainable Development Goals are the following (UN, 2015):

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

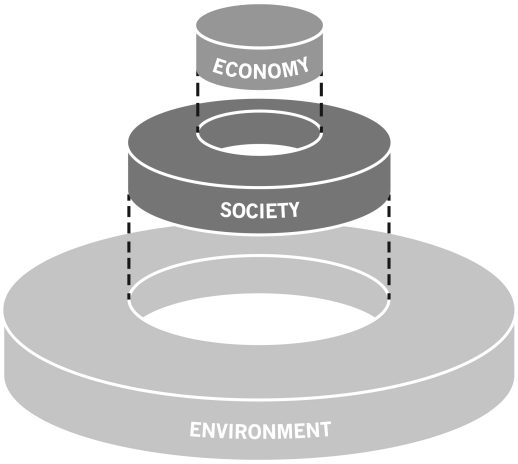
Global strategy

The UN SDGs is the global strategy of the governments under the auspices of the United Nations and provides direction towards (future) government polices, like regulation and taxation of environmental and social challenges. The global strategy is boosted by technological change (e.g. the development of solar and wind energy and electric cars at decreasing cost), which supplements government policies (e.g. carbon pricing). Some companies are preparing for this transition (future makers) and are part of the solution (Mercer, 2015). Other companies are waiting for the transition to unfold before acting (future takers). A final category of companies is unaware of this transition and continues business as usual. They are part of the problem.

We, as authors, attach a positive probability to the scenario that the SDGs are largely met. Our observation is based on the success of the earlier Millennium Development Goals in reducing poverty, hunger and child death rates in Southeast Asia and Latin America, but less so in Africa. Of course, opinions can, and do, differ about the probability that the transition towards a sustainable economy will largely succeed. But the status quo scenario, which assumes no transition, is highly implausible. While the pathway and the speed of the transition are uncertain and may even be erratic with failures along the way, the sustainable development agenda gives direction to thinking about the future. This book is about the role finance (investors and lenders) can play in shaping this future and making production and consumption more sustainable.

The UN SDGs address challenges at the level of the economy, society and the environment (or biosphere). Figure 1.4 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. In their seminal book *Why nations fail*, Acemoglu and Robinson (2012) show that political institutions that promote inclusiveness generate prosperity. Inclusiveness allows everyone to participate in economic opportunities. Reducing social inequalities is thus an important goal (goal 10 above). 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 1.4: 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 current and future 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.

Examples of cross-system interactions and uncertain thresholds

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 CH_4 and nitrous oxide N_2O.

Another example of cross-system interaction is climate change leading to more and more intense weather-related 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. 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.

A related example is land degradation in the form of soil erosion, salinisation (exacerbation of natural soil salinity level), peatland and wetland drainage and forest degradation. The resulting damage is estimated at $6.3 trillion a year (8.3 per cent of global GDP) in lost ecosystem service value, which includes agricultural products, clean air, fresh water, climate regulation, recreational opportunities and fertile soils (Sutton, Anderson, Costanza and Kubiszewski, 2016). Land degradation also exacerbates losses in biodiversity and jeopardises the livelihoods of half a billion mostly poor people who depend on forests and agricultural land. Declining land productivity undermines sustainable development, threatens food and water security, and leads to involuntary human migration and even civil conflict.

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.

An important conclusion from this section is that 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.

1.3. 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 and more 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. In Section 1.4, we review the progressive thinking about how interests should be balanced, including the interests of the environment and society. A rising trend in sustainable investment is engagement with companies in the hope of reducing the risk of adverse events occurring in those companies.

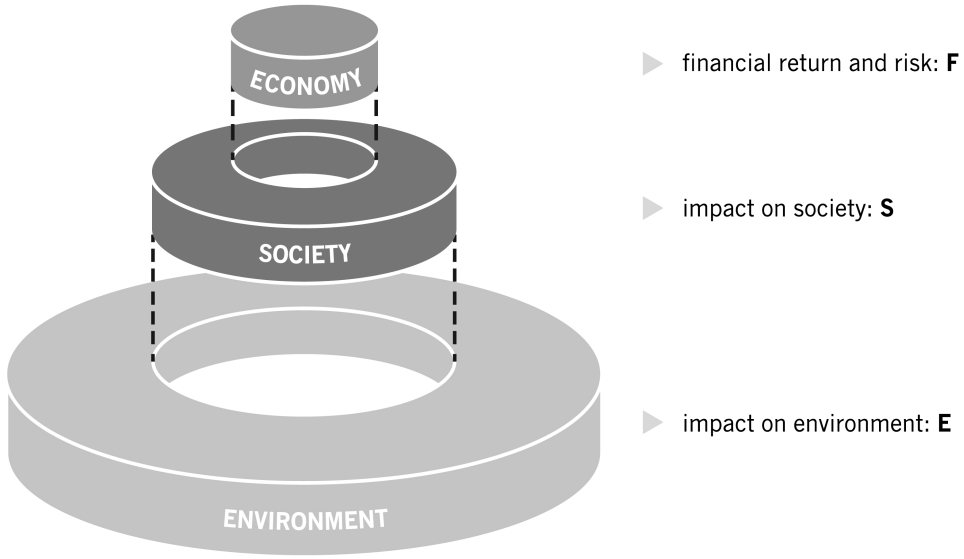
Finance is good at pricing the risk of future cash flows for valuation purposes. As there is inherent uncertainty about environmental issues (e.g. exactly how rising carbon emissions will affect the climate, and the timing and shape of climate mitigation policies), risk management can help to deal with these uncertainties. *Scenario analysis* is increasingly used to assess the risk and valuation under different scenarios (e.g. climate scenarios; see

Chapter 2). 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. Chapter 3 discusses the appropriate horizon for sustainable finance and ways to overcome the bias towards short-termism.

1.4. Three stages of sustainable finance

How can finance support sustainable development? Figure 1.5 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 1.5: Managing sustainable development



Source: Schoenmaker (2017).

The concept of sustainable finance has evolved as part of the broader notion of business sustainability over the last decades (see Chapter 5). Table 1.3 shows the 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.

In traditional finance, shareholder value is maximised by looking for the optimal financial return and risk combination. Table 1.3 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 (see Chapter 3). 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 1.3 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 1.3).

Table 1.3: 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)	I = F + S + E	Optimise I	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; I = integrated value. At Sustainable Finance 1.0, the maximisation of F is subject to minor S and E constraints.
Source: Schoenmaker (2017).

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 initial effects of exclusion and divestment are limited (Skancke, 2016). From a general equilibrium perspective, fewer investors hold the excluded companies leading to lower stock prices and a higher cost of capital. In an empirically calibrated model, Heinkel, Kraus and Zechner (2001) indicate that more than 20 per cent of green investors are required to induce any polluting companies to reform. Existing empirical evidence indicates that at most 10 per cent of funds is invested by green investors. Divestment by a growing number of investors might turn the balance. Another effect is that divestment may stigmatise a sector or companies to the point where they lose their social license to operate (see at SF 3.0 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. Box 1.3 contains the formal objective function for the refined profit maximisation approach of investors.

Box 1.3: Refined profit maximisation

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:

$$\max\ FV = F(\text{ profits, risk }) \quad subject\ to\ F'_{\text{profits}} > 0,\ F'_{\text{risk}} < 0,\ SEV \geq SEV^{min} \qquad (1.1)$$

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.

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, these externalities might become priced (e.g. a carbon tax) and/or might impact negatively on an institution's reputation. 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 integrated value I can be established by summing the financial, social and environmental values in an integrated 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. As social and, in particular, environmental impacts become manifest over a longer horizon and are also more uncertain than financial impacts, private discounting leads to a lower weighting of social and environmental value than financial value. Chapter 2 sets out the methodology for calculating and optimising the integrated value (which is also labelled total or true value).

However, integrated 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 1.2 the constraint that the social-environmental value cannot be worsened compared to its initial value. Another caveat is the inherent uncertainty (e.g. underlying climate scenarios) that makes pricing difficult. A final issue is participation (Coulson, 2016). Producers could involve stakeholders in the application of the integrated value methodology to form a more inclusive and pluralist conception of risk and values for social and environmental impacts. Box 1.4 provides the formal objective function of investors for optimising the integrated value of their portfolio.

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.

Box 1.4: Internalisation of externalities

To internalise the social and environmental externalities, investors optimise the integrated value IV of their portfolio. The integrated value is the sum of the financial value, the social value and the environmental value: $IV = FV + SV^p + EV^p$. The superscript p stands for the privately discounted value of the social and environmental impacts.

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

$$\max\ IV = F(\text{ integrated profits, integrated risk }) \quad s.t.\ F'_{\text{integr. profits}} > 0,\ F'_{\text{integr. risk}} < 0,$$

$$SEV_{t+1}^p \geq SEV_t^p \tag{1.2}$$

See Box 1.3 for the explanation of the variables. SEV_{t+1}^p = next period social and environmental impact. In line with the integrated 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.

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. Box 1.5 derives the formal objective function for this approach. The key change is that the role of finance turns from primacy (profit maximisation) to serving (a means to optimise sustainable development). It moves from the front row in equation 1.1 to the back row in equation 1.3.

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. This argument depends on sufficiently large amounts of investment moving to sustainable finance (see Chapter 4).

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.

Box 1.5: Contributing to sustainable development

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:

$$\max\ SEV = F(\text{impact},\ \text{risk})\ \ s.t.\ F'_{\text{impact}} > 0,\ \ F'_{\text{risk}} < 0,\ FV_{t+1} \geq FV_{t+1}^{min} \qquad (1.3)$$

See Box 1.3 and 1.4 for the explanation of the variables. 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.

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 per cent over the 2006-2015 period. At the same time, the median return on equity for the global banks fluctuated between 0 and 15 per cent 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 per cent compared to 8.7 per cent for the global banks over the 2006-2015 period, the variance of the return on equity is lower for the sustainable banks at a standard deviation of 4.9 per cent compared to 7.7 per cent for the global banks. This smaller variance can be explained by two factors: stable return on assets (around 0.5 to 0.7 per cent for sustainable banks versus 0.2 to 0.8 per cent for the global banks over the 2006-2015 period) and a higher capital ratio[1] (1 to 1.5 per cent 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.

[1] 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.

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 United States and the United Kingdom 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 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.

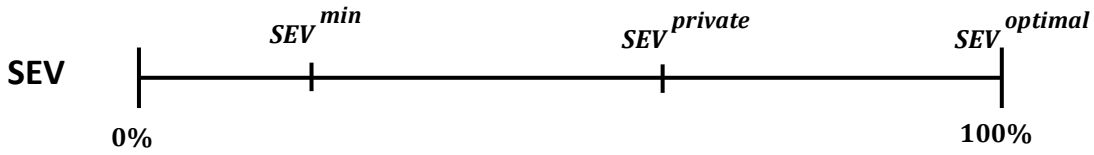
Finally, Dyllick and Muff (2016) argue that corporates need to develop an *outside-in perspective* by asking how they can contribute effectively to solving social and environmental challenges (instead of looking inside-out by asking how they can reduce their social and environmental impact). This outside-in perspective allows corporates to take a system approach towards sustainability at the macro level. As indicated in Section 1.2, 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). Chapter 4 discusses ways to achieve a system approach.

Comparing the stages: where are we?

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 integrated 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 1.6. 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.

Figure 1.6: Levels of social-environmental value (SEV)



Note: SEV^{min} = minimum level of social and environmental value; $SEV^{private}$ = optimised integrated value (= privately discounted financial, social and environmental value); and $SEV^{optimal}$ = optimised social and environmental value.
Source: Schoenmaker (2017)

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.

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. About 30 to 40 per cent of financial institutions and 20 to 30 per cent of corporates adopt sustainable principles in their investment and business practices (see Table 4.3 in Chapter 4). But these firms are only partly (fraction α) maximising integrated value. They are somewhere between Sustainable Finance 1.0 and 2.0, which can be expressed as $\max V = (1-\alpha)\, FV + \alpha\, IV = FV + \alpha\,(SV + EV)$, in which *V* stands for the overall value maximised by the firm, *FV* for financial value, *IV* for integrated value (*IV* = *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 per cent (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 challenge is to switch from Sustainable Finance 1.0 to 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). Box 3.2 in Chapter 3 reports on a recent battle between the shareholder model (SF 1.0) and the stakeholder model (SF 2.0). Finally, the group of financial institutions adopting Sustainable Finance 3.0 is tiny at less than 1 per cent (Table 4.3).

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 integrated value calculation.

1.5. Challenges to integration of sustainability into finance

The obvious answer to deal with social and environmental issues is to put them simply in our economic models. However, these models are still confined to capital and labour, without the services and goods of nature. The famous Cobb-Douglas production function, using labour input (the total number of person-hours working in a year) and capital input (the value of machinery, equipment and buildings) for the production of goods (Cobb and Douglas, 1928), is still being taught to first-year economy and business students. The problem is that many of the social and environmental issues are externalities or external effects, which affect other parties without these effects being reflected in market prices. Neo-classical models employ market prices as relevant signals for decision-making (e.g. investment, production or consumption decisions) and thus do not incorporate social and environmental externalities. Governments can use regulation or taxation to price or internalise externalities. Moreover, there are societal forces at work, which put pressure on investors and business, to internalise social and environmental externalities. **Chapter 2** discusses the concept of externalities and the rate of internalisation.

Figure 1.7 illustrates the inputs (in the form of capitals) and players in the economy (governments, corporates and households) for value creation. Panel A shows the traditional finance regime that is aimed at financial value creation and builds on linear production and consumption processes and locked-in government budgets for incumbent sectors (e.g. agricultural production and fossil fuel based energy infrastructure). Panel B illustrates the sustainable finance regime aimed at long-term value creation. This chapter stresses the need to take an integrated view on the use of the services of natural, social and financial capital in production and consumption. As this book focuses on the role of the financial system, Figure 1.7 draws the financing lines (investment and lending) to the main players. The endpoint – long-term value creation consistent with achieving the Sustainable Development Goals by 2030 – is the relevant perspective for all players (financial sector, corporates, government and households) in the system. The feedback loop highlights that long-term value creation preserves natural, social and financial capital in the long term.

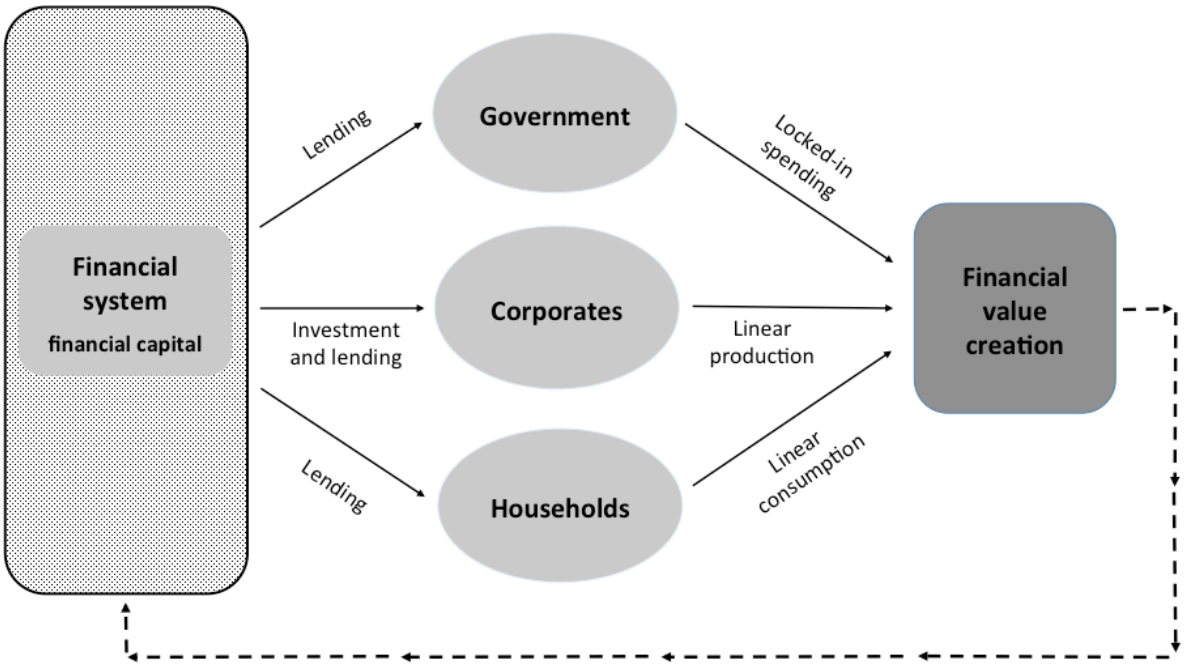
Corporates play a key role in the transition to a sustainable economy. It is therefore important to broaden their objective from shareholder value to stakeholder value, which integrates financial, social and environmental value. Another challenge is a behavioural bias towards the short term. Market practices, like monthly or quarterly performance benchmarking and variable pay, reinforce this short-term bias. A possible cost of financial markets is thus short-termism, with agents in the financial intermediation chain weighing near-term outcomes too heavily at the expense of longer-term opportunities. But sustainability is about the long term. **Chapters 3 and 4** explore governance approaches that focus on long-term value creation.

Some corporates will survive that transition, others will not, because their competitive positions are eroded. Sustainability is therefore also about corporate survival. It is a critical issue to competitive positions, business models and, ultimately, strategy. The fields of strategy and finance overlap in the areas of valuation and strategic value management. The latter is the practice of ensuring that investment decisions create long-term value. This involves the analysis of a company's value drivers, which in turn are

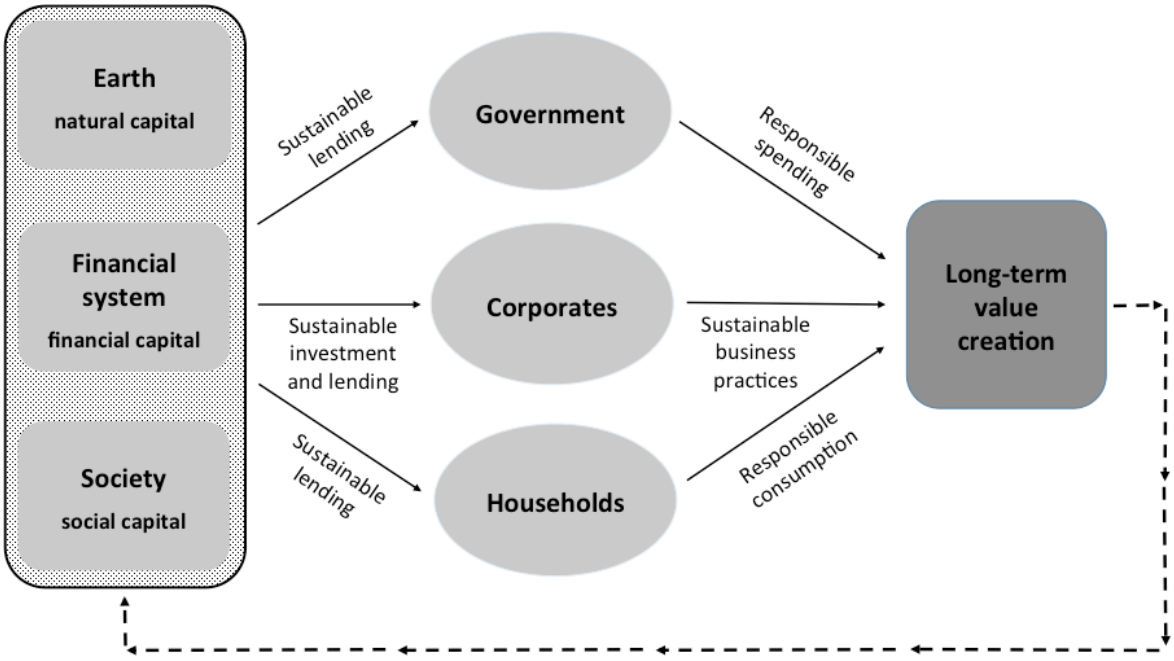
affected by material sustainability issues. **Chapter 5** discusses how successful companies can anticipate sustainability issues in their valuation and strategy.

Figure 1.7: Value creation

Panel A: Financial value creation in traditional finance



Panel B: Long-term value creation in sustainable finance



Metrics and data to assess and manage social and environmental issues are not only needed for *ex ante* decision-making, but also for *ex post* accountability to facilitate governance. An emerging trend is integrated reporting, whereby companies report on financial, human/social and natural capitals in an integrated way rather than publishing separate reports: one financial report and one sustainability report. Investors have typically been interested only in the first type of reports. The lack of reliable metrics and data is to date a major hurdle in the acceptance of integrated reports. **Chapter 6** highlights the need for developing appropriate metrics, collecting relevant data and assuring the quality of published data in integrated reports.

Sustainability needs to be incorporated in mainstream finance. Table 1.4 presents how our sustainable finance typology developed in this chapter can be applied to various financial instruments and sectors. At the basic level (SF 1.0), exclusion of companies or projects with very negative social or environmental impact is incorporated in the investment, lending or insurance strategy. The next level (SF 2.0) incorporates ESG factors and risks in the decision-making and manages the integrated value. The advanced level (SF 3.0) starts with an analysis of the social and environmental impact before considering financial returns. While **Chapter 7** analyses new investment approaches for long-term value creation, **Chapters 8 to 11** discuss the integration of sustainability in financial instruments and sectors.

Finally, the transition to a sustainable economy requires changing our ways of working (**Chapter 12**). While technical discussions of externalities and policy development dominate the sustainability debate, the real transition challenge is developing integrated thinking and implementing effective transition management. *Integrated thinking* combines the financial, social and environmental dimensions: integrated value becomes then the new norm for business and investment decision-making. Organisations are often hierarchical and locked into traditional ways of working; building capacity for sustainable development may be difficult in such structures. Doppelt (2017) outlines a guide for change, which starts with challenging and shifting the dominant business-as-useful mindset across the organisation.

Table 1.4: Integration of sustainability in financial instruments and sectors

Sustainable Finance Typology	Equity (Chapter 8)	Bonds (Chapter 9)	Banking (Chapter 10)	Insurance (Chapter 11)
Sustainable Finance 1.0	Exclusion			
Sustainable Finance 2.0	ESG integration			
Sustainable Finance 3.0	Impact investing	Green bonds Social bonds	Impact lending Microfinance	Microinsurance

1.6. Conclusions

Coming from an 'empty' world with abundant natural resources, the Industrial Revolution has brought prosperity in the form of economic and population growth. At the same time, this growth -based on production processes dependent on fossil fuels and other natural resources- has created social and environmental challenges. 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 are increasingly introduced to counter these practices and promote decent work and access to education and healthcare. Next, mass production and consumption is stressing the Earth system through pollution and depletion of natural resources. Climate change is now the most pressing ecological constraint or planetary boundary. 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 chapter shows how sustainable finance has the potential to move from finance as a goal (profit maximisation) to finance as a means. 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 and more 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.

Key concepts used in this Chapter

Common good refers to what is shared and beneficial for all or most members of a given community

Environmental issues or ecological issues are issues, abiotic or biotic, that influence living organisms; see *planetary boundaries* for the most critical environmental issues

Externalities refer to consequences of activities, which affect other (or third) parties without this being reflected in market prices

Fair financial return preserves at the minimum the (real) value of capital

Inside-out perspective asks how business can reduce their social and environmental impact; this perspective contrasts with the *outside-in perspective*

Integrated thinking combines the financial, social and environmental dimensions

Integrated value is obtained by combining the financial, social and environmental values in an integrated way (with regard for the interconnections)

Legitimacy theory indicates that corporates aim to legitimise their corporate actions to get the approval from society and thus to ensure their continuing existence

Linear production and consumption system is based on extraction of raw materials (take), processing into products (make), consumption (use) and disposal (waste)

Living wage is a wage for a full-time worker sufficient to provide his or her family's basic needs for an acceptable standard of living; a living wage varies with the local cost of living

Outside-in perspective asks how business can contribute effectively to solving social and environmental challenges

Planetary boundaries framework consist of nine planetary boundaries within which humanity can continue to develop and thrive for generations to come; these boundaries include climate change, biosphere integrity, land-system change, freshwater use, biochemical flows, ocean acidification, atmospheric aerosol loading, stratospheric ozone depletion and novel entities

Precautionary principle states that an action should not be taken (or a boundary should not be crossed) if the consequences are uncertain and potentially dangerous

Resilience of a system (e.g. an eco-system or organisation) is the adaptive capacity of a system to deal with unpredictable shocks

Resources abundances refers to the plentiful availability of natural resources like minerals, metal ores, fossil fuels, land and freshwater

Shareholder value approach means that the ultimate measure of a corporate's success is the extent to which it enriches its shareholders

Social foundations consist of 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

Stakeholder value approach means that a corporate should balance or optimise the interests of all its stakeholders: customers, employees, suppliers, shareholders and the community

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

Sustainable finance looks at how finance (investing and lending) interacts with economic, social, and environmental issues

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