Managing environmental and energy transitions for regions and cities

Financing environmental and energy transitions for regions and cities: creating local solutions for global challenges

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To meet the Paris climate goals, we need serious environmental and energy transitions. Financing those transitions will require both the financial and the public sector to transcend business-as-usual and take on new roles and structures in this system change. Current financial practice lacks the structures to deal with local initiatives, and has a narrow focus on financial return calculations. For their part, subnational governments often lack the knowledge to take that role. This gap can be filled by adopting investment criteria based on integrated value, by educating students and practitioners on transitions and systems thinking, and by creating new structures that are adapted to local conditions, with active roles for city and regional governments.

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Background information

This paper was prepared as a background document for an OECD/EC high-level expert workshop on "Financing environmental and energy transitions in cities: local solutions for global challenges" held on 18 October 2019 at the OECD Headquarters in Paris, France. It sets a basis for reflection and discussion. The background paper should not be reported as representing the official views of the European Commission, the OECD or one of its member countries. The opinions expressed and arguments employed are those of the author(s).

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The workshop is part of a five-part workshop series in the context of an OECD/EC project on "Managing environmental and energy transitions for regions and cities". The five workshops cover "Managing the transition to a climate-neutral economy, "Managing environmental and energy transitions in cities", "Managing the transition to a circular economy", "Managing environmental and energy transitions in rural areas", and "Financing, scale-up and deployment". The outcome of the workshops supports the work of the OECD Regional Development Policy Committee and its mandate to promote the design and implementation of policies that are adapted to the relevant territorial scales or geographies, and that focus on the main factors that sustain the competitive advantages of regions and cities. The seminars also support the Directorate-General for Regional and Urban Policy (DG REGIO) of the European Commission in work of integrating sustainability transitions in the next generation of European Union Cohesion Policy programmes 2021-2027, as well as to support broader discussion with stakeholders on managing long-term environmental and energy goals in EU regions and cities. The financial contributions and support from DG REGIO are gratefully acknowledged.

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Executive summary

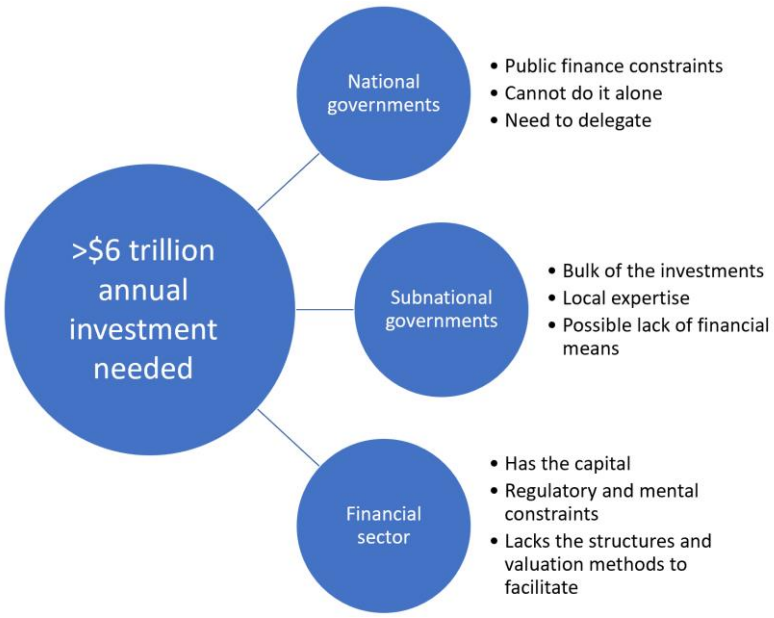
To meet the Paris climate goals, we need serious environmental and energy transitions. Financing those transitions will require both the financial and the public sector to transcend business-as-usual and take on new roles and structures in the system change. And to be effective, these structures need to be adapted to local conditions, with active roles for city and regional governments.

Current financial practice works for funding business as usual, but is less suitable for funding sustainability transitions. Transitions mainly happen at the city and region level, but academic finance does not pay attention to the subnational level – where proximity and context-specific solutions matter. That gap also applies to financial institutions, which lack the structures to deal with local initiatives, and have a narrow focus on financial return calculations. This means that scale-up often does not happen; and even large projects are not done if they do not fit all the standard requirements of the financial sector.

What is needed is:

- more government initiation to take early stage risk;
- new vehicles for scale-up;
- structures to make blended finance work; and
- more visibility and steering on integrated value rather than financial value only.

All that can be done, the methods are there. But we need the institutional will to put those methods into general practice.



1 Introduction

The erosion of natural capital poses existential threats to national and global prosperity, but political and economic systems are unprepared for responding to that risk (Cohen *et al*., 2017). The sense of urgency is rising from a low base. Climate-related weather catastrophes, in particular near the equator, are becoming more intense and destructive. Economic losses from natural disasters are estimated at US$ 165 billion and 13,500 people lost their lives in 2018 (Swiss Re, 2019). These numbers are on the rise. Next, the first climate bankruptcy has already happened as the Californian utility PG&E was hit by wildfires (Mui, 2019). To meet the Paris climate goals and to avoid disasters, we need serious environmental and energy transitions.

The OECD (2018a) estimates that US$ 95 trillion in public and private investments will be needed in energy, transport, water and telecommunications infrastructure globally between 2016 and 2030 in order to support growth and sustainable development. That is US$ 6.3 trillion per year for which there is insufficient public funding. This leaves a funding gap, but the financial sector is not (yet) ready to fill that gap. Current financial sector practices are not very suitable for financing transitions since large amounts of capital are stuck in specific boxes (e.g. investment mandates and asset classes). Efforts to align financial flows with climate objectives remain incremental and fail to deliver the radical transformation needed (OECD, 2019).

Kawabata (2019) indicates that the climate finance flow is far behind the level needed to meet the target in the Paris Agreement. The engagement of climate finance initiatives plays a facilitative role by providing pressures on financial institutions to mobilise climate finance. There is also a need to structure transitions in such a way, that they can attract private funding. This requires an initiating and coordinating role for the government. Cities and regions are crucial since they are estimated to account for 57% of public investment in OECD countries (OECD, 2018b) and even 64% for environment and climate related investment (OECD, 2019). Climate finance should not only consider the financial returns, but also the social and environmental returns. The concept of societal value, which integrates financial, social and environmental value, is starting to gain traction in the private sector (Schoenmaker and Schramade, 2019a).

The role of governments versus financial institutions

Financial institutions and markets excel in efficiently achieving goals at scale, provided that those goals are set and structures are in place. It is the role of society and governments to set sustainability goals: determine where we need to go, what transitions are needed, what will be allowed to be profitable and what not. The UN Sustainable Development Goals (SDGs) provide the global strategy (UN, 2015), which needs to be further specified at the national and subnational level.

The second role of governments is to follow up on those goals by providing the structures and incentives, the playground for markets and financial institutions to achieve the goals (Mazzuchato, 2018). This includes determining at what level of administration the steps need to be taken. For example, carbon pricing is probably best tackled at the EU level, while traffic congestion pricing is better done at the city level. The third role of governments is to engage the financial sector in the earliest stages of development of technologies and business models. In those early stages the private risk-return trade-off does not work

properly, while the societal risk-return does work. The long-term viability of transition initiatives can then be assessed, with a potential need for short or intermediate term concessional finance.

Framework for sustainable finance

Table 1.1 provides a framework for sustainable finance (Schoenmaker and Schramade, 2019a). Most financial institutions are at Sustainable Finance 1.0 (SF 1.0), with standard products and some minor exclusions (e.g. tobacco or coal). Some financial institutions are starting to integrate financial, social and environmental goals at SF 2.0, which leads to incremental changes towards green finance. At SF 3.0, impact investors and values-based banks aim for societal impact. They are not yet sufficiently developed to provide the required finance for transition, as they currently form less than 1 percent of the financial sector (Schoenmaker, 2019). Moreover, their approach is still mainly supply driven, as financial institutions are looking how they can contribute from their organisations.

The challenge for green finance is to better fit with the nature of the transition challenges and projects (i.e. become demand driven) and to adopt backcasting (i.e. starting from the desired outcomes to determine what is needed; see Figure 2.2 in Section 2 below). What are the required transitions? And how can these transitions be structured to attract funding?

Table 1.1. Framework for sustainable finance

	Sustainable finance 1.0	Sustainable finance 2.0	Sustainable finance 3.0
		Green finance	
Advantages	Vast infrastructure in place that facilitates enormous volumes of funds to be transferred	Connected to main-stream finance	Goal setting first, structures follow. Has the potential to unlock vast potential
Disadvantages	Cannot deal with non-financial goals and non-standard methods	Cannot deal well enough with non-financial goals, non-standard methods, and regime change (transitions)	Lack of methods and track record leading to still high transactions costs, which impedes scaling up

Source: Adapted from Table 1.3 from Schoenmaker and Schramade (2019a).

Additional challenges and opportunities at the subnational level

While transitions are often cast in an international or national context, it is good to realise that more than half of the world's population lives in cities and their importance is expected to increase further (UN, 2018). The concept of bioregional planning links global risks (such as climate change) with manageably local frameworks of collaboration in ecosystem management (Brunckhorst, 2013). This place-based community approach allows for involvement of local stakeholders (subnational government, citizens and firms) to find innovative solutions at the local level. Effective cooperation between national and subnational governments is important, because the deep pockets and the regulatory apparatus are typically at the national level. But most of the action takes place at the local level, undertaken by subnational governments, SMEs, and the local branches of banks and local subsidiaries of MNCs. Unfortunately, these local dynamics are hardly

studied in the financial literature. That is strange, as these local ecosystems offer the advantages of proximity, direct participation, local knowledge, and context-tailored solutions.

The structure of this paper is as follows. The next section describes the nature of transitions and the special role therein of cities and regions. We then address the shortcomings of the financial sector in financing transitions (section 3) and the resulting financing challenges and new roles for subnational governments and financial institutions (section 4). These are illustrated with sector examples in section 5. We offer recommendations in section 6.

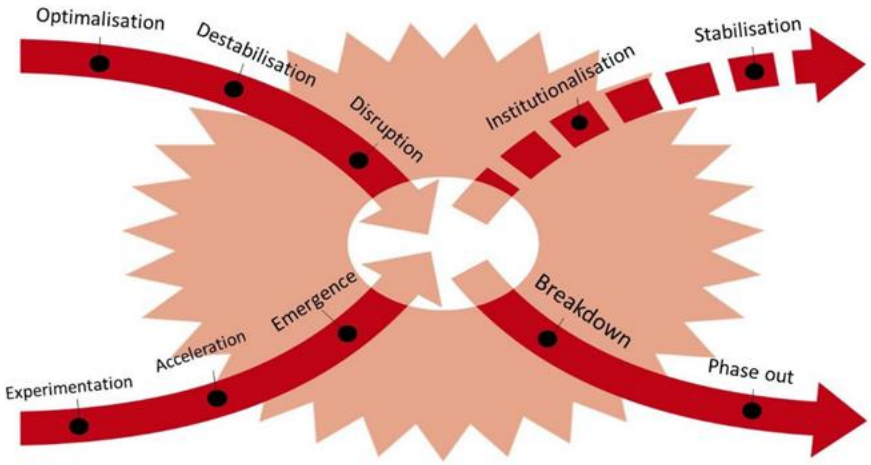
2 Transitions

The transition process determines which action is needed by which party and at which stage. This section analyses the nature of transitions and discusses the main transitions at the environmental front.

Transition management

Transition is about transformational change of the system rather than incremental change (Loorbach, 2010). Figure 2.1 depicts the dynamics of societal transitions as iterative processes of build-up and breakdown over a period of decades (Loorbach, Frantzeskaki and Avelino, 2017). In a changing societal context, incumbent regimes develop path-dependently through optimisation, while change agents start to experiment with alternative ideas, technologies and practices. Over time pressures build on regimes to transform, leading to destabilisation as alternatives start to accelerate and emerge. The actual transition is then chaotic and disruptive and new combinations of emerging alternatives and transformative regime elements grow into a new regime. In this process elements of an old regime that do not transform are broken down and phased out.

Figure 2.1. The x-curve of transition dynamics



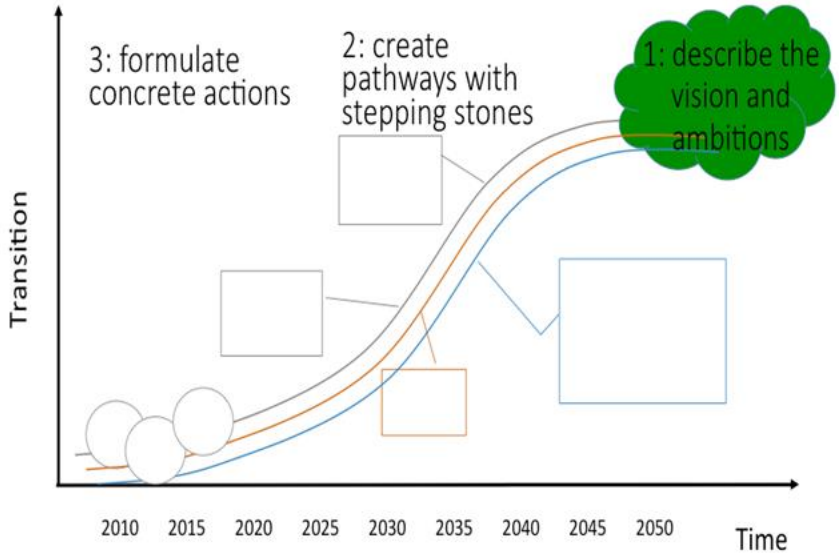
Source: Loorbach, Frantzeskaki, and Avelino (2017).

Transition of systems starts with new technologies and business models. The bottom arrow in Figure 2.1 shows the different stages: Experimentation; Acceleration; Emergence; Institutionalisation; and Stabilisation. The early stages are the hardest and most ‘unexpected’ government help and vision are needed (Mazzuchato, 2018). The required government help is not only financial through co-funding or other incentives, but also coordination through developing a system vision and using its convening power by bringing parties together.

Transition also implies phasing out existing technologies and business models, that cannot adapt (the top arrow in Figure 2.1). If markets are efficient, the Schumpeterian creative destruction can work on its own, as the highest return in the new sectors will enable the reallocation of workers. In reality, governments must help the workers to retrain. In the destabilisation and disruption stages, governments have often the kneejerk reaction to help the business that is in trouble and/or to protect the jobs involved. But it is better to focus on helping the people - retraining and finding new employment as in the Danish labour market - and changing the system. The Danish labour market is known for its high level of flexibility when hiring, social welfare system and active employment policies. Together, these three components constitute what is known as the 'Flexicurity Model', which combines the market economy with the traditional Scandinavian welfare state (see, for example, Jespersen, Munch and Skipper, 2008).

Cities, regions and business have both types of processes (emerging and disappearing) in their portfolio, but with varying mixes. Transition management (Loorbach, 2010) starts with rethinking current methods and structuring the underlying shortcomings. So, in climate finance, the shortcomings of current finance and government approaches need to be explored. The next step is to develop a new vision for the long term, which is then backcasted to new approaches for the medium term and concrete experiments in the short term (Figure 2.2).

Figure 2.2. Backcasting: From long-term thinking to short-term action



Source: Adapted from Loorbach (2010).

Transition governance

Transition governance looks at how actors can influence transition processes (Loorbach, Frantzeskaki, and Avelino, 2017). Actors in both the current regime and in emerging niches can explore initiatives for fundamental transition in a so-called transition arena. To steer clear of unsustainability lock-in, selective participation by front-runners and radical outsiders is needed. In the case of large-scale energy and environmental transitions, it is important to include both senior civil servants from the relevant regional (and national) government as well senior investors/bankers from the financial sector in the transition arena. This helps shaping the transition in a feasible way (i.e. alignment with government policies and regulations and alignment with funding practices of the financial sector). Nevertheless, it is crucial that senior officials and financials in these transition arenas are also front-runners, who dare to think out the box and are willing

to explore new ways. Where needed they should initiate within their own organisation changes in standing government policies and regulations and in funding practices. They play thus an important intermediary role between the transition projects and the government and the financial sector. Governments and financial institutions can then turn from blocking into enabling parties in transitions.

Financing new models across transition phases

Table 2.1 provides some examples of roles which the national and subnational government and the financial sector can adopt across the transition phases. The (subnational) government can initiate or steer transitions by using its public role (convening meetings) and/or public funds (regional development funds or development banks). Subnational governments often provide a territory of experimentation. An example is the experimentation of drones in Bordeaux to improve the efficiency of public services and their energy consumption (transport of blood between the various hospitals by drones rather than by cars). Moving to finance, traditional venture capital is still limited, as they find such transition projects (such as Hydrogen projects that are currently highly subsidised) too risky. Here, entrepreneurs and corporate venture capital are the main players. As risk diminishes across the phases, so does the role of government, and the participation of the financial sector increases (see Table 2.1). The use of instruments also changes across the various phases: from risky (government) venture capital finance to mainstream bank or market financing.

Alternative financing structures are also emerging, outside of the traditional financial institutions. Some bottom-up ecological projects are facilitated by crowdfunding or participative finance (e.g. Lam and Law, 2016; Vasileiadou, Huijben, and Raven, 2016; Polzin, Sanders, and Täube, 2017). The European Commission is working to help investors and businesses seize the potential of crowdfunding and make it easier for platforms to offer their services EU-wide. The European Commission has presented a proposal for a regulation on crowdfunding service providers (European Commission, 2018).

Crowdfunding is quite developed in Germany and the Netherlands (and is gaining popularity in France) for relatively small projects (with up to 500-800 citizens participating), notably in renewable energy. There is limited indication of learning across platforms and limited support from regime actors (Vasileiadou, Huijben, and Raven, 2016). Even if in terms of volume, crowdfunding might not be sufficient to finance the ecological transition, it can nudge interests and incentives for the government and the financial sector (e.g. showing that a project is sustainable and can be a good area of investment for the private sector, or showing the social/environmental benefit of a project that can get interest from the government). More generally, Polzin, Sanders, and Täube (2017) argue that a more diverse financial system, which includes crowdfunding allowing for more equity and less debt, will increase the flow of funds to innovative, small-scale, or experimental firms that drive the sustainability transition.

Table 2.1. Role of key players in transition phases of new models

Phases of new models	Government role	Financial sector role	Example
Experimentation	Can be crucial. Support promising technologies to create powerful options. Provide experimental territories. Invest actively.	Limited, VC finds it too risky, so usually privately funded (entrepreneurs and corporate VC), sometimes publicly, but typically not at all. Emerging use of crowdfunding.	Rotterdam municipal government funds waste to gas facility with 20% success probability.
Acceleration	Similar to the above, but investments giving way to financial sector, more focus on other instruments.	VC takes it up.	Proven models are scaled up from low base. Car-sharing programs.
Emergence	Diminishing role in financing.	Bank and stock market finance become more important.	Wind and solar projects are economical with little or no subsidy.
Institutionalisation			Wind and solar projects are economical without subsidy, but question marks remain over peak capacity.
Stabilisation			Wind and solar are the default options.

Source: Authors.

Facilitating the phase out of old models

There are strong forces to maintain the status quo, such as lobbying by incumbent companies against change in order to preserve the current value of their assets. A case in point is the lobby of the oil industry against electric cars in California in the 1990s, which is documented in the 2006 film 'Who killed the electric car?' (Bedsworth and Taylor, 2007). Another example is the lobby of the energy-intensive steel industry against the EU's Emissions Trading Scheme.

Table 2.2 sketches the key players across the transition phases of out-dated models. The starting point of a successful transition is for the government to stop the 'wrong' subsidies. A major example is fossil fuels which are heavily subsidised in many countries. Pre-tax energy subsidies for fossil fuels amount to US$ 5.3 trillion, which is 6.5 per cent of world GDP in 2015 (Coady, Parry, Sears and Shang, 2017). These subsidies are counterproductive and a highly inefficient way to provide support to low-income households. Fossil fuel subsidies discourage needed investments in energy efficiency, renewables and energy infrastructure.

The financial sector and sub-national governments are not isolated subsystems, but part of larger socio-economic systems (like energy supply systems). In the transition, old socio-technical systems need to be phased out. It starts with an analysis of barriers that the current finance regime manifest. Next, measures can be designed to counteract or even start breaking down these regimes and the powers their incumbent agents have that block higher investment in sustainable transitions. Organisational transition within incumbent financial players are important to cope with outdated visions, attitudes, models-in-use and rules-in-use (see Chapter 11 in Schoenmaker and Schramade, 2019a). Moving to energy infrastructure, Verbong and Geels (2010) analyse possible transition pathways for sustainability transitions in the electricity system and indicate the implications for (grid) infrastructures.

Table 2.2. Role of key players in transition phases of out-dated models

Phases of old models	Government role	Financial sector role	Example
1. Optimisation	Cut subsidies, start pricing externalities, stricter regulation. Offer alternative uses of assets, co-finance under strict conditions.	Higher cost of capital, exclusions, engagement.	Oil companies, airlines.
2. Destabilisation	The above, but stricter Etc.	The above, but stricter. Etc.	Packaged food companies.
3. Disruption			Fossil fuel cars.
4. Breakdown			Coal mining in the West.
5. Phase out			Coal power plants in the West.

Source: Author's elaboration

The tables can turn in favour of renewable energy if there is a price on carbon emissions, which can be a tax or an emission trading system. Instead of solely reaching the carbon emission threshold with carbon taxes or trading, Acemoglu, Aghion, Bursztyn and Hemous (2012) propose to reach the R&D threshold above which clean technology becomes more efficient than dirty technology. Their solution to redirect technical change to cleaner technology (e.g. renewable energy, energy efficiency and carbon storage technology) is a mix of carbon taxes to make dirty technology more expensive and research subsidies for clean technology to redirect research. These subsidies can be used at the national and subnational level. They can be in the form of credit subsidies or direct subsidies of initial costs for high risk renewable energy projects. Further complementary measures include investment in a skilled workforce who can deploy the new technologies and provision of information to consumers. Even when there is a clear economic rationale for building retrofits or electromobility, a lack of information often keeps consumers from making full use of these alternatives to fossil energy.

In the financial sector, exclusion of 'unsustainable' companies is one of the first instruments (negative screening in Sustainable Finance 1.0). However, the exclusion of 'sin' stocks has limited impact, as other financial institutions may pick up these companies. In Sustainable Finance 2.0 and 3.0, financial institutions engage with companies to foster sustainable business practices (Schoenmaker and Schramade, 2019a). The key result of exclusion and/or engagement is that the cost of capital increases for 'unsustainable' companies and decreases for sustainable companies.

If necessary, (subnational) governments can pay incumbents off. Their losses in a transition are probably much smaller than the (societal) opportunity costs of delaying the transition.

Subnational government roles in transitions

Whereas national governments are the most powerful players with full access to taxation and regulation, subnational governments also have a role to play as transition often occur at regional level (Brunckhorst, 2013). Moreover, as the latter are closer to the citizens, they can play a key role in the acceptance of a transition. Effective interplay between the national and regional level is crucial. A historical example is the transition from coal to gas in the Netherlands, which was funded by the revenues from gas exploration (Correljé and Verbong, 2004). When the coal mines in the south of the Netherlands were closed in the 1960s, the national government provided state aid to DSM (Dutch State Mines) to reform itself and offer alternative employment. The closure of the coal mines was prepared and executed jointly by the national government and the provincial government of Limburg. DSM is now one of the leading Dutch sustainable companies.

Lack of political support can hamper regime change. The idea of a ‘just transition’ stresses the need to ensure that efforts to steer society towards a lower carbon future are underpinned by attention to issues of equity and justice: to those currently without access to reliable energy supplies and living in energy poverty and to those whose livelihoods are affected by and dependent on a fossil fuel economy (Newell and Mulvaney, 2013).

Main types of (global) transitions

The SDG agenda is about the transition to a sustainable and inclusive economy (UN, 2015). A just transition encompasses a range of social interventions to secure workers' employment prospects and citizens’ livelihoods when economies are shifting to sustainable production and consumption. It is not possible to have a transition that is not socially acceptable. Three main transitions can be identified at the environmental front:

1. Energy transition: Moving from the use of fossil fuels to renewable energy.
2. Circular economy: Redesign and recycle products (McDonough and Braungart, 2013) leading to less carbon emissions (e.g. recycling aluminium saves on carbon emissions in the production of aluminium).
3. Natural food/land restoration: Trend towards healthy food with respect for land (so keeping up the quality of the land without overuse of fertilizer and use of pesticides). In addition, land restoration (including forest areas) provides watershed function and carbon absorption (Ferwerda, 2016).

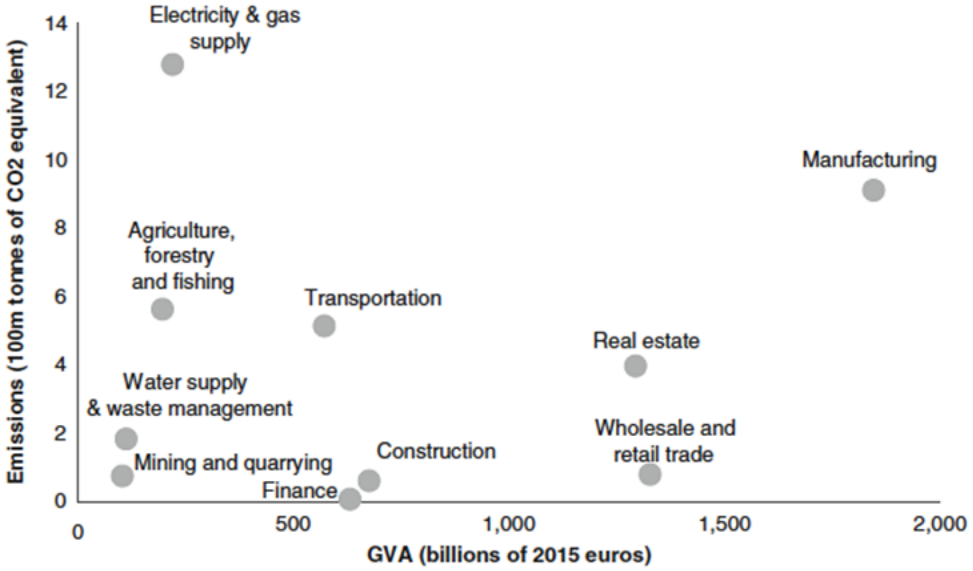
To reduce carbon emissions, it is crucial to tackle the most carbon intensive sectors. Figure 2.3 shows that electricity is the most important sector for energy transition (renewable power generation and new networks e.g. using industry warmth as heating). Other carbon intensive sectors include manufacturing, agriculture, transportation and real estate (including heating and cooling).

This paper focuses on transition in the following sectors:

- Electricity: Power generation and energy networks;
- Mobility: From individual owned petrol cars to public transport and car sharing;
- Real estate: Improving energy efficiency houses and offices, as measured with energy label;
- Manufacturing: Not manufacturing in general (that is to be addressed at corporate level), but specific in relation to fostering circular business models (McDonough and Braungart, 2013);
- Agriculture: Land restoration (Ferwerda, 2016).

These transitions differ in terms of incentives needed and stage of development. The precise role of the government (both subnational and national) and the financial sector will be tailored to the specific situation in Sections 4 and 5.

Figure 2.3. Greenhouse gas emissions and gross value added (GVA) by sector, EU



Note: This graph shows greenhouse gas emissions. Real estate emissions include heating and cooling. GVA is gross value added, taken from Eurostat.
Source: Schoenmaker and Van Tilburg (2016).

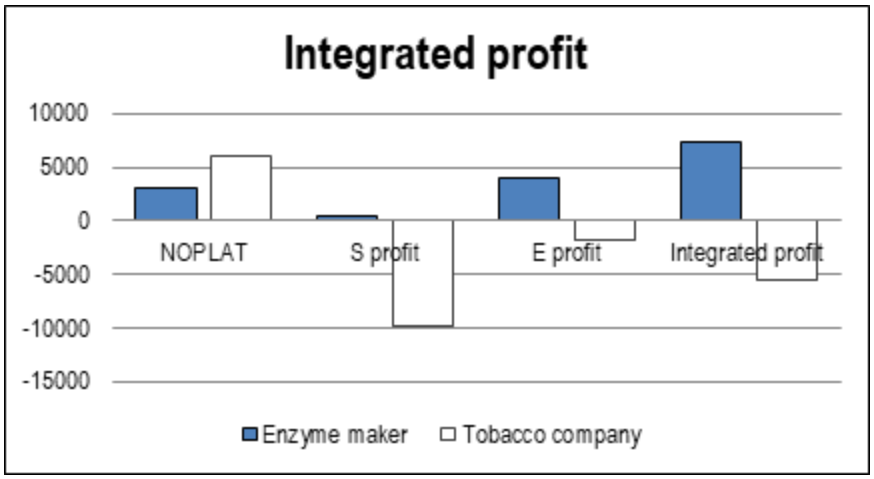
Societal value, indicators, and business models for transitions

Societal value

Governments should steer transitions on the basis of societal value, which includes financial, social and environmental value (Schoenmaker and Schramade, 2019a). While the literature uses various terms, such as true price (True Price, 2014), true value (KPMG, 2014) and integrated value (Schoenmaker and Schramade, 2019a), the basic methodology involves measuring, monetising and balancing financial and non-financial values. Figure 2.4 expresses integrated value for two hypothetical companies, showing the contrast between an enzyme maker that creates value on all dimensions; and a tobacco maker that is financially profitable, but value destructive in environmental and especially social terms.

Some players in the private sector have also started to adopt these new valuation techniques to inform long-term investment projects. Some major oil and chemicals companies, for example, use a shadow carbon price when evaluating long-term investment proposals. Decision-making (investing or not) is then based on this societal value calculation.

Figure 2.4. From financial profit to integrated profit



Note: The Net Operating Profit Less Adjusted Taxes (NOPLAT) is a financial metric that calculates a firm's operating profit after adjusting for taxes. The S profit is related to a firm's social capital and the E profit to its natural/environmental capital. Integrated profit adds up the three profit components.
Source: Author's compilation

Indicators

For tracking progress and calculating societal value of energy and environmental transitions, we need indicators. These come in many forms and are typically layered. A dashboard could look like Table 2.3. These indicators can be expressed in several ways, such as totals, averages, growth, per person, per km2, per euro, per sector, per area, etc. Ideally, such indicators feed into and can be sourced from national accounting systems, and can be compared across geographies. Crucially, this should include granularity at the regional and city level, which is now typically missing.

When the Dutch state issued its first green bond, it had to work with green indicators, which changed the internal dialogue. Moreover, the external dialogue changes as well as it found that investors asked them many questions about indicators. These are mutually reinforcing processes. But more is needed and Hoekstra (2019) proposes a national accounting framework that comprises:

- Four system accounts, which measure quantities along the most important dimensions:
- Environmental accounts
- Societal accounts
- Economic accounts
- Distribution accounts
- Quality accounts, which provide quality assessment criteria to understand whether the systems are improving or deteriorating

These accounts should replace GDP as the sole indicator of prosperity and contribute to a much broader view of societal value. They are analogous to the Framework for Impact Statements of the Impact Institute (2019) for corporations, as applied in the 2018 ABN AMRO impact report. The International Accounting Standards Board (IASB) should develop International Financial Reporting Standards (IFRS) for sustainability or non-financial information to complement current IFRS standards for financial information (Barker and Eccles, 2018). Ideally, these two worlds of national reporting and corporate reporting will converge to a state where societal information is properly and consistently integrated in a way that allows

for meaningful communication between both worlds. International organisations, such as the OECD with its well-being framework and the World Bank, could play a leading role in this process.

The central element in these new accounting frameworks at corporate level (such as Integrated Reporting of the International Integrated Reporting Council) and at national level (such as the OECD's Well-Being Framework) is to add human, social and natural capitals to the current measurement of economic capital (i.e. profit and GDP).

Table 2.3. Examples of indicators

GHG emissions	GHG emissions in power generation % renewables in power mix Growth in power demand GHG emissions in industry GHG emissions in consumption/use GHG emissions in imports Emission reductions innovations Carbon absorption of land Etc.
Materials use & circularity	Value loss in materials Recycling rates Circular jobs Size of the circular economy Use of toxic materials Use of critical materials Waste generated % waste incinerated
Natural capital	Water consumption Green areas Ecosystem value Land restoration Soil quality

Source: Author's compilation.

New business models or products

As we move towards a more sustainable economic model that accounts for environmental issues, business models will change as well. Value destructive models are replaced by value creative models – of which many are currently not viable because the old models are priced too cheaply (i.e., the externalities are not in the price). Those new business models and products in the transition sectors may differ in terms of:

- payback time – may be longer as we are moving towards long term solutions;
- residual value – may be higher or lower depending on the way products are processed in their post-use phase;
- ownership – a shift from buying to leasing;
- value chains – will change in terms of structure, nature of players, and cooperation; and
- transaction moments – pay a monthly or annual fee for a services rather than a lump-sum upfront.

These differences have implications for financial instruments, transaction costs, reporting, etc. They can make financing from traditional sources troublesome. For example, if you buy the services of a machine rather than the machine itself, that means you cannot get the typical bank loan against the collateral value of the machine. Hence, the models and methods of banks need to change as well, perhaps shifting more towards equity financing, or loans based on expected cash flow rather than on collateral (Schoenmaker and Schramade, 2019a).

The role of cities and regions

Cities

More than half of the world's population lives in cities and their importance is expected to increase further. The population living in cities is set to increase from 4 billion in 2015 to 6 billion in 2030 (UN, 2018). Cities account for 70% of direct CO_2 emissions. Moreover, 88% of urban population is exposed to unacceptable pollution (Citi, 2018). A recent report by Citi (2018) summarises the significance of cities nicely in Figure 2.5.

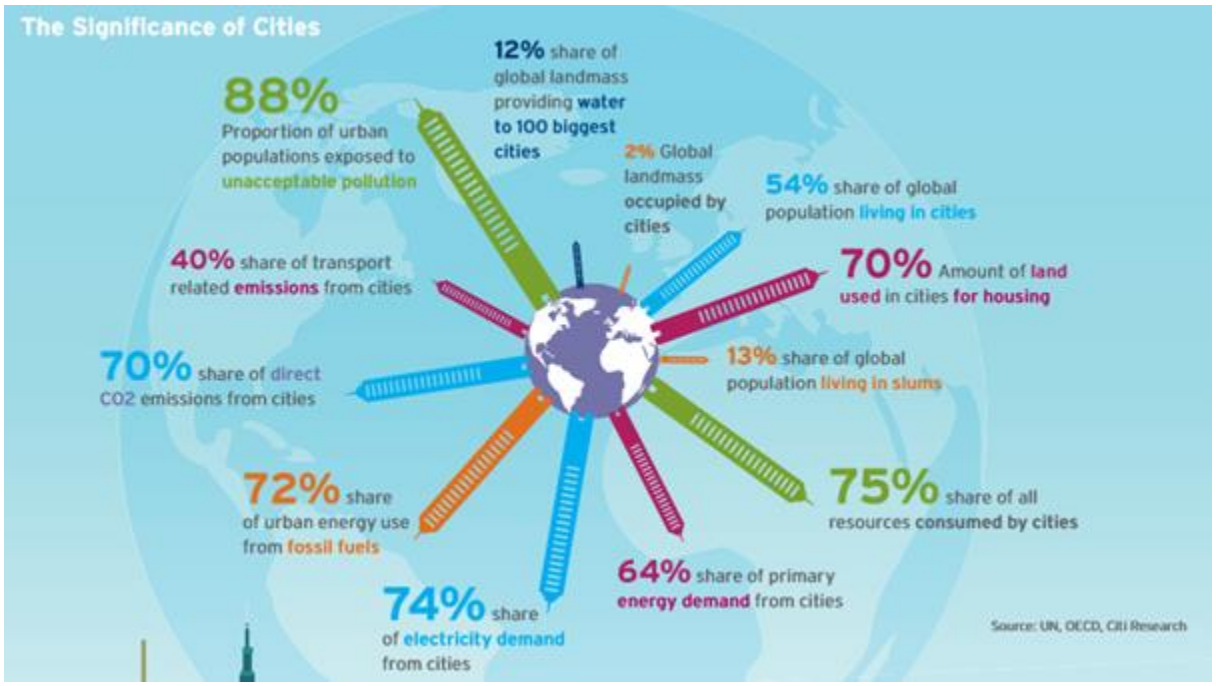
Glaeser (2011) calls cities engines of innovation and claims that urban density provides the clearest path from poverty to prosperity. Human capital, far more than physical infrastructure, explains which cities succeed. As cities double in size, productivity across sectors increases by 3-8% (Spence, Annez and Buckley, 2009). At the same time, cities attract poor people looking for work, which poses social development challenges. Glaser (2011) further argues that the central paradox of the modern metropolis is that proximity has become ever more valuable as the cost of connecting across long distances has fallen.

At the environmental front, dense urban areas are much more energy efficient and environmentally friendly than suburbia, for example because people live in smaller homes, own less stuff, and move more by public transport and less by cars. Glaeser (2011) argues that good environmentalism means putting buildings in places where they will do the least ecological harm. This means that we must be more tolerant of tearing down low-quality short buildings in cities in order to build tall ones.

Nevertheless, cities have additional problems, but also additional incentives and means to tackle those problems. Think of air quality problems caused by traffic congestion, which incentivise cities to reduce the use of petrol cars, by means of congestion pricing, stimulating electric vehicles (powered by green electricity) and improving mass transit systems – with a positive climate side-effect. Another challenge is that cities are warmer. There is scope for nature-based solutions, such as green roofs and green-blue infrastructure (Toxopeus and Polzin, 2019).

Cities are cooperating in bodies such as the C40 Cities Climate Leadership Group (promoted by Michael Bloomberg), the International Council for Local Environmental Initiatives (ICLEI), the Global Covenant of Majors, United Cities and Local Governments (UCLG) and NATURVATION (NATure-based URban innoVATION). The C40 is a group of 94 cities around the world that represents one twelfth of the world's population and one quarter of the global economy. NATURVATION is a four-year project, funded by the European Commission and involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics. The aim is to understand the potential of nature-based solutions for responding to urban sustainability challenges by working with communities and stakeholders.

Figure 2.5. Significance of cities



Source: Citi (2018).

Regions

Regional governments, which are elected and have a proper budget, often play an important role on environmental issues. In France, regions are for example in charge of Plans Environnement Climat. Similar to cities, regions are cooperating in bodies, such as R20 – Regions of Climate Action, which is accelerating the implementation of green infrastructure projects in the field of waste optimisation, renewable energy and energy efficiency by “connecting the dots” between public authorities, technology partners and financial investors.

At the regional level, Truffer and Coenen (2012) argue that research on the interdependencies between ecological sustainability, technological development, innovation, markets, institutions and territory is still lacking. Much of the sustainability transitions literature can be criticised for being spatially blind and for (implicitly) overemphasising the national level at the expense of other geographical levels. As a result, data at the subnational level, in particular on climate finance, is typically missing, which hampers decision making.

While there is a wide consensus that place-specificity matters, Hansen and Coenen (2015) indicate that there is still little generalisable knowledge about how place-specificity matters for transitions. Most contributions add spatial sensitivity to frameworks from the transition literature, but few studies suggest alternative frameworks to study sustainability transitions. The economics and feasibility of renewables, for example, differ by the geography of the particular region. So, renewables need to be adapted to the resources of a region to develop the most suitable ecological solutions (also in terms of circular economy). Likewise, the urgency to adapt to climate change also differs by region, such as coastal regions discussed above and island nations. In New Zealand, for example, sea level is projected to rise by about 30 centimetres between 2015 and 2065, which is the midpoint of the four IPCC scenarios for global mean sea-level rise with an additional rise of 10 per cent projected for New Zealand (Parliamentary Commissioner for the Environment, 2015).

Notwithstanding the lack of research on the role of regions in environmental policies, the concept of bioregion has emerged, which functionally links global risks with manageably local frameworks of collaboration. A bioregion is an integration of human governance with ecological law (Brunckhorst, 2013). It is an operationally pragmatic context that matches the functions and requirements of culture and society with ecological processes, services and functions. A bioregional framework for planning and managing ourselves helps us understand and develop an enduring relationship within ecological law - the rules and conditions necessary to sustain biodiversity and ecosystem processes (Brunckhorst, 2013). Local stakeholders are involved to find innovative solutions.

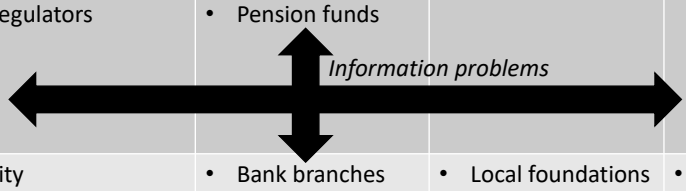
An interesting example is the initiative of WeMakeThe.City with Kate Raworth. WeMakeThe.City is a city festival to celebrate urban life and work on important urban questions in the Amsterdam metropolitan area. How do we make better cities? How do we make cities better? City makers, policymakers, citizens, businesses, artists, organisations and scientists take part in numerous conferences, meet-ups, hackatons, expositions and films to discuss and show how we make the city of the future.

Differing dynamics at national and subnational levels

It is important to recognise the difference in dynamics between (inter)national and subnational levels. Table 2.4 sketches the differences, including the information problems between the various players and levels. The focal point of study, including of academic studies, is often the (inter)national level. We are used to thinking in units of countries and MNCs, implicitly seeing them as monolithic actors. Yet, in reality, it is the local subsidiaries of MNCs that act in specific cities and regions, often in direct coordination with subnational governments. So, we also need to build local systems of environmental governance, which allows for direct participation of citizens (Brunckhorst, 2013). Social and institutional change is needed for learning and adjustment. An action-oriented approach to learning-by-doing might engage bottom-up, top-down and 'sideways-in' capacities along with the required transformations (see Section 6 for examples).

Table 2.4. Differences between (inter)national and subnational levels

Level	**Administration**	**Financial & corporate sectors**	**Civil society**	***Advantages***
(Inter)national	• Supranational bodies • National government • Regulators	• MNCs • Banks • Insurers • Asset managers • Pension funds	• NGOs • Academia • Media	• *Scale* • *Financial means* • *Visibility* • *General solutions*
Subnational	• City • Province	• Bank branches • SMEs • Local subsidiaries of MNCs	• Local foundations • Active citizens	• *Proximity* • *Direct participation* • *Local knowledge* • *Context-tailored solutions*



Source: Author's compilation

3 Role of the financial sector

Green finance, as branch of sustainable finance, is about financing the environmental and energy transition (see Table 1.1 above). The challenge is twofold (Schoenmaker and Schramade, 2019a). First, the financial sector (both banking and investing) has to incorporate the environmental and social dimension in its decision-making. Second, the financial sector needs to become more long-term oriented (again).

Literature review on sustainable finance

A short review of the literature on sustainable finance indicates an evolution of this fast-growing field. Three broad strands are distinguished:

1. The relation between environmental, social and governance (ESG) factors and financial returns;
2. Impact investing;
3. Value creation.

The relation between ESG factors and financial returns

Chava (2014) reports that many large banks have started to incorporate climate change concerns in their lending decisions, with some banks explicitly stating a target for reducing greenhouse gas emissions in their lending. Chava (2014) finds that lenders charge a significantly higher interest rate on bank loans to companies with environmental concerns compared to companies without such environmental concerns. Banks are concerned about environmental issues that are already regulated, such as hazardous waste and substantial emissions of toxic chemicals, and environmental concerns that are not yet regulated, such as concerns related to greenhouse gases or other climate change aspects.

Moving to investing, Friede, Busch and Bassen (2015) provide aggregated evidence combining the findings of about 2200 individual studies. About 90 percent of these studies find a nonnegative relation between ESG factors and financial returns, which is stable over time. It should be noted that this high percentage can be partly due to a publication bias, whereby studies that find a positive relation get more published than studies that find no or a negative relation.

There are different forms of ESG investing. Table 3.1 reports on worldwide ESG investment methods (GSIA, 2019). The first three methods are based on (general) screening methods and rely on ESG ratings or ESG indices (used in the empirical studies reviewed by Friede, Busch and Bassen, 2015). Investors thus use external ratings to screen in a more or less passive way their investment portfolio. These screening methods are currently used for almost half of sustainable investments, whereby exclusionary screening (e.g. excluding coal or tobacco) is most often used. The remaining four methods rely to some extent on an active investment approach aiming for long-term value creation (see below on the third strand).

Table 3.1. ESG investments by method (2018)

Method	ESG investments (in US$ billion)	Share (in %)
1. Negative/exclusionary screening	19,771	36%
2. Norms-based screening	4,679	8%
3. Positive/best-in-class-screening	1,842	3%
4. ESG integration	17,544	32%
5. Corporate engagement	9,835	18%
6. Sustainability-themed investing	1,018	2%
7. Impact investing	444	1%
Total	30,683	

Note: The figures do not add up to the total, as some investors combine several methods for sustainable investment. Negative/exclusionary screening is the exclusion from a fund of certain sectors or companies based on specific ESG criteria; Norms-based screening is screening of investments against minimum standards of business practice based on international norms; Positive/best-in-class screening is investment in sectors or companies selected for positive ESG performance relative to industry peers; ESG integration is the systematic and explicit inclusion by investment managers of ESG factors into financial analysis; Corporate engagement regards the use of shareholder power to influence corporate behaviour, including through direct corporate engagement; Sustainability-themed investing is investment in themes or assets specifically related to sustainability (for example clean energy, green technology or sustainable agriculture); Impact investing are targeted investments aimed at solving social or environmental problems.
Source: GSIA (2019).

Heinkel, Kraus and Zechner (2001) examine the equilibrium effect of exclusionary screening. 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 change the equilibrium outcome. In that case, polluting companies face a higher cost of capital than green companies. This higher cost of capital induces the excluded polluting companies to reform. Busch, Bauer and Orlitzky (2016) make the paradoxical observation that increased sustainable investment has not yet spurred sustainable development. There is a need to step up sustainable investment from the current ESG approaches that have limited effects to a truly sustainable investment approach focused on long-term value creation (see second and third strands).

Impact investing

The second strand of the sustainable finance literature concerns impact investing. The debate moves from ESG factors, which can be considered as input variables to sustainable investing and lending, to SDG impact, which is more outcome oriented. Impact investing is a type of investments that aims to generate both positive societal and positive financial returns. It thus fits naturally with Sustainable Finance 3.0 (see Table 1.1) as it explicitly goes for achieving more than a financial return. In an overview paper, Höchstädter and Scheck (2015) observe that conceptual clarity is still an issue in impact investing. The Global Impact Investing Network identifies four characteristics for impact investing:

- Intentionality. It should be the explicit goal of the investor to generate a positive social or environmental impact.
- Investment with return expectations. It is not charity, but should yield a return on capital.
- Range of return expectations and asset classes. Impact investments can generate return above or below the market and can be done in asset classes like private equity, public equity, and fixed income
- Impact measurement. The investor is committed to measure and report the social and environmental performance and progress of underlying investments.

So far, little research has been done on impact investing, and all of it has been done on private equity impact funds, which are a much less recent phenomenon than listed equity impact funds. In an analysis of more than 5000 private equity impact funds, Barber, Morse and Yasuda (2019) find that demand for such funds exceeds the supply of such funds. In random utility/willingness-to-pay models, investors accept 2.5-3.7% lower internal rates of return for impact funds. Jackson (2013) argues that while the impact investing industry has made a lot of progress in developing impact metrics and data, its evaluation practices still tend to focus on counting inputs and outputs and on telling stories.

As impact investing in listed equity is a very recent phenomenon, there is no data yet on the relation between financial performance and impact performance. However, there are good reasons to suspect that listed equity impact investing should give at least market rate financial returns. As Schramade (2017) points out, impact stocks have the tailwind of the Sustainable Development Goals (SDGs), which should help their value drivers: companies that provide solutions to the SDGs should, all else equal, have higher growth rates, higher margins and lower risk, whereas companies that are obstacles to the SDGs should have lower growth, lower margins and higher risk going forward. Next, Schramade (2019a) finds that in a universe of 15,000 stocks, the 3,000 stocks with positive impact potential already have historically stronger value drivers: on average, they have higher growth rates, higher Cash Flow Return on Capital Invested (CFROI) and a lower cost of capital – also when corrected for sector affiliation. Going forward, this relation is unlikely to weaken. As social and environmental externalities are increasingly being internalised, the relationship between impact (societal) returns and financial returns will only get closer.

Place-based impact investing refers to impact investing that is focused on one particular place. Very little is known about this type of impact investing since it only recently got back into vogue again.[1] However, Schramade (2019b) suggests that place-based impact investing offers several advantages over non-place-based impact investing:

- A clear focus of attention / less distraction of management in screening;
- A local information advantage (easier measurement and evaluation) that reduces transaction costs;
- The ability to add more societal value by connecting local initiatives and better understand beneficiaries.

Value creation

The third and final strand of the sustainable finance literature looks at the value created (Schoenmaker and Schramade, 2019a). The basic methodology for calculating integrated value involves measuring, monetising and balancing financial and non-financial values (see Section 2.3). Coulson (2016) recommends to adopt a participation approach. 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. It is important to avoid economic imperialism. Daly and Farley (2011) warn that the environment should not fully or exclusively be cast in economic terms.

Examples of integrated value calculations include the valuation of ecoservices and energy labels for real estate. Section 5 provides examples at regional and local levels. Most of the literature on integrated value looks at companies. Investing in sustainable companies, defined as companies that pursue long-term value creation, requires fundamental analysis of their business models and their underlying value drivers (Schramade, 2016). In that way, fundamental analysts can assess companies' social and environmental value, alongside their financial value. Such fundamental analysis also allows for an assessment of companies' preparedness for the transition to a sustainable economy, based on low-carbon and circular

[1] Per September 2019, there are no articles to be found on Google Scholar that have place-based impact investing in the title or as the central subject.

concepts. The incorporation of ESG information into stock prices then becomes an adaptive process, dependent on the number of fundamental analysts, how they have their decisions determined by ESG factors, and the quality of their learning (Lo, 2017).

The ultimate question on long-term value creation is whether a company (or city, region, country) is prepared for the transition to a sustainable and inclusive economy (Schoenmaker and Schramade, 2019a). Transition preparedness is an endogenous variable. The more companies are preparing for the transition, the faster the transition will happen and pay off. It also implies that companies that conduct business as usual may risk becoming stranded earlier.

Academic debates

There are several controversies debated in the academic literature. First and foremost, there is a debate whether ESG investing results in lowering, equal, or even higher returns. On the one hand, Riedl and Smeets (2017) show that responsible investors are prepared to forego return. Moreover, one could argue ESG investing will deliver lower returns, since ESG investment analysis is costly and reduces the investment universe. On the other hand, one could argue that such analysis results in better informed decisions and higher returns. Next, the results of Schramade (2019a) suggest that even after reducing the universe, there are still plenty of stocks to choose from for sufficient diversification. What is more, the universe reduction is useful in selecting better investments: Schoenmaker and Schramade (2019a) argue that fundamental investing with engagement can improve the transition preparedness of companies. Companies can thus become more futureproof, fostering their financial viability.

Another controversy is risk versus opportunity. Finance is usually cast in risk-return considerations (e.g. the capital asset pricing model). ESG investing is then considered as a mechanism to reduce ESG risks, which is at the heart of the first strand of the sustainable finance literature (e.g. reducing risk by exclusionary screening). To facilitate the transition to clean energy, the financial sector should not only reduce their exposure to fossil-fuel based technologies (risk driven), but also invest in clean energy solutions (opportunity driven). Impact and value investing look for these opportunities. Table 3.1 shows that positive-based investment methods (methods 4 to 7) are gaining ground.

A final debate is about reorienting finance towards sustainability versus the amounts of funding needed for the sustainability transition. The academic literature stresses the need for finance to include the social and environmental dimensions into pricing and valuation (e.g. Naidoo, 2019; Schoenmaker and Schramade, 2019a). The policy literature indicates that trillions of dollars of public and private funding are needed for the sustainability transition (e.g. OECD, 2018a). The solution is to structure transition projects in such a way that private funding will come forward. These structures are discussed in Section 4.

Subnational dimension

The second and third strands on impact and value creation pay more attention to context specifics, while the subnational context is often neglected in ESG analysis, which is typically done at company level. Moreover, traditional finance theory considers differences in governance, cost of capital and capital market developments between countries (e.g. La Porta, Lopez-de-Silanes and Shleifer, 1999). Table 3.2 summarises the lack of the subnational dimension in financial approaches. The result is that too much finance is supplied at the (inter)national level and too little finance at the subnational level (final column of Table 3.2).

There are very few academic papers considering (green) finance at the subnational/local level. Halland *et al* (2018) indicate that successful mobilisation of private capital from institutional investors has taken place at the local level, by strategic investment funds and some green banks. This is likely due to advantages of being a local investor, including risk assessment, networks and “boots on the ground”; as well as the design

of mandates, structure, governance, and staffing." Some institutional investors have been changing their modus operandi, from an intermediary to a collaborative model, and are re-localising their operations.

Table 3.2. The lacking subnational dimension in financial approaches

Level	Traditional finance theory	ESG	Impact	Value creation	*Finance practice*
(Inter)national	√	√	√	√	*Oversized*
Subnational	X	X	≈	≈	*Underdeveloped*

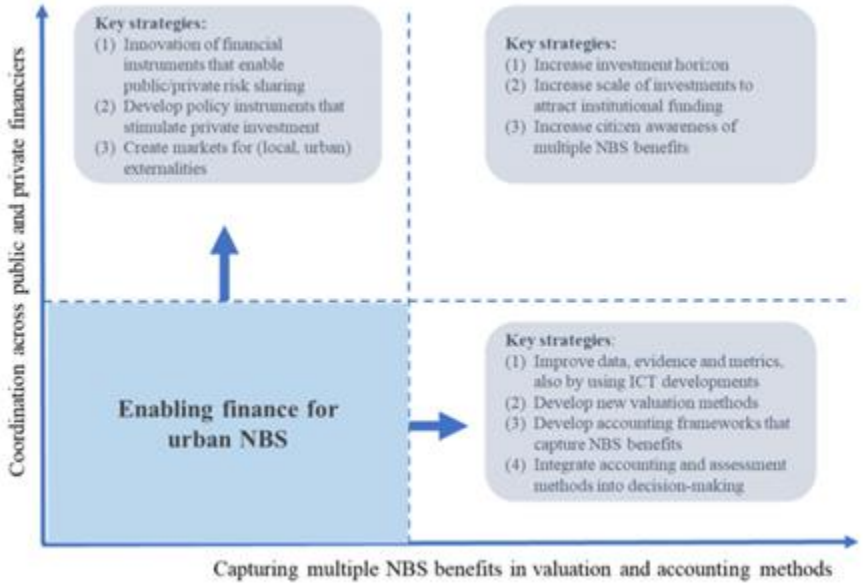
Source: Author's compilation

The intermediary model is characterised by a long and complex investment chain with many intermediating parties – from beneficiaries (e.g. pensioners), asset owners (pension funds), multiple asset managers to final investments. The more parties in such an investment chain, the shorter the focus (Schoenmaker and Schramade, 2019b). The elimination of financial intermediaries with a short-term focus in the investment chain removes a bottleneck between two categories of long-term investors – institutional investors and multilateral finance institutions, and opens new opportunities for collaboration. To take advantage of such opportunities, multilateral finance institutions will likely need to deepen their integration with the collaborative model and work closely with successful strategic investment funds and green banks.

Halland *et al* (2018) argue that a paradox of globalisation and the advancement of information and communications technology is that geography still matters. The ease of communication and the ability to share information almost instantly has not reduced the value of being 'there'. Face-to-face contact is still important, particularly where information is imperfect and not easily codified, which is characteristic of most development projects in low and middle-income countries. Even in advanced economies, evidence has shown that fund managers earn higher returns when making investments in securities that are close to home, which suggests they benefit from local information advantages.

Toxopeus and Polzin (2019) investigate financing barriers for urban nature-based solutions and strategies to overcome them. Reviewing the literature, they identify two key barriers of urban finance: 1. coordination between private and public financiers; and 2. adjustment of valuation and accounting methods to account for multiple sustainable finance benefits. Figure 3.1 summarises the barriers and strategies to overcome these barriers. These strategies are further discussed in Section 4.

Figure 3.1. Coordination vs benefits capture in urban nature-based solutions (NBS)



Source: Toxopeus and Polzin (2019)

New thinking in finance

Table 3.2 indicates that traditional finance theory looks at the (inter)national level. The efficient markets hypothesis (EMH) assumes that all relevant information of a company is incorporated in that company's stock or market price (Fama, 1970). So, investors cannot systematically beat the market. The market is supposed to be so efficient that it immediately incorporates all relevant new information, making it impossible for investors to benefit from superior insights or information.

Next, the capital asset pricing model built on modern portfolio theory (Markowitz, 1952) stresses that risk is an inherent part of higher reward. Importantly, risk and return characteristics should not be considered in isolation per security, but by how much the investment affects the overall portfolio's risk and return. In the capital asset pricing model, the only relevant variable to determine a stock's return is its sensitivity to the market, which is called systematic risk. In equilibrium, all investors hold the international market portfolio, which is replicated in the market index. It suffices to adopt a passive investment approach by investing in the market index. However, this narrow view on financial risk and return ignores the social and environmental dimensions (Schoenmaker and Schramade, 2019b).

By contrast, the adaptive markets hypothesis (AMH) provides an alternative description of markets (Lo, 2017). Contrary to the neoclassical view that individuals maximise expected utility and have rational expectations, an evolutionary perspective makes considerably more modest claims. The degree of market efficiency depends on an evolutionary model of individuals adapting to a changing environment. Prices reflect as much information as dictated by the number and nature of distinct groups of market participants, each behaving in a common manner and having a common investment horizon. For example, retail investors, institutional investors, market makers and hedge fund managers can be seen as distinct groups with differing investment horizons. If multiple groups (or the members of a single highly populous group) are competing within a single market, that market is likely to be highly efficient. If, on the other hand, a small number of groups are active in a given market, that market will be less efficient. The adaptive markets hypothesis can explain how new risks, such as environmental risks, are not yet fully priced in, as not enough investors are examining these new risks.

Schoenmaker and Schramade (2019b) propose fundamental analysis of companies to uncover their social and environmental value, alongside their financial value. This is not yet mainstream. A small, albeit growing number of, sustainable investors follow an active investment approach based on fundamental analysis and deep engagement. Halland *et al* (2018) show how institutional investors start to collecting information and collaborating at the local level. These informational challenges are even more poignant for investing in low and medium-income countries. An interesting model is emerging, whereby institutional investors, sometimes facilitated by multilateral development funds (e.g. the IFC), set up investment funds for low and middle-income countries. Also banks from high income countries (e.g. FMO) invest in local African banks, which use their local knowledge to provide bank loans on the ground.

Financial institutions and the role for subnational governments

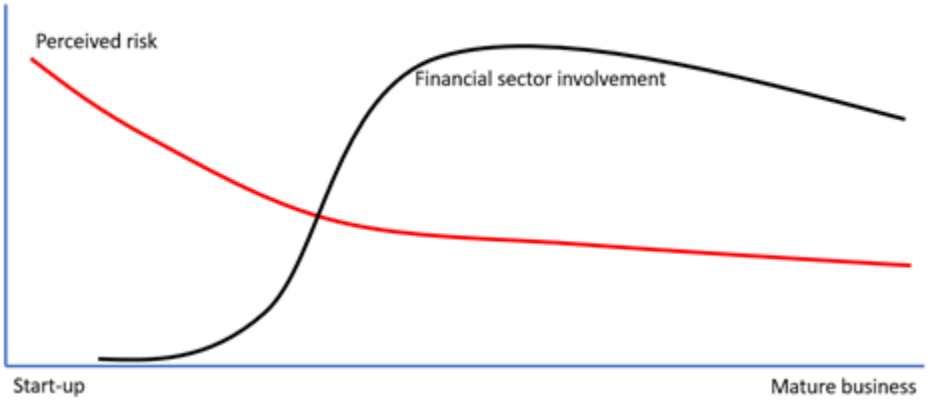
The rise of sustainable investment is for a large part risk driven based on exclusionary screening (see Table 3.1). Impact investing is slowly on the rise. Leading financial institutions (banks and asset managers) are increasingly setting targets to reduce carbon emissions in their lending / investment portfolio, which boosts the demand for low carbon assets. There is also demand for inflation proof assets, in particular from pension funds. Energy and transport infrastructure are favoured asset categories, as usage and payment are inflation linked.

Multilateral development institutions (e.g. the World Bank, the International Finance Corporation (IFC), the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD)) have a catalyst role in financing large projects. An interesting example is the Channel Tunnel, which is largely financed by the EIB in conjunction with commercial banks. This project would today be considered as a major climate investment in transport, as it boosts train travel and reduces air travel resulting in major carbon emission reductions. In addition to the multilateral development institutions, there are national development funds and banks (e.g. KfW bank, the German state-owned development banks, the UK Green Investment Bank in the United Kingdom, the Caisse des Dépôts et Consignations (CDC) in France, and FMO, the Dutch development banks) as well as regional funds (e.g. LIOF, the Limburg Investment and Development Fund in the Netherlands).

But the bulk of the financial sector is not on board for transition finance. As discussed in section 3.1, there are still bottlenecks in financial institutions in the form of: 1) efficient markets thinking which assumes that all information is embedded in market prices, 2) complex investment chains with multiple asset managers, and 3) silo-thinking, whereby selection of investee companies and engagement with these companies happen in separate departments. The investment process is top-down steered on the basis of simplistic financial targets, which are based on very strict application of frameworks that relate expected financial returns to risk – both based on historical return patterns. This involves a bias towards projects/companies that worked well in the past and already achieved scale. It is less suitable for dealing with, let alone scaling up projects that have: 1) no track record, and/or 2) serious non-financial return components instead of financial return. Moreover, the rigidity of processes in large financial institutions also means that it takes a long time to adapt processes and to develop and implement new financial structures and mandates. Kawabata (2019) calls for a need for change of thinking at senior management in financial sector.

Figure 3.2 summarises the challenge, whereby perceived risk is a function of the underlying risk and risk management (e.g. structuring / managing a project properly reduces risk).

Figure 3.2. Perceived risk and financial sector involvement



Source: Author's compilation

The risk of a company/project diminishes from a high level as it goes through these stages:

1. proof of concept;
2. small-scale production;
3. scale up to mass production;
4. growth in mass production;
5. steady state mass production.

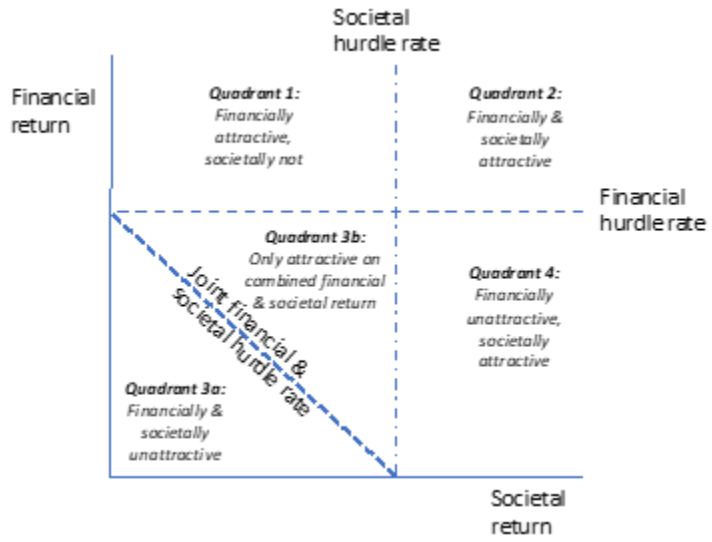
For most financial institutions, the sweet spot is in stage four, where growth is high and risk low. They typically find the first three stages too risky from a short-term financial perspective. That may indeed be the case from a short-term financial perspective, but from a long-term societal perspective, the risk-return can be much more attractive. However, since these stages need to be completed to get to the later stages, many promising projects never get anywhere near completion. Such projects (e.g. scaling land restoration in Section 5.4) would be in quadrant 3b and 4 of Figure 3.3, which illustrates the financial and societal return of projects. The figure brings a new perspective in that it combines the traditional financial perspective (i.e., financial return versus a hurdle rate) with a non-financial perspective. It can be read as follows:

- Everything above the financial hurdle rate is financially attractive – without regard for the societal return
- Everything above the societal hurdle rate is societally attractive – without regard for the financial return
- Ideally both hurdle rates are met (quadrant 2): the easy cases
- One could also devise a joint hurdle rate (the diagonal line), which distinguishes the projects that are worthwhile doing from a joint financial and societal perspective. Projects that are between this diagonal and the financial hurdle rate, can be made financially attractive by making wealth transfers to the financiers.

Financial institutions would only invest in projects that meet the financial hurdle rate in quadrants 1 and 2 of Figure 3.3, mostly without even being aware of the difference between those two quadrants since they do not measure the societal return. Rather, their main concern is to meet the financial hurdle rate and to stay within the boundaries set by regulation, their systems, and their specific mandates. The result is that massive amounts of money are stuck in financial institutions that need to (or feel they need to) invest nearly

everything in bonds and stocks – while at the same time many small entrepreneurs and large transition projects are looking for money but cannot get it. What is missing is the financial infrastructure that connects these small entrepreneurs and large transition projects to the deep pockets of the financial sector, while overcoming the abovementioned problems and information problems around the entrepreneurs' projects and transition projects. Such problems should not be underestimated. Obtaining sufficient information on the entrepreneur's prospects might cost more than the funding itself. And structuring transition projects in such a way that they can attract public and private funding is complex and costly (OECD, 2018a).

Figure 3.3. Financial and societal return



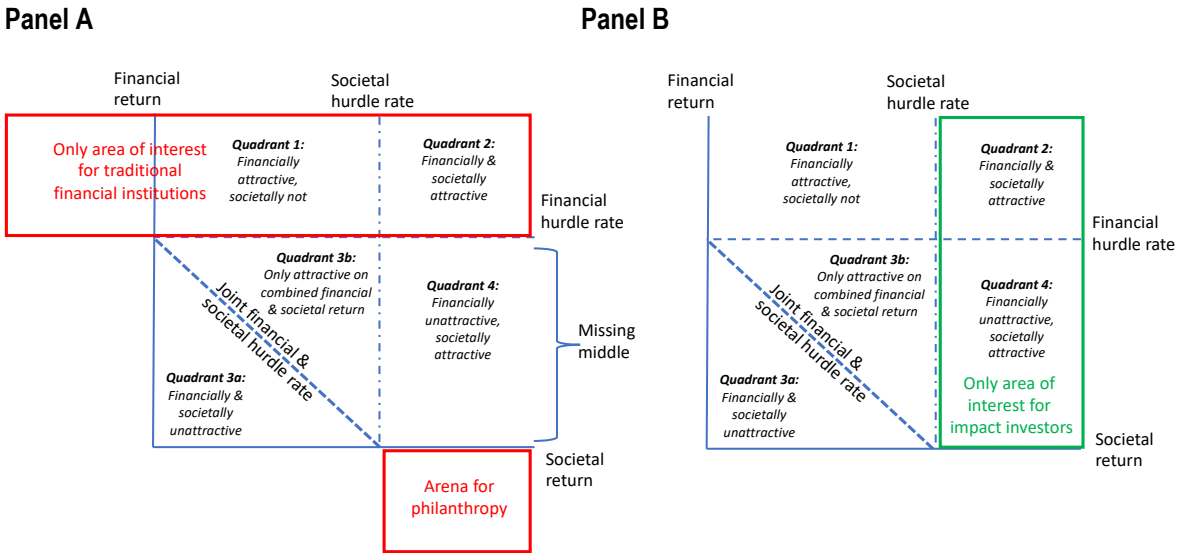
Note: Private investors require a minimum financial return (the financial hurdle rate); public investors (governments and philanthropists) require a minimum societal return (the societal hurdle rate). Only projects that pass one of the hurdle rates (or the joint financial & societal hurdle rate) are attractive for the respective investor group.
Source: Author's compilation

An emerging group of socially minded investors, such as Rotterdam based iFund2, are only interested in quadrants 2 and 4, with the goal of helping their investee companies move to the top right corner of Figure 3.4, but accepting lower financial returns for superior societal returns. Figures 3.4.a and 3.4.b illustrate the contrast of social impact investors (panel b) with traditional investors and philanthropy (panel a).

There is an important role for subnational governments as initiator and coordinator of projects in quadrants 3b and 4. Public funding can be an important catalyst. The financing challenge is to make blended finance (combining public and private funding) work for these quadrants. In particular, quadrant 3b asks for integrated value thinking, whereby financial and societal value are combined. With blended finance, subnational governments can tap resources (money, technology and knowledge) of the private sector. But there are also risks for subnational governments, such as lack of creditworthiness of some cities (in particular in many developing countries), lack of capacities to undertake public-private-partnerships and lack of scale (OECD, 2018a; Blended Finance Taskforce, 2018). Section 4 discusses how to meet these challenges.

[2] http://www.ifund.nl/en/

Figure 3.4. Financial and societal return per type of funder



Note: In panel A, traditional financial investors require a minimum financial return (the financial hurdle rate) and philanthropists require a minimum societal return (the societal hurdle rate), but accept a negative financial return ('give money'). In panel B, impact investors require a minimum societal return and also require a positive financial return.
Source: Author's compilation

Financial instruments and their use by subnational governments

The existing financial instruments that are the bread and butter of financial institutions and can be used for financing environmental and energy transitions comprise:

- Equity and bond investing - based on fundamental analysis or quant approaches;
- Bank loans - based on screening and monitoring., using credit risk models.

Less standardised instruments include green bonds, transition bonds, green venture capital, public-private partnerships and regional development funds. Green bonds are any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible green projects (ICMA's Green Bond Principles, 2018). They are very useful for large infrastructure projects. Green bonds are an intermediate solution – catering for the clientele effect of investors. The issuers of green bonds, such as companies, (multilateral) financial institutions, countries, regional governments or cities, own a range of green and brown projects. In the long run, bond issuers are likely to be scored on their overall degree of sustainability. The interest rate will then be a combination of an issuer's creditworthiness and sustainability. Such sustainability scoring systems already exist but are not yet sufficiently reliable (see for example Schoenmaker & Schramade, 2019a, p. 265-9).

A new class of bonds is transition bonds. Whereas green bonds finance green projects or companies, transition bonds would help the issuer switching to a cleaner way of doing business. This is an interesting and important financing instrument, as it helps companies to improve their business practices.

Green venture capital is a sub-set of the venture capital industry that has explicit sustainability targets. This is very important in building and scaling new companies, and hence for stimulating transitions. It is less relevant for filling the infrastructure funding gap.

Blended finance is, in the broad sense, defined as the use of both public/philanthropic and private funds to make societally desirable projects work. The big challenge is to make blended finance work (see Section 4.3), which is even more challenging for cities and regions, as a recent OECD (2018a) publication on PPPs finds. In a narrower sense, blended finance is defined as the strategic use of development finance for the mobilisation of additional finance towards sustainable development in developing countries (OECD, 2018c). Or even more narrowly, as the strategic use of development finance and philanthropic funds to mobilise private capital flows to emerging and frontier markets. It enables multiple time more capital flows than traditional donor activities. Pioneered by Innpact, who invented these structures for the German government and KfW, the German development bank, in the early 2000s.

Public-private partnerships (PPPs) can be considered as a type of blended finance (in developed and developing countries) and an alternative to traditional government procurement in infrastructure projects. However, as the OECD (2018a) puts it: “PPPs are complex and sometimes risky arrangements that require capacity to undertake them that is not always readily available in governments, in particular at the subnational level. There have been many examples in recent years of PPP failures or misuse, which call for caution in their use.” The report also points out that most PPPs occur at the subnational level (e.g., circa 80% of contracts in France and Germany, and even 90% in Australia) and that many of their problems happened because the subnational governments chose PPPs for the wrong reasons: to overcome tight budgets and circumvent fiscal rules, not for value for money and affordability.

The uptake of PPPs is not great yet: most OECD countries report that less than 5% of their public investments took place through PPPs (OECD, 2018a). The report stresses the importance of intergovernmental regulatory coherence: “For a PPP to be feasible, private sector actors must be able to reconcile and comply with regulations across levels of government, jurisdictions, and sectors.” Navigating that myriad of regulations increases the administrative burden, likely increasing the cost and risk of the project.

Social impact bonds are misleading in that they are not bonds, but effectively incentive compensation packages for companies that take responsibility for specific government roles. They are a payment by results contract where an organisation, typically one with a social purpose, agrees to deliver a certain outcome. So far, the market for social bonds is less developed than the green bonds market (Schoenmaker and Schramade, 2019a). The Social Bond Principles (ICMA, 2018) define a social bond as ‘any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance in part or in full new and/or existing eligible social projects and which are aligned with the four core components of the Social Bond Principles’. They have been questioned for lack of success and even perverse incentives to scale down state services. Their use and reach are limited so far.

The development institutions, described in Section 3.2, provide concessional investment and lending at multiple levels.

New financial structures need to be and are being designed. They cater to new business models and new needs, including payment for eco-services. An example is the IFC’s funding of an eco-system services project in Africa by selling carbon offsets. Another example is Econnext’s icebreaker (discussed in Section 4.3), which makes projects attractive to financial institutions by lowering their risk. And funds like the Social Impact Fund Rotterdam (discussed in Section 4.2) adopt dual return targets and improve the viability of new social business models by providing technical assistance in a place-based (city or region focused) context. Moreover, local governments are looking into creating currencies that price services provided between and within local business and local administrations.

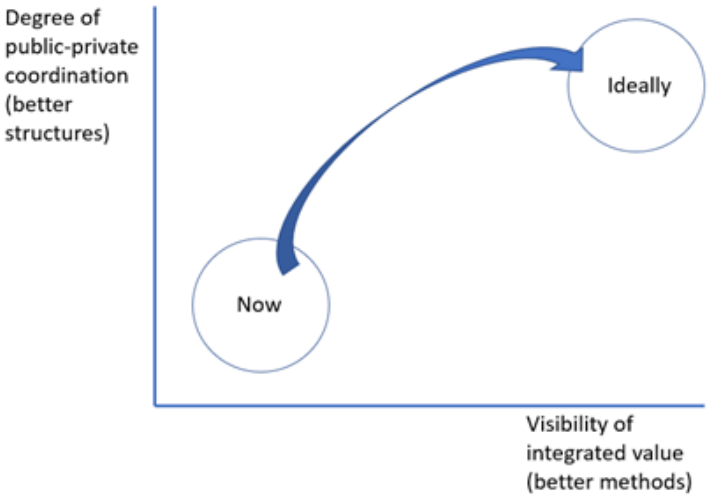
4 Financing challenges and new roles for (subnational) governments

The previous chapter makes clear that stubborn finance problems are obstacles to environmental and energy transitions. Figure 4.1 summarises the main financing challenges, as coordination between the public and private (financial) sector (i.e. better structures) and visibility of integrated value (i.e. better methods). Governments, at all levels, can and should play a role in transitions. Section 4.1 argues that governments should take a more active role than they have taken in the past decades. Given the importance of local context, much of that government role should be left to the appropriate local levels - be it with a complementary role for national governments, particularly in setting frameworks.

The main challenges can be formulated in more detail as follows:

1. A lack of coordination and financing structures:
    a. Lack of subnational governments initiating transition and inadequate framework conditions at the national government level;
    b. Little coordination between public and private funding;
    c. Small projects/companies cannot attract sufficient funding;
    d. Large projects may not fit the boxes that financial institutions, in particular institutional investors, need to tick.
2. A lack of appreciation of non-financial value

Figure 4.1. Financing challenges

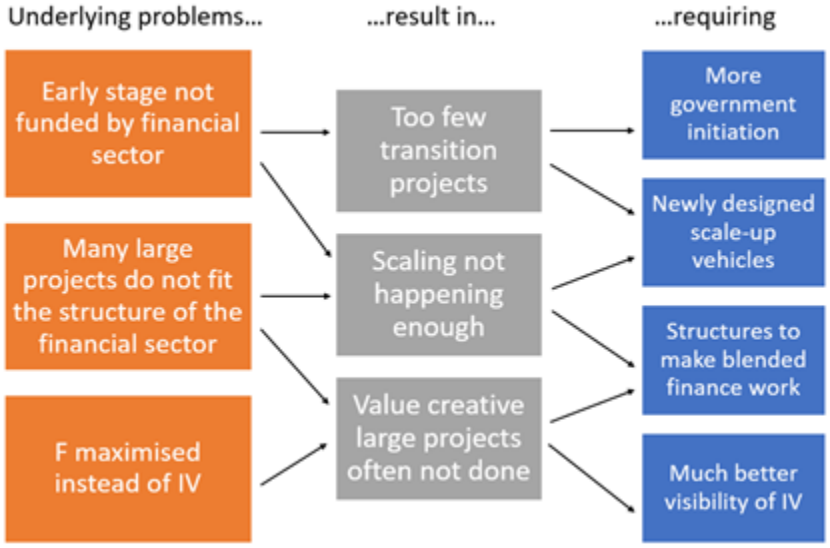


Source: Authors based on Figure 3.1 in this paper taken from Toxopeus and Polzin (2019).

These financing challenges highlight the gap between the large environmental and energy transitions that society needs and the availability of private finance. The result is that too few and/or too small transition projects are undertaken, which hampers the timely transition to a low carbon economy (Figure 4.2). The requirements to meet the financial challenges are four-fold:

- More government initiation;
- Newly designed vehicles to scale up private funding;
- Structures to make blended finance work in practice;
- Methods to improve visibility of integrated value.

Figure 4.2. Financing challenges and requirements



Source: Author's compilation.

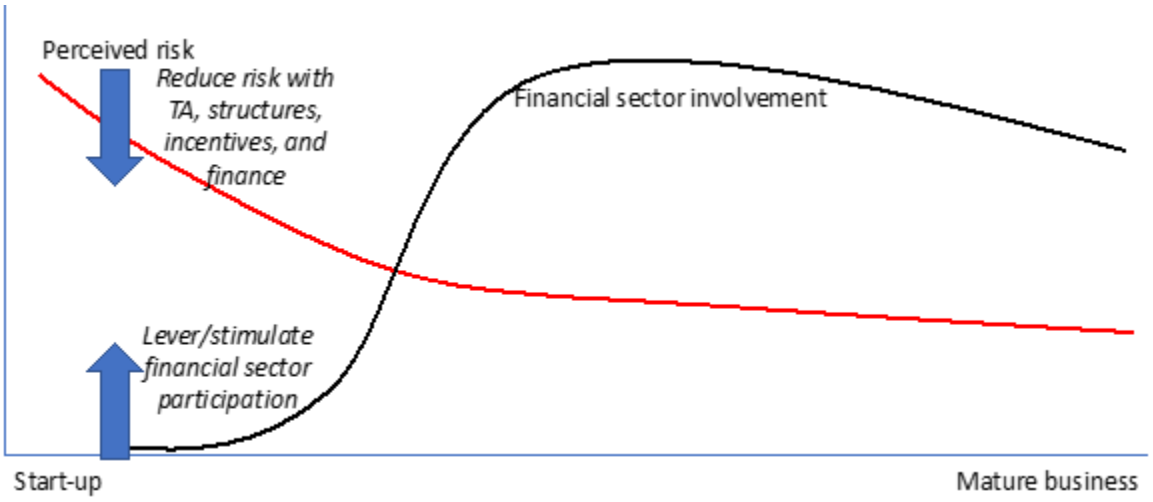
New roles for national and subnational governments

In the Western world, governments used to be large investors in the public infrastructure, such as energy, water and telephone utilities as well as networks distributing these services. During the privatisation wave of the 1980s and 1990s, most central and subnational governments privatised these public utilities and networks and subsequently sold their shares in them. Because of this 'privatisation' ideology, central and subnational governments are no longer used to thinking as investors.

At governments, especially in the western world, mental change is needed (and seems to be happening) in that they need to believe again they can be effective investors who pave the path for the type of society that people want - like they were in the past (Mazzucato, 2018). That means getting rid of the flawed argument that 'governments cannot pick winners' – they do not need to, they just need to create options, and think more in terms of options.

Figure 4.2 identifies a large role for governments in early stage finance. Government can reduce risk with technical assistance (TA), structuring of projects, and providing incentives and public funding and stimulate financial sector participation (Figure 4.3). Governments and financial institutions work together in providing blended finance, as projects and companies scale up and mature (see Sections 4.2 and 4.3).

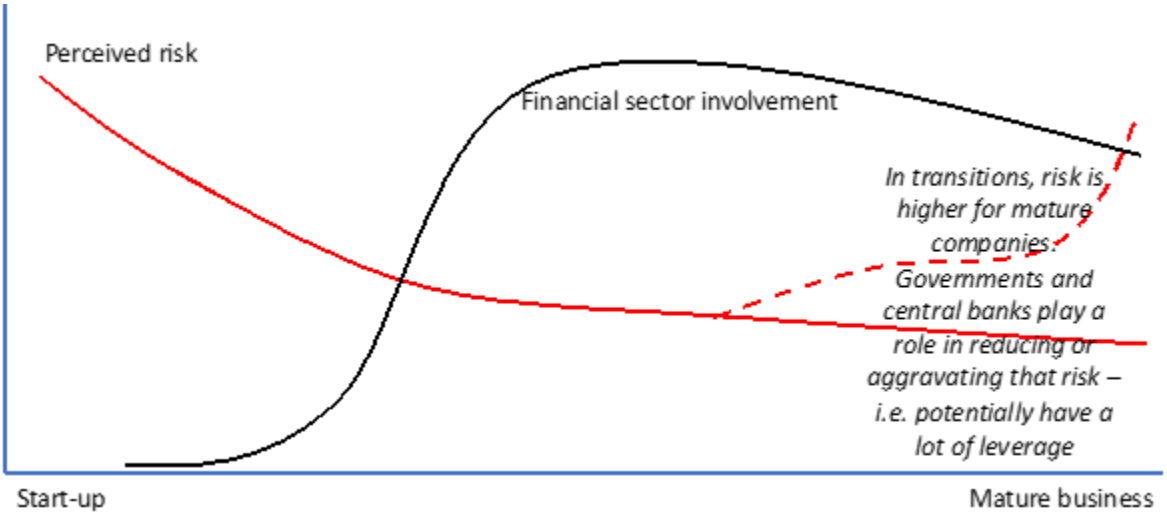
Figure 4.3. Role of government in new financial sector involvement



Source: Author's compilation

Governments have a very different, but also important role in phasing out companies with outdated business models (Figure 4.4). Section 2 highlights the dynamics of transition - you want to be in time in the new world and not stuck in the old fossil world with stranded assets (Caldecott, Talbury and Carey, 2014). Central banks are starting to require financial institutions to conduct climate stress tests, which are a very helpful tool to show their vulnerability to high-carbon sectors (Battiston et al, 2017; Reinders, Schoenmaker and Van Dijk; 2019). Another forward-looking tool is scenario analysis about climate-related financial risks from the Bloomberg Task (Task Force on Climate-related Financial Disclosures, 2017).

Figure 4.4. Role of government in phasing out old companies



Source: Author's compilation

Local / city level

There is a large potential for local circular business models that is hitherto unmet. Local governments typically own the local infrastructure, but they may lack the power of national governments in terms of regulation setting and financial resources. Examples of assets that may be owned at the city level:

- Mass transit systems: these can be expanded and optimised to make public transport more attractive versus cars; to reduce work related travel time; to improve local air quality;
- Water works;
- Waste management services: can me improved for higher recycling rates; waste to gas facilities;
- Electric utilities: coal facilities can be closed in favour of renewable capacity for lower carbon footprint and better local air quality;
- Heat management services: use locally generated industrial heat for heating homes;
- Urban wealth funds.

Examples of instruments at the city level beyond the administration's own assets:

- Spatial and urban street planning;
- Building requirements;
- Subsidising specific local activities – e.g., could stimulate a local circular economy;
- Assigning pilot areas for experimentation – e.g., Bordeaux drones example;
- Local taxes and user charges, such as congestion pricing to reduce road traffic;
- Stimulating certain clusters of economic activity;
- Rule of law & regulatory stability to eliminate corruption, for better decision-making and outcomes;
- Advanced analytics – also for better decision-making and elimination of waste;
- Clear long-term plans to provide visibility to investors – and hence reduce their risk and required return.

However, cities struggle to mobilise these instruments for transition management. Boehnke *et al* (2019) find that this is especially the case for small and medium-sized cities. Analysing climate efforts by 13 small and medium-sized cities in the Netherlands, they find 26 good practices, but no evidence that these practices were embedded in protocols and key performance indicators (KPIs), nor that they resulted in actual GHG emissions reductions. Action plans tend to be incomplete and municipalities typically operate in isolation, with little cooperation between municipalities and little awareness of best practices and KPIs used by others.

Regions

Most of the examples mentioned at the city level, also apply at the regional level, but at different scale and in slightly different forms. For example, at the regional level trains are more important than metros or trams; and air quality may be a less important consideration. And some issues that are almost absent at city level, do come to play at the regional level, such as agriculture and land restoration (see Section 5.4).

There is a very important role for subnational governments (both cities and regions) as initiators of the energy transition, for example by:

- Creating the right conditions for innovation (creative communities, etc);

- Bringing parties together (coordinating role), driving cooperation between regional/city government, local business, civil society, national government, development banks (e.g. Randstad public transport network);
- Running pilot projects (experimentation) – e.g., Rotterdam city government sponsoring risky chemicals projects that could revolutionise materials streams;
- Setting up funds for (co-)financing / kick-starting ventures;
- Regional Development Boards, where regional/city governments and financial institutions cooperate (e.g. Singapore, Amsterdam).

These initiatives reduce the information problems identified in Section 3. They also shift or reduce risk for financial institutions, enabling them to participate. Nevertheless, a fair risk (and return) sharing arrangement between the subnational government and financial sector is necessary to keep continuous support from the public and private side for these initiatives.

Building capabilities

To fulfil these roles, subnational governments need to build financial and coordination capabilities to develop (i.e. procure) and structure transition projects. The EIB provides not only funding, but also technical assistance to invest in these capabilities at the local level. Executive education in project finance has also a role to play in building local knowledge.

New structures for scaling up

A major problem is the gap between small projects looking for funding and the big asset owners that want to fund, but require scale and standardisation. Funding a €20,000 project typically costs more in terms of information gathering than the actual funding itself. Local parties can do that efficiently and while adding value, but additional standardisation (for efficient reduction of information costs) is needed to be able to get funding from the large institutions. This can be done in several ways:

One can provide well-structured information on the projects and their transitional potential:

- Documenting and structuring of initial projects that is sufficiently standardised to cater to the information needs of institutional investors;
- Showing the transition potential to should make these projects attractive to forward-looking investors and lenders;
- Develop intermediary institutions that solve information problems, locally.

One can develop better project structure, by means of:

- Governance arrangements: clear delineation of project ownership and control, including risk sharing arrangements between private and public parties and enforcement of contractual payments;
- Financial-administrative arrangements, such as AO/IC procedures to calculate, monitor and verify financial and non-financial information;
- Efficient legal infrastructure, including ownership registration;
- Guarantees or certification;
- Local bundling of projects.

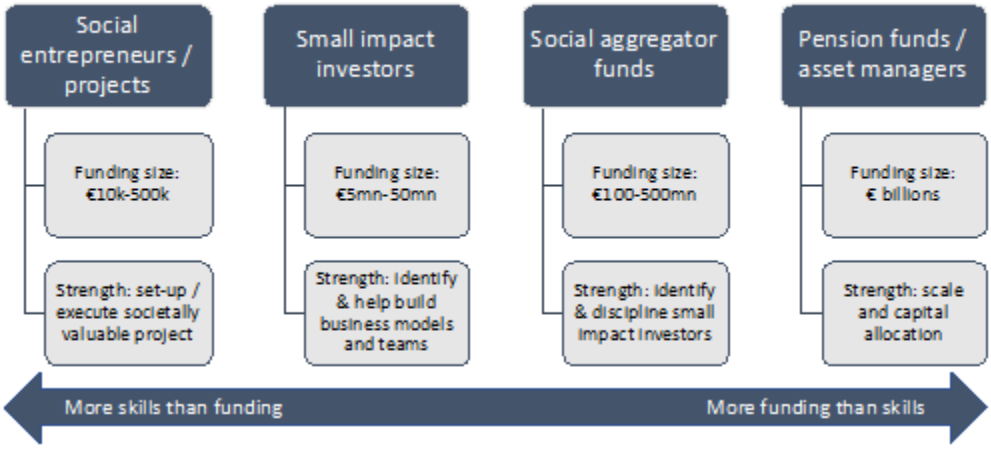
One could promote adaptation by financial institutions:

- More regulatory leeway for financial institutions to participate in real assets (e.g., lower risk assignment in so-called risk-weighted assets);
- Expand asset classes and mandates at financial institutions;
- Promote the modernisation of financial education beyond efficient markets thinking;
- Backcasting by financial institutions to arrive at truly long-term capital allocation decisions rather than the current practice of Strategic Asset Allocation driven by benchmarks.

One could stimulate the emergence of two types of organisations that sit between small projects and large institutional investors (see Figure 4.5 below):

- **Small impact investors**: these investors provide small amounts of funding and, even more crucially, valuable skills to small social entrepreneurs for becoming viable enterprises. With a focus on a single city or region, they are able to lever their local network and knowledge for better outcomes. For example, Rotterdam has iFund (private, already mentioned in 3.2) and Social Impact Fund Rotterdam (government initiated, also mentioned in 3.3 and 5.7) that are part of and benefit from a local network of actors that help each other.
- **Social aggregator funds**: these investors invest in dozens of small impact investors, which they select on their ability to create both financial and social value. Aggregator funds exist for ordinary private equity, but aggregator funds with an impact objective are rare.

Figure 4.5. Bridging the gap between projects and big finance



Source: Author's compilation

Examples of social aggregator funds include the Amundi-IFC emerging markets green bonds fund and Kommuninvest. Amundi, a leading French asset manager, and IFC, the private financing arm of the World Bank, have joined forces in a public-private partnership setting up a $2 billion Green Cornerstone Bond Fund (Schoenmaker and Schramade, 2019a). The expertise of Amundi (the private part) is combined with protection by IFC (the public part). The IFC will take a junior tranche of $125 million in the $2 billion bond issue. The green bonds are issued by emerging market financial institutions. Technical assistance is provided to the issuers to analyse green assets (to identify use of proceeds; good governance on these projects is important to prevent green washing) and to provide impact reporting for the bond issuer and in aggregate for the Fund. The Green Cornerstone Bond Fund means that money from developed markets is channelled towards banks in developing markets that are working on aligning their economies with a low carbon economy.

Kommuninvest is a Swedish local government funding agency that was set up in the 1980s, with the aim of helping municipal governments to raise capital through the issuance of bonds. Whereas a single municipality has little ability to raise capital alone, the Kommuninvest scheme allows many to issue a bond together. Due to their ability to raise taxes when needed, Swedish municipalities are almost risk-free in terms of meeting debt obligations. As a result, Kommuninvest gets very high ratings and is able to attract international institutional investors. Moreover, Kommuninvest plays an important capacity building role for municipalities.

Such aggregation is needed to reduce information problems, but one should be mindful of not making the investment chains too long, since that results in narrow information transfers based on basic financial metrics – a serious problem for the investment industry (Schoenmaker and Schramade, 2019b). Moreover, keeping fees low is a major challenge as they can effectively kill the viability of many projects. Philippon (2015) finds that the spreads earned by the financial sector have remained high over the past decades. Hence, we need new structures and attitudes. An interesting example is True Price (see Section 2.3), which is organised as a social enterprise and delivers integrated valuation services, which are comparable to (if not better than) traditional financial consultants, at lower fees – because its employees are willing to work at lower salaries for more meaningful work[3].

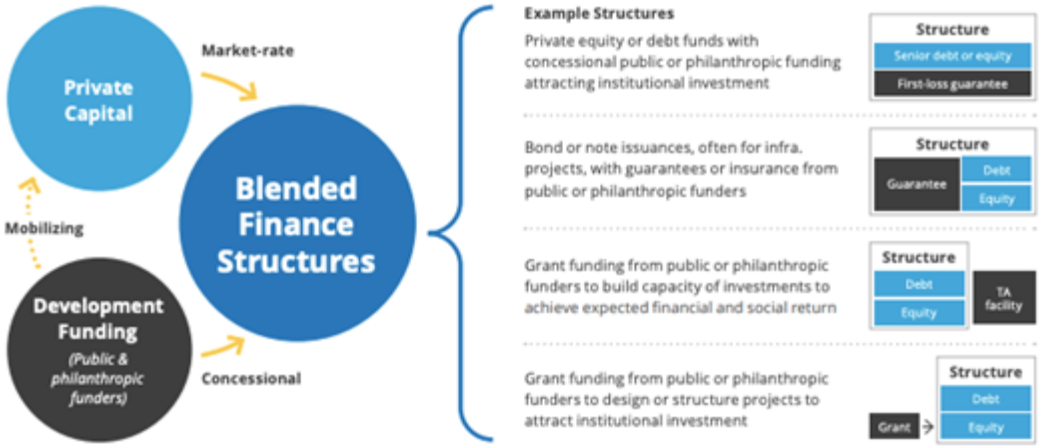
Making blended finance work

While there is a large body of literature on blended finance (public-private sector together, Figure 4.6), in practice the activity is quite limited (Convergence, 2018; Blended Finance Taskforce, 2018). To make blended finance work, a few things need to happen. First, lessons need to be learned from public-private partnerships (PPPs) since these are well-established financing mechanisms for infrastructure, especially at the subnational level. Second, it is important to explore the proper division of truly public goods with no private payments (e.g. the creation of forests in land restoration) and goods which can be paid for (such as energy and transport networks, and restored land). Third, attention needs to be paid to the stages of financing mentioned in Section 3.2 (proof of concept; small-scale production; scale up to mass production; growth in mass production; steady state mass production) since they have different requirements in terms of contractual arrangements. Furthermore, Hatano (2019) warns that it is vital to develop a common understanding about the practical issues blended finance faces. He identifies two main challenges:

- The constant evolution of the appropriate role for the public sector in blended finance structures. For example, public/private co-financing of large solar power projects in mid-income countries was appropriate when the technology was untested, but now such projects can be done privately. Hence, they should no longer be done with blended finance, as it would crowd out investment. Rather, blended finance should be aimed at innovation and only operate on the frontiers.
- The careful balancing of risk taking and risk avoidance by public entities. To a large degree, public entities need to take on difficult risks by themselves, so as to reduce remaining risks to levels palatable for the private sector, but not more!

[3] See www.trueprice.org and www.impactinstitute.com.

Figure 4.6. Blended finance structures



Source: Convergence (2018).

The Icebreaker by Econnext

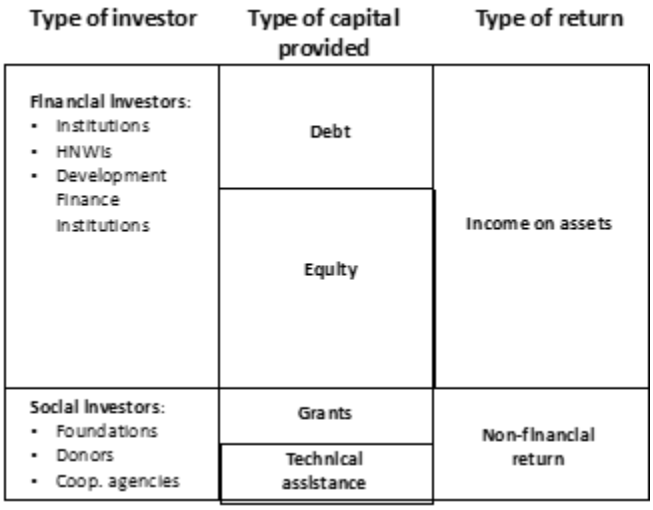
The icebreaker model makes the risk-return profile of projects more attractive. Figure 4.7 shows the structure.

This set-up improves risk-return in several ways[4]:

- The grants lower capital needs, hence result in higher expected return for investors;
- Certification by ILO or similar organisation lowers risk;
- Project advisors and developers are remunerated in shares, which raises alignment and reduces management fees, hence raises net expected return;
- Technical assistance improves project execution, hence lowers risk;
- Combining several projects in one financial structure lowers management fees and transaction/information costs, hence raises expected returns;
- No debt at the project level means no loss of projects from covenant breaches, hence lower risk;
- The clear structure (which meets the industry's reporting requirements) facilitates the implementation of governance and administrative procedures.

[4] And in more subtle ways as well, which are not discussed here for sake of simplicity.

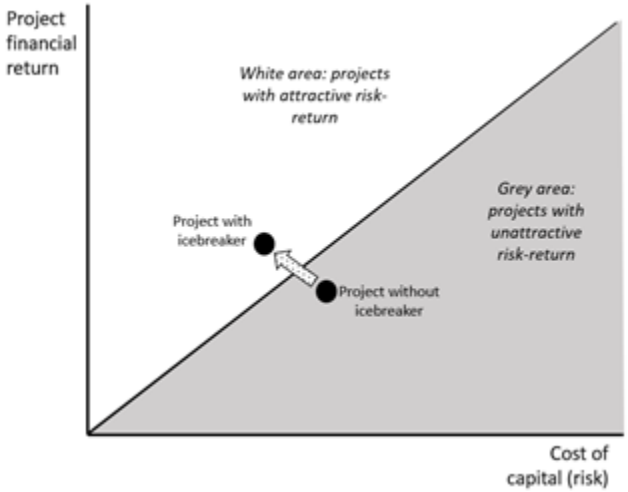
Figure 4.7. Icebreaker model of blended finance



Source: Authors, adapted from Econnext.

Figure 4.8 shows that such improvements with the icebreaker can turn a (mildly) unattractive project into an attractive one.

Figure 4.8. The icebreaker's impact on the ability to fund a project

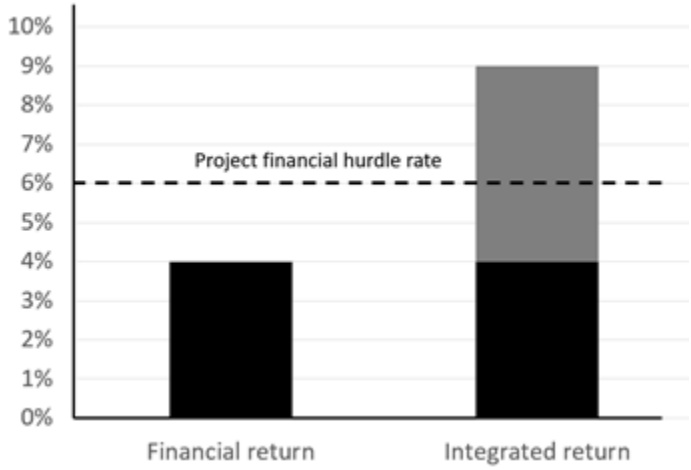


Source: Author's compilation.

Making integrated value visible

Many projects are not executed because they do not meet the financial hurdle rate, although they should have been done from a combined financial and societal value perspective. This was illustrated in Figure 3.3 of Section 3.2 with the projects in quadrant 3b. Such a project could look like the one in Figure 4.9.

Figure 4.9. Project financial return versus project integrated return



Note: The integrated return sums the financial (dark) and societal (grey) returns
Source: Author's compilation

In Figure 4.9, the project's financial return of 4% falls short of the 6% required by financiers in a hypothetical case. But with its 9% integrated return it is attractive from an integrated perspective. To make such projects happen, one needs to:

- Make this calculation in the first place;
- Identify the additional non-financial return (or not-yet-financial return or return for someone else);
- Organise a transfer from the beneficiaries of that non-financial return to the financiers so that the financial hurdle rate is met.

For example, the above project's 5% non-financial return could be made up of two equal parts: (1) health benefits to society that will yield lower government expenditure in the future; (2) elimination of a government investment that would have been done otherwise. Especially the second one is easily quantified and can be transferred to the financial project return – provided that legal structures are in place to realise this. The first part would be harder, but eventually (after more experience with this kind of structures) this one could be monetised as well. Admittedly, this does require modelling assumptions on the pricing of externalities and the use of discount rates.

It should be stressed that the third step is crucial: actual cash flows have to be realised to make it work for the financiers. A cost-efficient structure should be set up to ensure that cash flows are collected from the public/philanthropic sources to distribute to the financiers (see Figure 4.7).

Discounting cash flows begs the question what discount rate to use. The problem is that discounting often means that anything that is decades away, is effectively valued at or near zero. Hence, low or even zero discount rates might be appropriate. In the context of climate change abatement investments in infrastructure, Giglio et al (2015) find that discount rates should be below 2.6%, and ideally downward sloping, to account for long term benefits.

Stimulating this kind of integrated value thinking requires a number of actions:

- Corporate reporting regulation asking for this kind of information, with sticks and carrots to give proper incentives – which are currently lacking, except in leading companies;
- Integration into national accounting as proposed by Hoekstra (2019), see Section 2.3;
- Alignment between national accounting and corporate reporting;

- Integration into finance, accounting and economics education.

In the first three steps, the OECD can play a leading role. Universities and business schools can execute the fourth action as part of responsible management education (Principles for Responsible Management Education, 2018).

5 Application to sectors

To make the above more concrete, this section gives some examples of sectors facing transition challenges as the subnational level. This is certainly not meant to be a complete overview, but should illustrate how the challenges in sectors can differ from each other in terms of the bottlenecks faced and the way in which responsibilities are shared between national and subnational governments.

Power generation

Power generation is possibly the most important sector for the energy transition. The sector accounts for a third of emissions (IEA, 2018), and its footprint also impacts the footprint of downstream sectors like mobility, industry, and real estate. As Bauer *et al* (2017) argue, "the mitigation challenge strongly corresponds with global baseline energy sector growth over the 21st century, which varies between 40% and 230% depending on final energy consumer behaviour, technological improvements, resource availability and policies."

It is clear that wind, solar and other renewable sources of power should replace gas and coal power plants. On new built capacity, wind and solar power are already competitive, with lower total operating costs than the traditional sources of coal, gas, and nuclear. But it is a different matter when looking at existing capacity, which typically has a long remaining lifetime (often decades) and low marginal costs as the bulk of the costs has been sunk. When it comes to replacement, it is all about marginal cost. This raises the question as to what would be the optimal timing of making the replacement, taking into account other investment options with similar or perhaps better value for money in terms of reducing carbon footprints. Only considering the options in terms of financial cash flows will not suffice, as that does not include a serious carbon price. So, any serious evaluation should compare the costs of the alternatives including a serious carbon price.[5]

Such tools for comparison will obviously give different outcomes depending on the carbon price used (and any assumptions for that matter). To stimulate early replacement, the use of such tools should become commonplace, and incentives should be introduced: first and foremost a serious carbon price (preferably globally, but local is possible as well), but it can also be done with tax incentives or regulation that raises the operating (marginal) costs of the old facilities.

Additional issues at the local level include:

- The location of the facilities, as dirty plants in/near cities are more likely to be replaced early given their large impact on air quality for a large number of people;
- The nature of local power demand and the state of the grid since the local power mix should remain flexible and resilient;

[5] The High-Level Commission on Carbon Prices indicates that the explicit carbon-price level consistent with achieving the Paris temperature target is at least US$40–80/tCO$_2$ by 2020 and US$50–100/tCO$_2$ by 2030 (Stiglitz and Stern, 2017).

- The availability of resources used as inputs, such as excessive coal reserves in parts of China, Poland, Australia and the United States;
- The affordability and reliability of power for the local population, especially in emerging markets.

More generally, there are several urban and rural development issues. Often both rural and urban areas are locked in to existing practices and dynamics, which means that transitioning to a low-carbon economy likely poses significant challenges and creates complex dynamics of change that will impact on other major areas of social and policy concern. There is an important role for bioregional planning, with collaboration with local stakeholders (see Section 2.4).

Financing challenges and solutions

The main problem to fix in power generation is the inclusion of non-financial costs and benefits in making replacement choices – traditional approaches just look at marginal operating costs, but forget to include the costs of greenhouse gas emissions, health effects of poor air quality, biodiversity loss, etc. Still, in terms of financing, this is probably the least challenged of the sectors to be discussed, as it does not have to scale up, and the business models of renewables are not that different from the traditional ones – although the nature of renewables and the advent of technologies and smart grids will likely dramatically change power transmission. The ability to really go for long term value creation also depends on the state of local governance (or lack thereof), and the constraints on subnational government finance.

Another way is to make investments locally embedded, driven by local grassroots movements. Examples include crowdfunding and citizen cooperatives. Such cooperatives can achieve large scale fairly quickly. REScoop.eu is the European federation of renewable energy cooperatives. It is a growing network of European energy cooperatives, which sell bonds to cooperants and get them involved in the governance of energy cooperatives works as well. Community of interest REScoops like Ecopower, ODE and Windvogel show that their business model works. They have financed, developed and are maintaining a growing number of wind parks in The Netherlands and Flanders. In Denmark half of the population is a REScoop member.

Mobility

The transport sector is yet another heavy emitter of greenhouse gases, responsible for about a quarter of a typical city's emissions. Local mobility is mostly about cars, trucks and public transport. For certain regions, river shipping is relevant as well. Especially at the city level, mobility brings other issues as well, such as traffic congestion, poor air quality, and loss of valuable real estate to parking spaces. As Sumantran *et al* (2017) put it, many cities have been designed for cars when they should have been designed for people. And most urban roads and parking spots are underpriced.

Apart from the location of air and sea shipping hubs, mobility seems more of a subnational than a national issue, with most solutions to be found at city or region level. As national governments tax fossil fuel cars and trucks, cities can complement that with congestion pricing or denial of entry for heavy polluters. In addition, city governments can introduce mobility plans that offer car sharing programs by neighbourhood.

In car sharing, one car replaces up to 10 cars, which means you need much less parking space and get back prime real estate locations that can be used in better ways, ideally adding green spaces. Cities can also put in place more bicycle pathways, as Copenhagen and many Dutch cities have shown.

Sumantran *et al* (2017) envision a future of connected, heterogeneous, intelligent, and personalised (CHIP) mobility, in which public, personal and shared modes of transit blur, and mobility can be offered as a mass-customised service. That means that everyone can get a tailored transport solution, using public and private modes of transport that connect seamlessly. This does require a lot of coordination and investment

in mass transport systems, such as metro systems and local light railways. In evaluating such projects, one should go well beyond traditional cost-benefit analyses and include externalities as well to assess integrated value. The projects can be financed in PPPs or with municipal green bonds.

Financing challenges and city examples

Mobility faces all the challenges mentioned in Section 4 and government initiation is crucial here, given the close link to urban and regional planning. London introduced congestion pricing in the early 2000s, which helped reduce congestion and pollution. Copenhagen has been very successful in getting its inhabitants to use bicycles rather than cars, thanks to an excellent bicycle road network. The city closely monitors the use of bicycles with a set of indicators. Indonesia plans to move its capital because of unsolvable congestion problems in its capital city Jakarta. In the Mobility Challenge, inhabitants of a Rotterdam neighbourhood were challenged to temporarily trade in their car for a car sharing program, funded by the city governments. The program has not ended yet, but results so far suggest behaviour is a bigger challenge than funding.

At the regional level, mass transit systems are discussed to reduce car use. An example is a new or improved public transport system in the densely populated Randstad area of the Netherlands, connecting the large cities (Amsterdam, The Hague, Rotterdam and Utrecht) as well as the suburbs and smaller towns. Such mass transit systems require clear transition goals of central and regional government, integrated calculation of costs and benefits (including avoided carbon emissions) and public-private partnerships for funding.

Real estate

Real estate is another key sector to address. Real estate is also closely linked to other sectors, such as mobility and power generation. Moreover, real estate plays a key role in making or keeping cities liveable and protecting biodiversity. For example, the presence of green areas makes people happier and more productive. And greener streets and roofs in cities keep cities several degrees cooler on hot days.

In theory, the solution is simple: design buildings on minimising total cost of ownership including externalities. In practice, such calculations are complicated and highly context specific. And the solutions span a wide range of areas and stakeholders, from green rooftops for residents to the redesign of entire neighbourhoods and mass transit systems. This requires an integrated vision on what the city or region should look like. Ideally, this encompasses targets on, for example, carbon emissions, air quality, resident well-being, and the percentage of square meters in green areas.

Supposing that such a vision is already there, let’s consider what subnational governments can do to finance that vision, both for the real estate they own and for the real estate they do not own.

For their own real estate, the subnational governments face the issues of financing and procurement. For finance, they could resort to issuing regional or city green bonds or green loans. The green bond market is booming for large corporates and national governments. However, given the cost of the administrative processes, green bonds are less attractives for smaller entities unless they are creative in bunding projects. Green loans are more tailored and might contain provisions that lower interest payments if certain environmental targets are met.

In procurement, subnational governments should set targets that minimise not simply the construction costs of the buildings. Rather, they should maximise integrated value by considering the total (financial) cost of ownership in tandem with the non-financial costs and benefits of ownership and usage.

For the real estate they do not own, subnational governments have options as well. Towards both residents and corporate real estate owners, they can incentivise solar panels and green rooftops – for example, by co-financing them or by directly offering installation services.

The financial sector plays a modest role here as well. Some banks have introduced green mortgages for houses that are sufficiently energy efficient; and low interest loans for making existing houses more energy efficient. Government regulation and supervisory demands could boost these markets.

City example

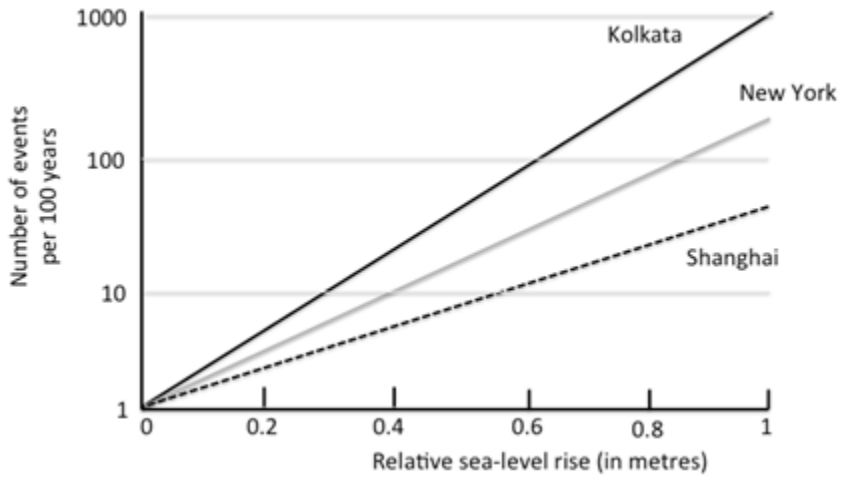
A C40 report on circular activities by its member cities describes the Amsterdam initiative on the circular built environment (C40 Cities, 2018). This included the creation of a roadmap on circular buildings; application of circular criteria to development tenders; networks for partnerships and training for the supply chain; commissioning of research and establishment of 'living labs'; and the incorporation of circular criteria into procurement requirements. Done properly, this should provide visibility to investors and other stakeholders.

Not all cities are created equal

While most environmental transition projects in the field of real estate are related to mitigation (i.e. reducing carbon emissions or reducing use of raw materials), there are also adaptation challenges which need to be financed. As cities are concentrated in coastal areas and river basins, they (and their real estate) are particularly exposed to the effects of climate change, such as rising sea levels and flooding. Nicholls, Reeder, Brown and Haigh (2015) show the increase in the frequency of current 100-year events in New York, Shanghai and Kolkata, as sea levels rise. A 1 meter rise in the relative sea-level rise, for example, increases the frequency of current 100-year flood events by about 40 times in Shanghai, about 200 times in New York, and about 1000 times in Kolkata (see Figure 5.1).

Nicholls *et al.* (2015) argue that climate mitigation can stabilise the rate of sea-level rise, which makes adaptation more feasible. However, even if the global temperature rise is stabilised, sea levels will continue to rise for many centuries as the deep ocean slowly warms and the large ice sheets reach a new equilibrium: this has been termed the commitment to sea-level rise (IPCC, 2014). This suggests that for cities in coastal areas mitigation and adaptation must be considered together as the committed sea-level rise necessitates an adaptation response. This perspective changes the mitigation discussion towards avoiding high-end changes in climate over longer time spans than are typically considered.

Figure 5.1. Increase of frequency of present 100-year events with rising sea levels



Source: Adapted from Nicholls, Reeder, Brown and Haigh (2015)

There are knock-on effects on the housing stock and communities in coastal areas at risk (Schoenmaker and Schramade, 2019a). With increasing flooding risk, property insurance may retreat from coastal areas and/or premiums may become prohibitive (Storey and Noy, 2017). As insurance retreats from particular locations, house prices in those areas are likely to decline and infrastructure investments may be more difficult to justify. Insurance is often a requirement for residential mortgages and failing to maintain insurance can trigger 'technical' default. The possibility of default is exacerbated by maturity mismatches between residential insurance (annual renewal) and mortgages (often a decade or more). As a consequence, in the future, bankers may lend to owners of coastal property less often, require more equity as collateral, or offer shorter mortgage terms. Unless defences are significantly upgraded, coastal areas may thus become abandoned, well before the risks materialise, impacting the local community.

Financing challenges

The financing challenges for real estate seem less severe than in mobility, at least in terms of government initiation, scaling up, and blended finance. However, green buildings do tend to have higher upfront costs – whether these will be accepted by private investors will depend on discount rates and payback times, which might not be in sync with long term problems like climate change.

Sea-level rise has major financial implications for urban planning (some neighbourhoods may need to be relocated) and infrastructure (building sea and river flood barriers).

Agriculture and land restoration

Land restoration is key example of need for cooperation at regional level between various stakeholders (subnational government, farmers, agricultural companies, financiers). Ferwerda (2016) estimates that there are 2 billion hectares of severely degraded land suitable for rehabilitation through forest and landscape restoration. Of that, 1.5 billion hectares are suited to mosaic landscape restoration, in which forests and trees are combined with other land uses, including agroforestry, and smallholder agriculture. Examples of such regional projects are restoring the Western Australian Wheatbelt in Australia and the Altiplano in southern Spain[6]. Commonland, a non-profit foundation for land restoration, follows a stakeholder approach involving regional government, local communities, local agricultural companies and local farmers (Ferwerda, 2016). These large projects start with philanthropic funding to experiment with new agricultural working methods which restore the land. But they face difficulties in attracting private funding to scale up, as appropriate governance and administrative arrangements are not in place.

A related environmental transition is the move from large-scale intensive farming with land degradation to more natural ways of farming without land degradation. Governmental subsidies will then need to be redirected from increasing food production (animal or crop related subsidies) to nature friendly production (subsidies for preserving/improving nature). This will require new farming business models, fostered by (subnational) government initiatives and incentives. Land restoration and agricultural reform projects are most effective at the regional level.

Only when all interested parties (in particular the farmers) participate in the transition, the transition will reach its full potential. This calls for an important coordination role for subnational governments to bring all parties together and to incentivise them to participate in the envisaged projects.

[6] See www.commonland.com.

Financing challenges

The big challenge for land restoration is to scale up. These land restoration projects with multiple farmers need to be structured with social aggregator funds (see Figure 4.5 in Section 4.2) to make them eligible for finance. To enable blended finance, there is also a need to account for social and environmental benefits. An additional hurdle is that land is typically not regarded as an asset class by most asset owners and asset managers – it does not fit their box.

For agricultural reform, banks need to help their farmer clients in the transition. The transition challenge is similar to the one on power generation in Section 5.1. Large farmers have invested in equipment and buildings suited to intensive agriculture (e.g. fertilizer machines, pesticide appliances and mega stalls), often heavily financed by their bank. As government incentives and regulations change, the farmers need to adopt nature friendly agricultural practices, which requires new type of equipment (e.g. precision irrigation appliances) and working methods, which are less intensive.

Circular manufacturing

In the current linear economy, products are designed for use, with little regard for what happens thereafter. The essence of a circular economy is that materials are used in such a way that they can be cycled at continuous high value (McDonough and Braungart, 2013). How that is achieved depends on locally available streams of materials. Hence, the challenge differs per city and per region. Bottlenecks are both behavioural (not used to thinking in this way) and economical (too expensive).

To some degree, companies can cycle at high value independently. For example, Philips refurbishes second hand medical equipment by taking it back from clients and upgrading it with new software. But often, coordination across the value chain and some form of government interference are required. For example, the collection (and recycling) of many materials are driven by the provision of accessible collection facilities and by government regulation.

Region example

The Dutch province of Zuid-Holland has strong circular ambitions, which have been explored in several published reports, which outline:

- The size and nature of the region's most important materials flows, as well as the options the region has to improve these flows;
- Circular indicators to steer on; and
- Circular macro-economic scenarios, and their impact on the region's most important sectors.

In the case of Zuid-Holland, important considerations are the presence of Europe's largest port (Rotterdam) and a major food hub (Delft and Westland).

Financing challenges

This is perhaps the most financially challenged of the sectors discussed, as scaling up, blended finance and government initiation are all early days here. A big challenge in the move to a circular economy is that it often entails a major shift in business models given shifts in the following elements (as discussed in section 2.3):

- Ownership;
- Residual values;

- Cooperation in the chain;
- Transaction moments;
- Payback times.

This can make financing from traditional sources, which are often asset based, troublesome. For example, if you buy the services of a machine rather than the machine itself, that means you cannot get the typical bank loan against the collateral value of the machine. Hence, the models and methods of banks need to change as well, perhaps shifting more towards equity financing, or loans based expected on cash flows (service contracts and quality of customers) rather than on collateral (Schoenmaker and Schramade, 2019a).

A strong initiating role of the government is needed in making local circular economies take off, both as an early stage investor and as a buyer demanding or favouring circular procurement.

Comparison of the sectors

When comparing the sectors in Table 5.1 below, it becomes clear that they face similar problems but to varying degrees.

Table 5.1. Comparing the sectors' problems

Sector	Main bottlenecks	National government role	Subnational government role
Power generation	Right incentives for timely replacement of fossil fuel generation by renewables – as financial marginal cost of existing fossil fuel capacity is low and does not include integrated value.	Setting carbon prices & wide regulatory framework.	Additional incentives and adjustments for local conditions. E.g., where to put what kind of powerplant?
Mobility	Coordination of various modes of transport and pricing them right for integrated value. Public cost-benefit analyses are typically too narrow.	Provide incentives and connections.	More important since local conditions need to be optimised.
Real estate	Incentives for integrated value. Plethora of rules gives large building companies too much of edge over smaller ones, resulting in too much pricing power.	Maximise incentives with minimal regulatory burden.	Plan and coordinate for local optimisation; and incentives schemes for residents
Agriculture and land restoration	Lack of mechanisms to hold and manage land in sustainable ways. Undervaluation of land by traditional metrics	Reorient subsidies from crop maximalisation to land/nature preservation.	Initiate and coordinate land restoration projects and new agricultural practices.
Circular manufacturing	Lack of understanding and thinking in circular terms.	Nationwide target setting.	Subnational targets and action

Source: Author's compilation.

Integrated approaches at the city level

Table 5.1 shows that integrated thinking based on integrated value, which includes financial, social and environmental value, is crucial for the sustainability transition. Developing indicators and criteria based on a consistent accounting system for social and environmental value is therefore important. The examples below of Toronto and Rotterdam also show the need for using integrated value.

Toronto

The example of Toronto indicates that instruments such as green bonds can be aimed at several sectors at the same time, as the reporting criteria of Toronto's green bond programme[7] in Table 5.2.

Table 5.2. Toronto's green bond criteria

Project Category	Potential KPIs
Renewable Energy	Installed renewable energy generation capacity (MW) GHG emissions reduced/avoided (tCO2e)
Energy Efficiency	Annual energy saved per year (ekWh/year) GHG emissions reduced/avoided (tCO2e)
Pollution Prevention and Control and utilizing waste as a resource	Reduction in Particulate matter concentration (PM2.5/PM10) Waste recovery and landfill diversion rate (%)
Sustainable Clean Transportation	Cycling and Walking trips (% of modal share) Bike lanes installed (kms)
Sustainable Water & Waste Water Management	Increase in permeable surface area (%)
Climate Change Adaptation & Resilience	Avoided cost of basement flooding ($), increase in tree canopy (%), green roof space (m^2)
Eco-efficient and Circular Economy	Value of eco-efficient procurement ($)
Green Buildings	Number of eligible buildings that received third party-verified green building certification (LEED Gold or Platinum) or Toronto Green Standard (Tier 2,3 & 4)

Source: City of Toronto.

Rotterdam

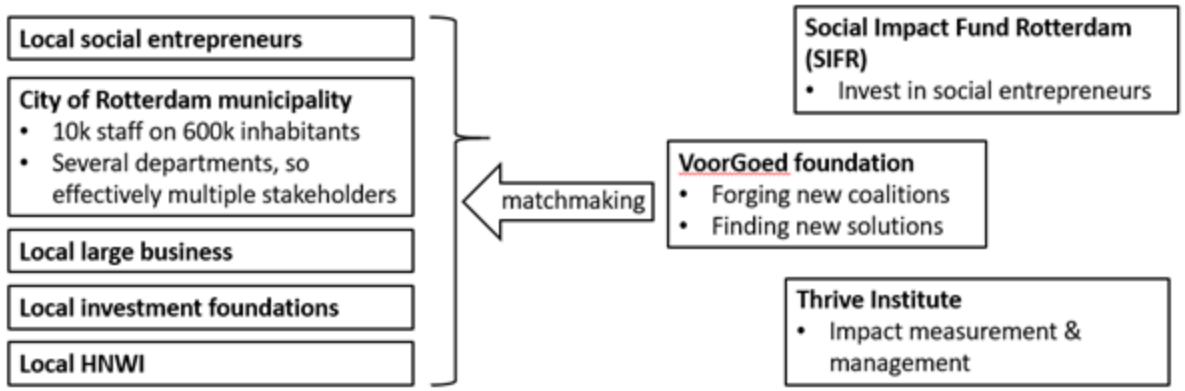
Some cities are experimenting with new structures to tackle the aforementioned problems. For example, the city of Rotterdam has set up new agencies that should help the public and private sectors in connecting and scaling up solutions for societal problems. Rotterdam has a long tradition of foundations helping out on social issues, but there was a widely felt need to step up coordination efforts between the local government and other stakeholders.

The nexus of this evolving ecosystem is VoorGoed agency, which aims to find new solutions and forge new coalitions – often by identifying common needs or complementary capabilities (see Figure 5.2). It is run by people with a strong network in the city who are well versed in overcoming the barriers to getting

[7] https://www.toronto.ca/city-government/budget-finances/city-finance/investor-relations/green-debenture-program/

something done in the city. VoorGoed works closely with the various parts of the Rotterdam municipal government, and also with local businesses (SMEs and subsidiaries of MNCs), the local foundations and socially minded High Net Wealth Individuals (HNWI). In addition, VoorGoed cooperates with the Thrive Institute on measurement of societal value; and with the recently founded Socal Impact Fund Rotterdam (SIFR) that invests in local social entrepreneurs by providing them funding and technical assistance – in cooperation with established businesses who provide volunteers with expertise in say accounting, marketing, HR or IT. Schramade (2019b) provides a case study on this type of place-based impact investing.

Figure 5.2. The Rotterdam social finance ecosystem



Note: HNWI = High Net Wealth Individuals.
Source: Schramade (2019b)

6 Policy recommendations

Based on the analysis in this paper, we make a number of policy recommendations for several actors.

All actors

The environmental and energy transitions affect current socio-technical systems at regional and city level.

Recommendation #1: Systems thinking is needed at all levels of government and in the financial sector. Such systems thinking enables players to see what new regimes and practices should be fostered and what old regimes and practices should be broken down to make system change possible.

Subnational governments

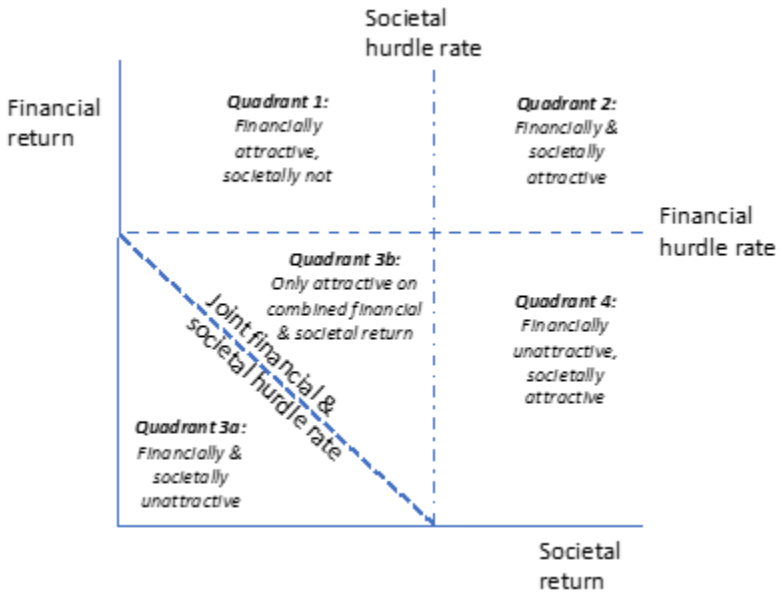
Subnational governments (cities and regions) play a key role in environmental and energy transitions, as they are in charge of some the key responsibilities linked to land-use, spatial planning, transport and energy infrastructure.

Recommendation #2: Subnational governments should set clear transition goals with specific indicators' targets (e.g. reduction by half of the number of cars in the city) tuned to their geographic circumstances. That can be at city or regional level. Or in most cases both – actions of cities and regions are complementary and not substitutable. Regional governments have a key role to play, which is different but complementary with the actions led by cities.

Recommendation #3: Subnational governments should play an initiating and coordinating role in financing transition projects. This in turn requires that they know very well what to do in which situations. That is, how to determine the situations in which social returns are attractive but financial returns do not suffice to get investors interested? What kind of structures can then be employed to get investors interested?

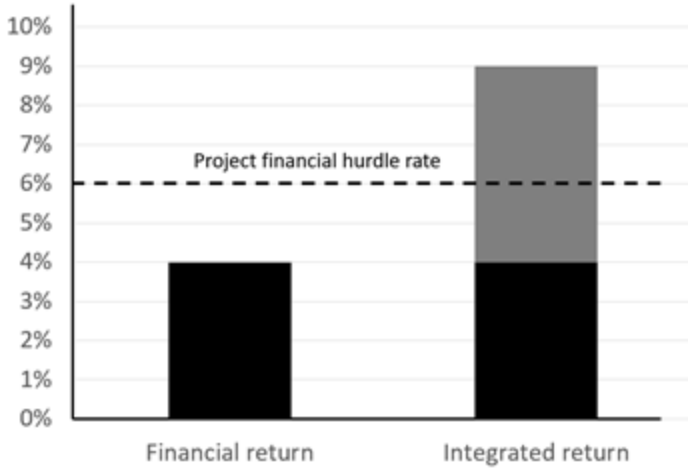
Recommendation #4: Subnational governments should identify and assess both the financial and societal potential of projects, and adjust their roles and structures accordingly. That is, they should know where projects are in the picture of Figure 6.1, taken from Section 3.2.

Figure 6.1. Financial and societal return



Recommendation #5: Subnational governments should jointly build financial and coordination capabilities to develop and structure projects. Education and technical assistance are important in building these capabilities. Coordination capacities are needed to bring parties together and initiate transition projects – especially for the projects in quadrants 3b and 4, which look like the one in Figure 6.2, taken from Section 4.4.

Figure 6.2. Project financial return versus project integrated return



For such projects, structures such as the icebreaker can be used to improve the financial risk-return profile.

National governments

National governments have the deep pockets and regulatory powers to broadly lead the sustainability transition, but many transition projects take place at the local level. National governments lack the local knowledge to make the right choices on the vastly more numerous local decisions.

Recommendation #6: National governments should set the adequate framework conditions and collaborate with local governments so as to allow them to follow recommendations 2 to 5.

Financial sector and its regulators

The financial sector has the means to (co-)finance the sustainability transition. It has the means to set up structures to foster the financing of transition projects and bridge the gap between (small) societal impact ventures and (large) institutional investors.

Recommendation #7: Set up and stimulate new societal aggregator funds to bundle small projects. It is typically too costly and inefficient for large asset owners to invest in small projects. Small dedicated, often local, funds can do that more efficiently. But even they are too small for large asset owners, unless investments into those small funds are bundled by societal aggregator funds. Asset owners can then invest in those societal aggregator funds at low information costs.

Recommendation #8: Introduce societal impact projects as a new type of alternative asset class. Asset owners and managers can then invest in this asset class, just as they have set up commodities and hedge funds as alternative asset classes in the past. To properly report on this, current ESG indicators do not suffice, and integrated value assessments are needed.

Recommendation #9: Report on integrated value and ask your investee companies to do so as well. With its 2018 impact report, ABN AMRO shows this can be done.

International organisations

New societal national accounts at country level and integrated reports at company level are emerging, and very necessary for efficient information sharing, but standards are lacking and needed.

Recommendation #10: International organisations, such as the OECD and the World Bank, should lead the development and coordination of accounting methods for integrated accounts at national and company level. Integrated accounts ensure consistent accounting methods for economic, social and environmental values. At the company level, the International Accounting Standards Board should develop IFRS standards for non-financial information to complement current IFRS standards for financial information.

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