

NATURE **SMART** CITIES **BUSINESS** MODEL

An Examination of the Financing Options Available to
Local Authorities to Fund Urban Greening Programmes





NATURE **SMART** CITIES

Business Model - Financing Options



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Executive Summary

Green Infrastructure (GI) offers significant advantages to urban areas in terms of liveability, sustainability, reducing the impacts of climate change, and encouraging economic regeneration, however, local authorities often find it hard to source the investment necessary to invest in GI.

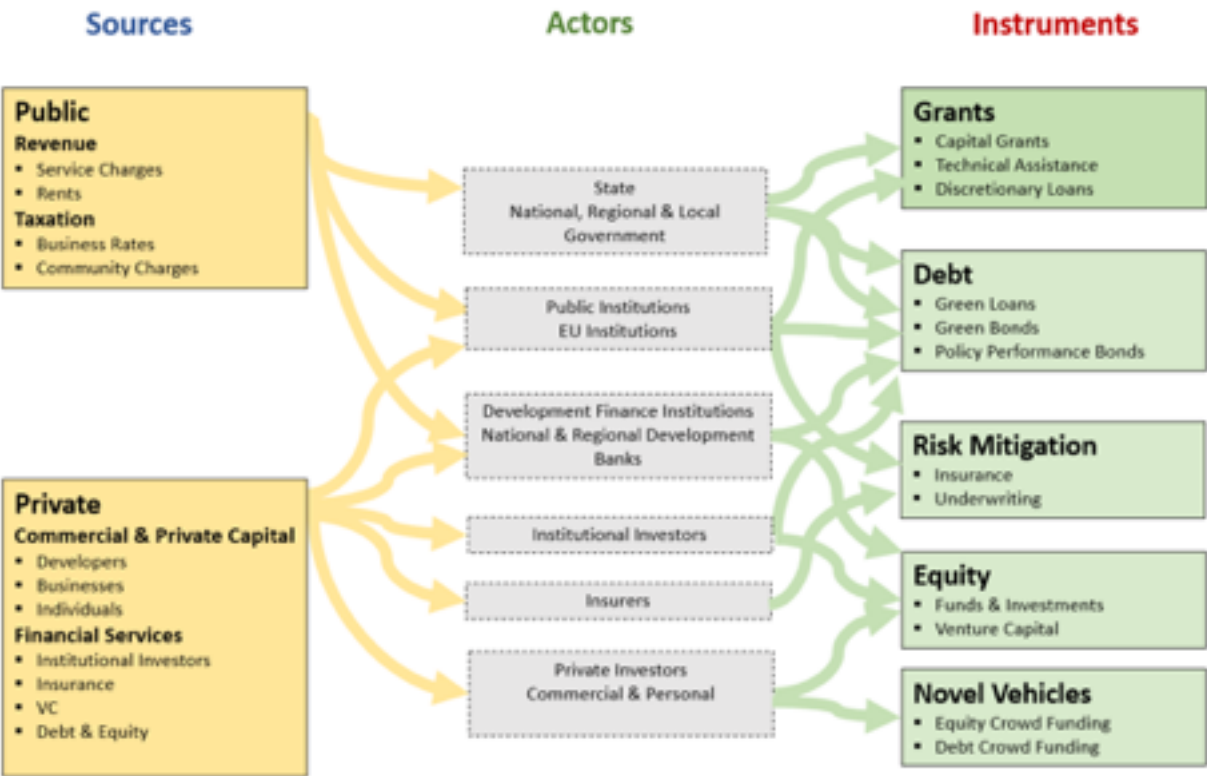
The issue is not merely one of capital funding - the maintenance of new green infrastructure is a struggle for local authorities which have been subject to a perfect storm of increased demand for public services, public expectations, pressures to tackle challenges such as climate change, and demographics. Public sector finance is currently insufficient to meet the needs of GI investment and private capital is required to fill the funding gap. However, markets have been slow to provide finance for GI investment.

Although policy and regulatory intervention would enhance the flow of capital into this area. There is already a wide variety of commercial and novel vehicles suitable for the financing of GI projects (see Figure 1).

Each of these approaches carries specific challenges:

- Equity-based approaches may carry political risk.
- Debt-based approaches require the development of effective measurement and monitoring systems and may lock in policy across multiple electoral cycles.
- Crowd funding may be effective at small scale but is unlikely to yield sufficient sums for large scale projects.

Figure 1: Sources of Financing Green Infrastructure

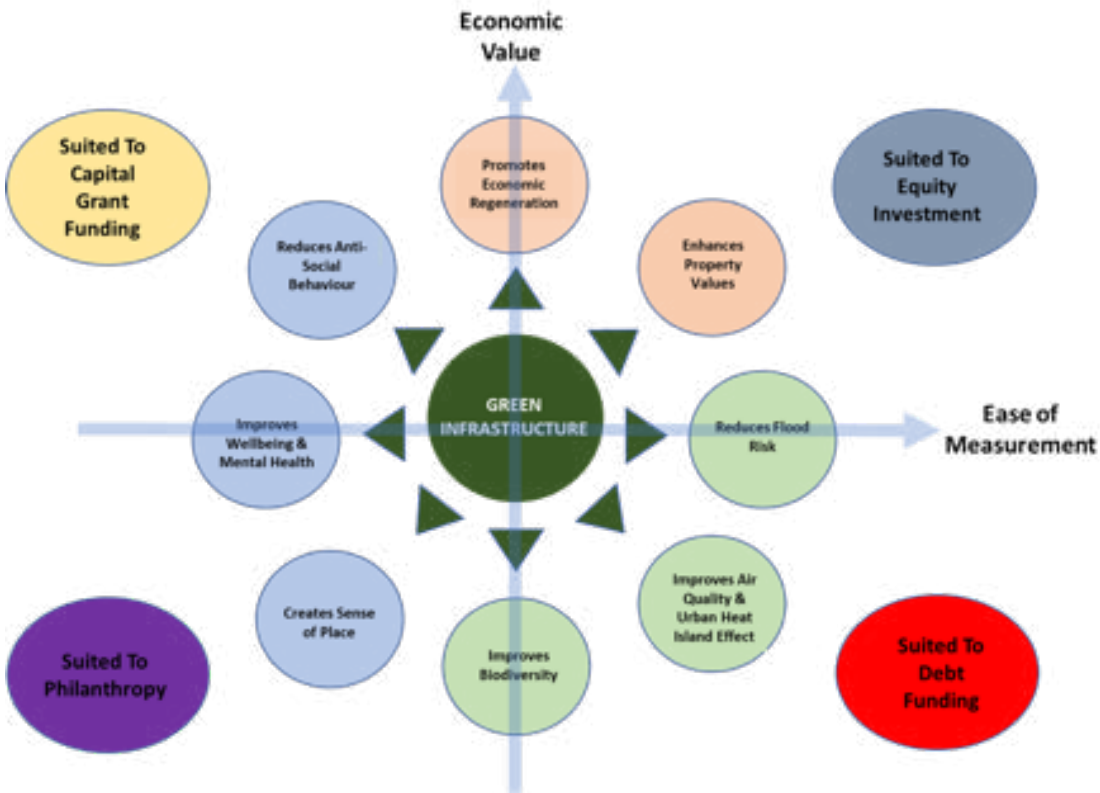


The viability of financing models and their long term funding are both affected by the difficulties associated with capturing the value associated with GI services. However, capturing income streams directly associated with GI programmes is challenging, and a degree of political resolve is required to persuade the beneficiaries of green infrastructure services to put value on what have, until now, been viewed as classical public goods.

- Permit trading schemes and taxation would require political will and regulatory input to be enacted effectively.
- Novel schemes, such as timebanks and community currencies offer advantages with respect to community involvement however, they involve “in-kind” payment rather than revenue and require administration.

GI can provide a wide variety of services, and focussing the design of GI to maximise particular outputs and the capture of commercially valuable data, can enhance the investability and long term financial sustainability of a project or programme (see Figure 2).

Figure 2: Values and Measurement





There are a number of possible routes to funding for local authorities seeking to invest in GI and private capital is already available. Local authorities can raise finance for infrastructure investment on the capital markets at competitive interest rates as, ultimately, risks are underwritten by the state.

Decisions on which individual product, or blend of products, are used to finance a GI programme must come down to calculations of interest rates, payback periods and costs. However, two significant stumbling blocks have been placed in the path of a local authority seeking to invest in GI;

- **Scaleability:** The relatively small sums of money sought for GI projects make it harder to seek private finance as it is unlikely to be economically viable to release bonds worth less than approximately €100 million. To this end aggregation vehicles are likely to be necessary.
- **Discounting:** It is essential that discounting levels are set at appropriate levels in order to make GI economically viable, and there is a case for treating GI differently from 'grey' infrastructure.

Although private capital is available for green infrastructure programmes, a great deal more can be done to increase the flow into this space. Markets can be a powerful force for good, but they require direction and regulators have an important role to play in encouraging investment in GI.



Green Infrastructure

The European Environment Agency defines green infrastructure as “a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation, and climate mitigation and adaptation”¹.

Green infrastructure has been proven to play a positive role in improving quality of life², mitigating pollution³, managing heat stress⁴, reducing flood risk⁵, enhancing property values⁶ and encouraging economic regeneration⁷. A network of green (land) and blue (water) spaces can improve environmental conditions and citizens' health and wellbeing as well as supporting a green economy, creating job opportunities and enhancing biodiversity.

The EU recognises the environmental, economic and social benefits provided by green infrastructure planning and is keen to reduce member states' dependence on traditional 'grey' infrastructure, which can often prove more expensive to build and maintain⁸.

The European Commission's Green Infrastructure Strategy⁹ aims to ensure that the protection, restoration, creation, and enhancement of green infrastructure become an integral part of spatial planning whenever it offers a better alternative, or is complementary, to standard choices. In 2013, the Commission adopted an EU-wide strategy promoting investments in green infrastructure as part the development of a Trans-European Network for Green Infrastructure in Europe, equivalent to the existing networks for transport, energy and ICT and designed to enhance the health and well-being of EU citizens, provide jobs, and boost the green economy.

1. EEA 2017 What Is Green Infrastructure? <https://www.eea.europa.eu/themes/sustainability-transitions/urban-environment/urban-green-infrastructure/what-is-green-infrastructure>
2. Szczepańska A & Wasilewicz-Pszczółkowska M 2018 Green Infrastructure As A Determinant Of The Quality Of Urban Life And A Barrier To The Development Of A City: A Case Study. *Geographia Polonica*. 91. 469-487
3. Bottalico F et al 2016 Air Pollution Removal By Green Infrastructures And Urban Forests In The City Of Florence *Agriculture and Agricultural Science Procedia* 8 243-251
4. Sarihi S 2015 Green Infrastructure: An Approach To Alleviate Urban Heat Island In Iran *International Conference On Modern Achievements in Civil Engineering, Architecture, Environment and Urban Management*
5. Dige G et al 2017. Green Infrastructure And Flood Management — Promoting Cost-Efficient Flood Risk Reduction Via Green Infrastructure Solutions *EEA ISSN 1977-8449*
6. ONS 2018 Estimating The Impact Urban Green Space Has On Property Price <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/compendium/economicreview/july2018/estimatingtheimpacturbangreenspacehasonpropertyprice>
7. Mell I 2009 Can Green Infrastructure Promote Urban Sustainability?. *Proceedings of The Institution of Civil Engineers - Engineering Sustainability* -162 23-34
8. Alberta Water 2019 Introduction To Green Infrastructure And Grey Infrastructure <https://albertawater.com/green-vs-grey-infrastructure>
9. EC 2013 The EU Strategy On Green Infrastructure https://ec.europa.eu/environment/nature/ecosystems/strategy/index_en.htm



The Funding Gap

Despite its proven benefits, and a globally recognised need to enhance the sustainability of urban environments, the burden of investment in green infrastructure has often fallen to the public sector, especially municipal and local government. Historically, public sector investments have often failed to capture a fair share of the benefits of green infrastructure. Around the world, the public sector faces acute pressure: fiscal pressures, pressures from public expectations, and pressures to tackle challenges such as aging, climate change, and population growth.

Alternative sources of funding for green infrastructure are needed. Such sources should move from a model based on capital-grant funding with on-costs for management and maintenance falling to the public purse, towards one that captures enough of the private benefits to encourage private sector investment, i.e. a blended model.

However, for many years financial systems have been failing to invest sufficiently in infrastructure¹⁰, let alone green infrastructure. Gross Domestic Fixed Capital Formation (GDFCF) fell as a proportion of GDP fell between 2007 to 2012 across the G7 economies¹¹, and it still remains substantially below 2008 levels today¹².

With respect to capital markets’ failure to invest in infrastructure, some of the blame may be laid at the door of short-term horizons for risk and reward, challenges, which as pointed out in Mainelli and Gifford’s 2009 paper The Road To Long Finance: A Systems View of the Credit Scrunch¹³, were responsible for the 2008 collapse of the global financial system, and according to many commentators¹⁴, have not been addressed effectively in the decade since the financial crisis occurred. Players in the financial system find it difficult to see, think and act long-term when structural characteristics incentivise short-term returns.

10. World Economic Forum 2014- Strategic Infrastructure Steps to Operate and Maintain Infrastructure Efficiently and Effectively http://www3.weforum.org/docs/WEF_IU_StrategicInfrastructureSteps_Report_2014.pdf
11. Driver C & Temple P 2013 Capital Investment: What Are The Main Long-Term Trends In Relation To UK Manufacturing Businesses, And How Do These Compare Internationally? https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283884/ep8-capital-investment-trends-ukmanufacturing.pdf
12. World Bank 2019 <https://data.worldbank.org/indicator/NE.GDI.FTOT.ZS>
13. Mainelli M & Gifford B 2009 The Road to Long Finance: A Systems View of the Credit Scrunch https://www.zyen.com/media/documents/Road_to_Long_Finance.pdf
14. IMF 2018 A Decade after the Global Financial Crisis: Are We Safer? <https://www.imf.org/en/Publications/GFSR/Issues/2018/09/25/Global-Financial-Stability-Report-October-2018>

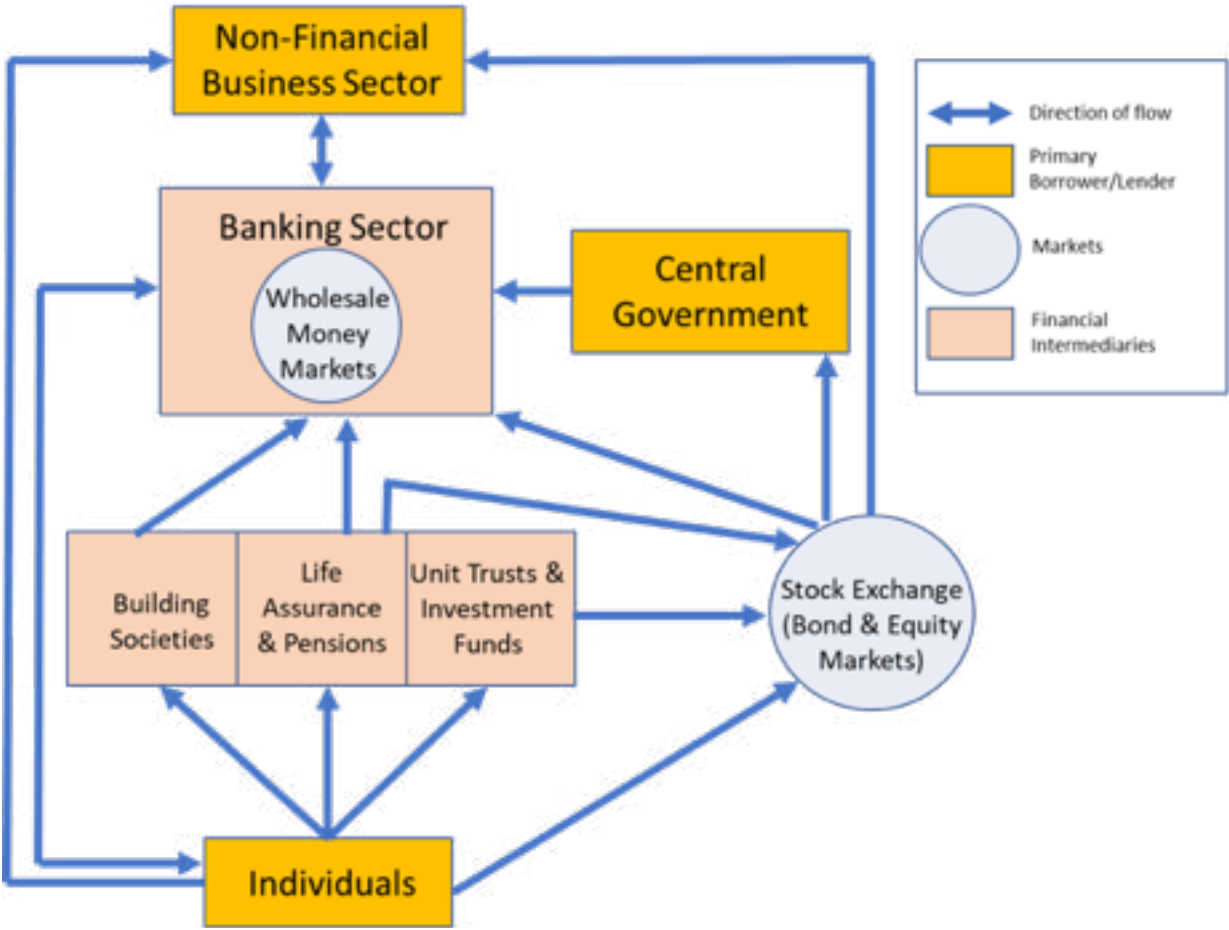
Unlocking Value

When considering finance for infrastructure, it is important to differentiate between infrastructure financing and infrastructure funding¹⁵:

- infrastructure financing, also known as capital financing, refers to the way in which debt and/or equity is raised for the construction and operation of an infrastructure project.
- infrastructure funding, also known as revenue funding, refers to how the operation of infrastructure is paid for - that is to say, the revenue sources, often collected over many years, which are used to pay for the costs of providing and maintaining infrastructure services. Common sources of funding include tax revenues, user charges and other charges or fees dedicated to infrastructure.

Sources of infrastructure financing refer to possible providers of capital to build and upgrade infrastructure (see Figure 3).

Figure 3: The Financial System



Adapted From “Finance & Water - Where’s The Data” NERC Working Paper¹⁶

15. Maier T & Jordan-Tank M 2014 Accelerating Infrastructure Delivery: New Evidence from International Financial Institutions World Economic Forum, 2014, 1-40
16. Cooper M & Fishman L 2010 Finance & Water - Where’s The Data NERC Working Paper https://www.longfinance.net/media/documents/Finance_and_Water_-_Wheres_The_Data_October2010.pdf



For Green Infrastructure, sources of finance may include:

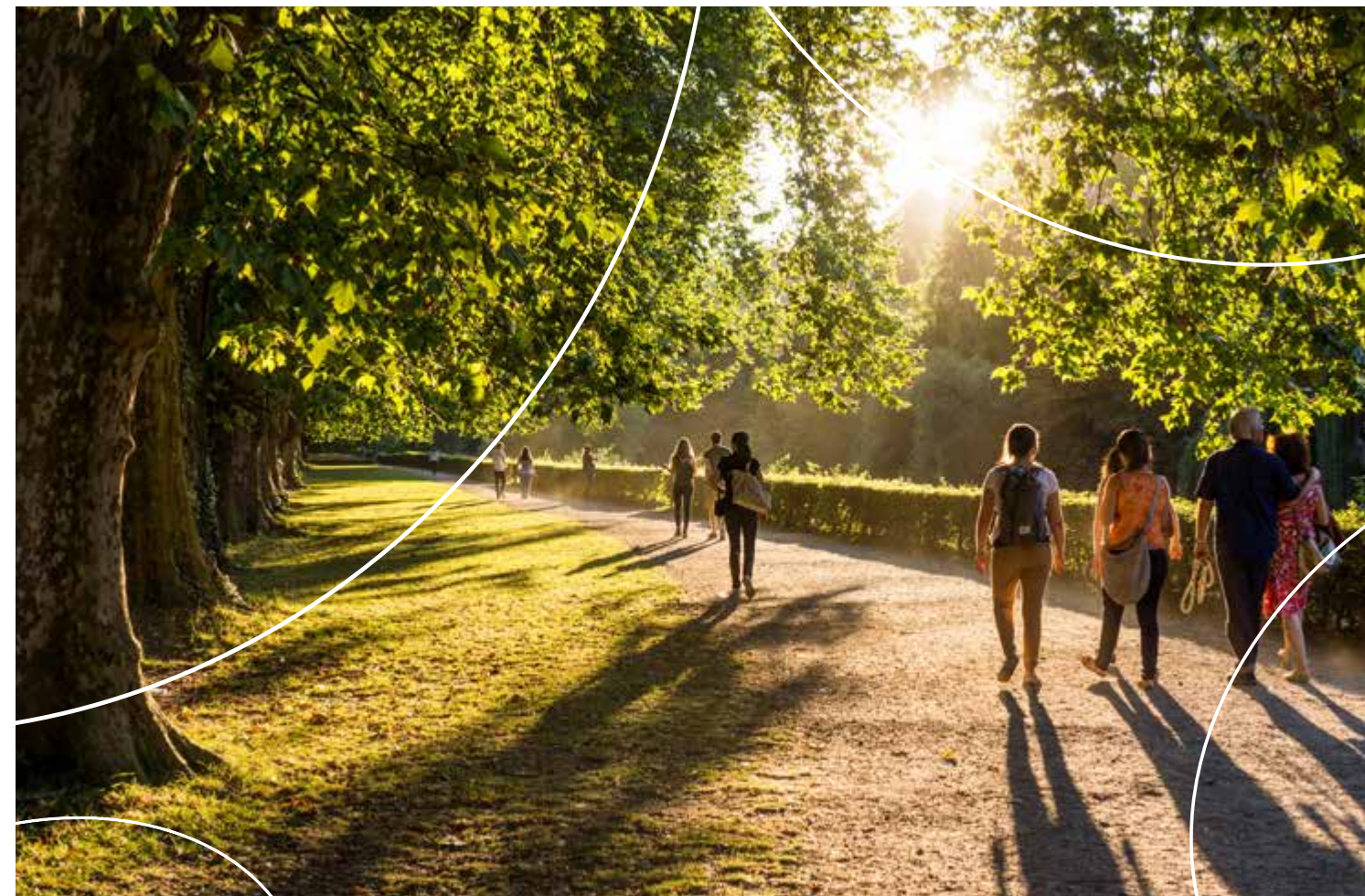
- governments – local, provincial, national;
- financial services – commercial banks, specialist funds, private equity funds, infrastructure funds, other asset management, and investment management firms and funds;
- public and development finance institutions – international financial institutions, multilateral and national development banks, export credit agencies;
- institutional investors – pension funds, mutual funds, insurance companies, sovereign wealth funds;
- capital markets – where people and companies trade debt and equities;
- private companies;
- communities.

However, accessing private sector capital requires the identification of revenue streams to service debt, or equity obligations. With respect to infrastructure, if a project is to be wholly or partially “self sustaining” (supported by income derived from the project, rather than public subsidy), the ability to collect revenue is dependent on clearly-defined ownership or rights over both the infrastructure and the services it provides. With green infrastructure this is further complicated by the difficulty in capturing the value created by green infrastructure services.

Studies have successfully placed commercial value on trees in terms of their impact on the value of adjacent properties⁶, value which can be recovered through property taxes, but how can you capture the value arising from a tree’s flood protection and pollution amelioration services, or the mental well-being and sense of place it provides?

The issue of capturing value lies at the heart of the challenges associated with the financing and funding of green infrastructure, and can be sub-divided into three facets, all of which need to be addressed:

- Externalities & Income – classical economic theory imbues biodiversity with some of the properties of a public good: individuals cannot (or should not) be excluded from consuming a particular commodity (for example, the flood protection qualities of green infrastructure), and available supply is more or less independent of the number of consumers¹⁷. These properties drive the “Tragedy of the Commons”- if a service is provided free of charge, what incentive is there to value it?



- Cui Bono? – The benefits associated with green infrastructure often extend beyond the community where that infrastructure exists. Some types of green infrastructure may involve sacrifice, for example, car parking spaces being replaced by Sustainable Urban Drainage Systems. How can the benefits of green infrastructure be shared equitably?
- Metrics & Data – quantifying and capturing the value streams associated with green infrastructure can be challenging. For example, while the concept of biodiversity is well established, its measurement has yet to be pinned down in the same way that carbon emissions have been established as the unit of measurement for climate change impact assessments¹⁸. Calculations to derive diversity and species richness were first developed by Robert MacArthur and Edward O. Wilson in 1967¹⁹. The results of their, and subsequent formulae designed to measure natural systems, require interpretation and are ill-suited to the needs of the financial services sector. As highlighted in a 2011 report for the NERC, without standardised metrics, it is more difficult to measure and compare the performance of financial instruments designed to promote green infrastructure²⁰.

17. Wiesmeth H. (2012) Public Goods in Environmental Economics. In: Environmental Economics. Springer Texts in Business and Economics. Springer, Berlin, Heidelberg

18. Mainelli M & Harris I 2011 The Price Of Fish p285 Nicholas Brealey ISBN 978-1-85788-571-2

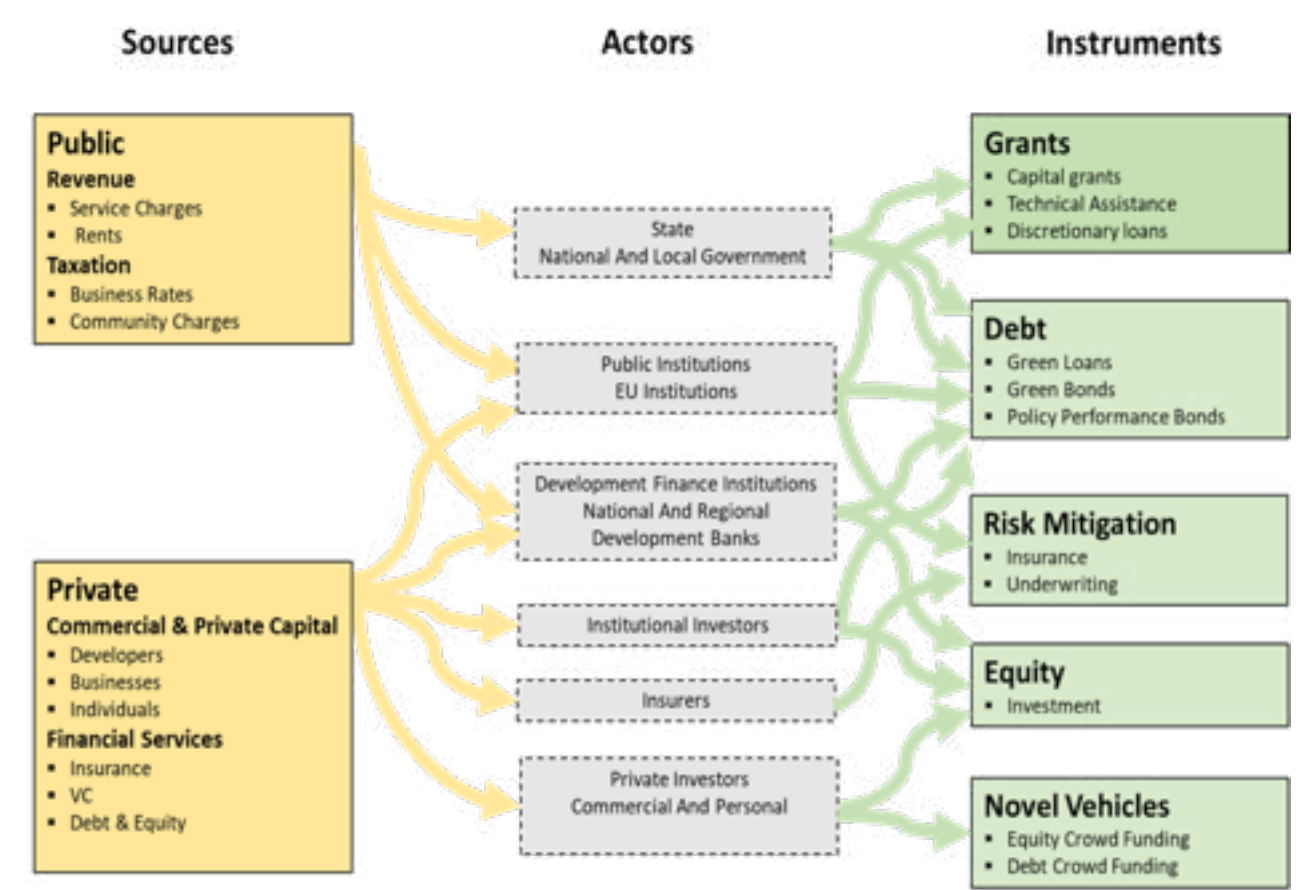
19. MacArthur R and Wilson E O 1967 The Theory of Island Biogeography Princeton University Press (Revised edition 26 Feb. 2001) ISBN-10: 0691088365

20. Z/Yen 2011 Finance, Biodiversity And Managed Ecosystems: Where's The Data? https://www.zyen.com/media/documents/nerc_biodiversity_2011.pdf

Infrastructure Financing

In this section we examine the types of financial instruments which could make effective vehicles for Green Infrastructure Financing, also known as capital finance. The infrastructure financing universe is illustrated in Figure 4.

Figure 4: Sources of Financing for Green Infrastructure



The primary focus of this section is on green private equity and debt. Standard debt vehicles, such as loans or municipal bonds are not examined in detail as they are well known to local authority financial managers. Likewise capital grant funding is not discussed as sources of EU funding are in the public domain, and member states have their own regional and national grant-funding schemes.

A summary of infrastructure financing vehicles is contained in Table 1. Each product is examined in further detail in the subsequent text.

Table 1: Summary of Capital Financing Vehicles

Product	Availability	Issues
Green Equity (ownership or usage rights). Establishes green infrastructure as an asset class, structured into investable modules. These can focus on: <ul style="list-style-type: none">SUDs and urban open spaces (such as parks);Establishing and maintaining infrastructure (such as green walls, electric vehicle charging points or small-scale renewables); andInvestments into additional mechanisms centred on environmental markets (such as carbon or biodiversity offsets).	Privately owned public spaces (POPS) are a common feature of many UK cities. The 34 streets that make up Liverpool One are owned by the Grosvenor Group and the new NOMA neighbourhood in Manchester, which is currently under construction, will include two POPS.	Advantages <ul style="list-style-type: none">No interest is payable.Infrastructure funding costs fall to the asset owner. Disadvantages <ul style="list-style-type: none">Political implications associated with the transfer of ownership of public goods into private hands.Consideration must be given to the rights of local communities and reversion to public ownership in the event of bankruptcy or failure of the owners to deliver agreed services.
Green Loans Offered by banks at preferential interest rates linked to the achievement of specific environmental targets.	Offered by many large banks (particularly in the Netherlands). The Loan Market Association's "Green Loan Principles" include green infrastructure in their definitions however, to date most green loans have focussed on carbon reduction.	Advantages <ul style="list-style-type: none">Preferential interest rates. Disadvantages <ul style="list-style-type: none">Accurate and effective performance measurement is essential, which can add to costs
Green Bonds Created to fund projects that have positive environmental and/or climate benefits. The majority of the green bonds issued are green "use of proceeds" or asset-linked bonds. There have also been green "use of proceeds" revenue bonds, green project bonds and green securitised bonds.	Green bonds have been issued by national governments, municipal authorities and private corporations. Green bond issuance in 2018 reached USD167.3bn worldwide.	Advantages <ul style="list-style-type: none">Low interest ratesWell established product which is understood by both markets and local authorities (viz Municipal Bonds). Disadvantages <ul style="list-style-type: none">Proceeds from these bonds are earmarked for green projects but are backed by the issuer's entire balance sheet.Sums required are small and may require an aggregation vehicle.
Policy Performance Bonds (PPBs) Government bonds where interest payments are linked to the delivery of an environmental policy specific target. If a target is missed, the yield on the bond increases. PPBs could be issued against a variety of different policy objectives, including flood protection and economic regeneration.	There are no technical or legal impediments to the issuance of this type of debt instrument, and the private sector has begun to issue them. However, to date no public sector institution has issued a PPB.	Advantages <ul style="list-style-type: none">Reduced political risk attracts low interest rates.Secondary markets could encourage additional investment Disadvantages <ul style="list-style-type: none">The liabilities associated with these debt instruments extend across multiple election cycles effectively locking in future administrations to particular policy goals.

Table 1: Summary of Capital Financing Vehicles (Continued)

Product	Availability	Issues
Impact Investment Investments made with the intention of making a positive, measurable social and environmental impact alongside a financial return. Impact investments are not philanthropy, although they may target a range of returns from below market to above market rate, depending on investors' strategic goals.	Impact investment has attracted a wide variety of investors, including: <ul style="list-style-type: none">• Fund Managers• Diversified financial institutions/banks• Private foundations• Pension funds and insurance companies• Individual investors• NGOs• Religious institutions.	Advantages <ul style="list-style-type: none">• Can attract capital at low cost.• Investors likely to be active. Disadvantages <ul style="list-style-type: none">• Impact investment funds have diverse financial return expectations. Some pursue market-competitive and market-beating returns.• Local authorities may have to surrender a degree of control over projects in return for investment.
Crowd-Funding A way of raising money for a project by using the internet to ask large numbers of people to invest small amounts of money. Crowd funding programmes can be equity based (donors expect a return on their investment) or philanthropic (no return is expected)	Has proven very successful for small scale renewable energy projects restoration of small public parks and open spaces.	Advantages <ul style="list-style-type: none">• Can be a highly effective way to engage local communities.• Can be low cost. Disadvantages <ul style="list-style-type: none">• The capital sums raised will be small.• In the case of debt and equity crowd funding, issues around measurement and value capture must be resolved



Analysis

Equity

Equity finance involves raising of capital through selling a stake in your business. The investor who buys that stake will take on a portion of the profits (or losses) that your business makes. In the case of green infrastructure the “business” is the green infrastructure asset, which may be an area of land or a specific piece of plant or equipment, such as a renewable energy generation facility. The “profits” will arise from the benefits that the green infrastructure may bring to the locality, such as enhanced rents or property values, reduced flood risk and lower insurance premiums, or renewable energy generation and reduced emissions.

The most significant advantages to equity finance is that the risks are evenly distributed and local authorities do not have to make repayments in the same way that they would if they took on debt. Equity finance is an investment, and does not need to be repaid - if things do not go to plan and the venture fails, investors share the risk. Equity investors frequently have extensive business experience and can play a key role in the development of a project.

Equity investment has proven particularly successful in the establishment of Privately Owned Public Spaces (POPS). In recent years these have become a common feature of many UK cities. The 34 streets that make up Liverpool One are owned by the Grosvenor Group and the new NOMA neighbourhood in Manchester, which is currently under construction, will include two POPS.

However, because of the risk to their capital, equity investors expect a higher return than debt providers, and as a condition of their investment they will expect to have a greater role in decision making with regards to the management of a project. Equity investment can also be expensive and difficult to acquire as it requires considerable expertise in business planning, the creation of complex contract documentation and a clear understanding of both the value streams created by green infrastructure and how they are to be captured.

Green Loans

Green loans, finance extended by a bank or other financial institution for use on environmental projects or programmes, and to be repaid, with interest, over an agreed period, are a relatively recent innovation, but volumes have risen dramatically over the past few years to over US\$99bn in 2018²¹.

Green loans are an increasingly attractive proposition for banks: They offer the prospect of new markets and products, enhance the CSR credentials of the lender, and as the environmental, social and governance risks associated with this type of lending can be lower than for standard lending, credit can be extended at competitive rates.

21. Linklaters 2019 The Rise Of Green Loans And Sustainability Linked Lending <https://www.linklaters.com/en/insights/thought-leadership/sustainable-finance/the-rise-of-green-loans-and-sustainability-linked-lending>



Green loans are loans which are used for green purposes, and there is a further subset of green loans where pricing is tied to the borrower’s performance against certain pre-determined sustainability criteria. Unlike most green bonds, which are issued with specific environmental projects in mind, such facilities focus on the company’s overall approach to Environmental Social and Governance (ESG)-related goals.

Market standards for green loans were published by the LMA in March 2018²², and were followed in March 2019²³ by sustainability linked loan standards. Green and sustainability linked loans are now recognised products globally.

Finnish telecoms giant Nokia has committed to a new €1.5bn credit facility²⁴, which will bind it to a set of targets for reducing greenhouse gas emissions. Nokia is aiming for a 41 per cent reduction in emissions by 2030, compared with its 2014 output, and a 75 per cent fall in emissions from products it has sold. Dutch international agri-business corporation Louis Dreyfus has a similar \$750m revolving credit facility, with interest payments tied to its achievement of green goals such as CO2 reduction, power consumption, water usage, and landfill waste²⁵.

Green loans are ideally suited to green infrastructure projects, but require careful planning for the measurement and monitoring of outcomes.

Green Bonds

A bond is a fixed income instrument that represents a loan made by an investor to a borrower (typically a corporation or a government). Bonds are used by companies, municipalities, states, and sovereign governments to finance projects and operations. Owners of bonds are debtholders, or creditors, of the issuer. Bond details include the end date (when the loan is to be repaid to the bond owner) and the terms for variable or fixed interest payments made by the borrower to the bond holder. Green bonds are a particular type of bond, that are created to fund projects that have positive environmental and/or climate benefits. The majority of green bonds issued are green “use of proceeds” or asset-linked bonds (see table 2). Proceeds from these bonds are earmarked for specific green projects but are backed by the issuer’s entire balance sheet.

To date green bonds issued , have tended to focus on infrastructure development designed to reduce carbon emissions and pollution. However, as interest in this product has soared (green bond issuance in to September 2019 has exceeded \$152.9bn worldwide and is set to smash previous years’ records) more sustainability orientated bonds are being released.

The Republic Of The Seychelles issued the world’s first blue sovereign bond²⁶ in October 2018. Proceeds will be allocated to eligible activities related to sustainable fisheries and marine projects, including the expansion of marine protected areas, improved governance of priority fisheries and development of the Seychelle’s blue economy. As with standard “gilts” (units of debt issued by governments), investors are effectively lending money to the government, which promises to pay back the amount in full (known as the principal) at a set date, along with interest (known as the coupon). Because this type of instrument is considered very low risk, interest rates are commensurately low.

US municipal authorities have been releasing green municipal bonds since 2013. In 2017, 27% of all green bond issuance in the US were by municipal authorities²⁷ (with around 60% of these focussing on water), although subsequent significant changes to US Tax law, passed by Congress in December of that year through the Tax Cuts and Jobs Acts has negatively impacted the issuance of refunding bonds.

Table 2: Types of Green Bonds (Source: Climate Bonds Initiative)

Type	Proceeds	Debt Recourse	Example
“Use of Proceeds” Bond	Earmarked for green projects	Recourse to the issuer: same credit rating applies as issuer’s other bonds	EIB “Climate Awareness Bond” (backed by EIB; Barclays Green Bond.
“Use of Proceeds” Revenue Bond or ABS	Earmarked for green projects	Revenue streams from the issuers through fees, taxes, etc. are collateral for the debt	Hawaii State (backed by a fee on electricity bills of the state utilities)
Project Bond	Ring-fenced for the specific underlying green project(s)	Recourse is only to the project’s assets and balance sheet	Invenergy Wind Farm (backed by Invenergy Campo Palomas wind farm)
Securitisation (ABS) Bond	Earmarked for portfolios of green projects	Recouse is to a group of projects that have been grouped together (e.g. solar leases or green mortgages)	Tesla Energy (backed by residential solar leases); Obvion (backed by green mortgages)
Other debt instruments	Earmarked for eligible projects	Varies	Convertible Bonds or Notes, Schuldschein, Commercial Paper, Sukuk, Debentures

22. LMA 2018 Green Loan Principles https://www.lma.eu.com/application/files/9115/4452/5458/741_LM_Green_Loan_Principles_Booklet_V8.pdf
23. LMA 2019 Sustainability Linked Loan Principles https://www.lma.eu.com/application/files/8015/5307/4231/LMA_Sustainability_Linked_Loan_Principles.pdf
24. Georgiadis P & Asgari N 2019 Nokia Signs €1.5bn Loan Linked To Greenhouse Gas Emissions FT June 19, 2019 <https://www.businessstelegraph.co.uk/nokia-signs-e1-5bn-in-sustainability-linked-credit/>
25. Holder M 2019 Louis Dreyfus Company Links Interest On \$750m Loan To Green Performance <https://www.business-green.com/bg/news/3076513/louis-dreyfus-company-agrees-usd750m-green-loan-repayment-deal>

26. World Bank 2018 Seychelles Launches World’s First Sovereign Blue Bond <https://www.worldbank.org/en/news/press-release/2018/10/29/seychelles-launches-worlds-first-sovereign-blue-bond>
27. Climate Bonds Initiative 2018 Can US Municipals Scale Up Green Bond Issuance? Likely, “Yes” https://www.climatebonds.net/files/reports/us_muni_climate-aligned_bonds_11-07-2018.pdf



However, one critical issue that local authorities seeking to finance projects through this route must consider is scalability. Green infrastructure projects tend to be relatively small scale and low cost. Discussion with green finance practitioners indicates that, for a bond issuance to be commercially viable, multiple projects would have to be aggregated in order to exceed a minimum threshold of €100 million. Individual municipal authorities may not have ambitions of this scale, so the intervention of a regional, or sub-regional body may be necessary, to act as a broker who could aggregate projects, raise the bond and provide a credit facility for municipalities who wish to use this route to finance projects.

Policy Performance Bonds

'Positive incentive loans' are a fast-growing part of green finance, and have recently seen some high profile issuances by major corporations. For this type of financial instrument, the cost of borrowing varies, depending on whether the borrower hits pre-determined targets linked to ESG standards.

Policy performance bonds (PPBs) are government or corporate-issued bonds where interest payments are linked to the delivery of policy-specific targets. Policy performance bonds, or surety bonds, could be an important link between government policies and real-world economies. A policy performance bond provides a hedge against the issuing country's government not delivering on its commitments or targets²⁸. Policy performance bonds could help unite businesses, organizations, and governments towards shared goals.

The Italian energy company Enel²⁹ has issued a bond that has linked its coupon to the company's achievement of a renewable energy generation target in line with the UN Sustainable Development Goals (SDGs). The \$1.5 billion, five-year issuance is for general corporate purposes, however, the coupon it pays investors will increase by 25 basis points if Enel does not achieve, by 31 December 2021, a percentage of installed renewable generation capacity equal to or greater than 55% of total consolidated installed capacity. The bond will pay a coupon of 2.650% until maturity, on 10 September 2024, but will rise to 2.900% if it does not achieve the renewables objective.

From a public sector perspective, policy performance bonds offer investors a critical advantage, the risk of failed government policy. Public policy is core to most environmental infrastructure and technology profitability. If policymakers stick to declared targets on, for example reductions in greenhouse gas emissions, increases in renewable energy, or higher carbon prices, many environmental and cleantech projects make investment sense. If government policies are subject to sudden changes, green projects are highly risky.

Policy performance bonds are a statement to investors that a public body intends to stick by its policy pledges, and investors know that they will be compensated through higher interest rates, should the issuer renege on their word. Policy Performance Bonds can be thought of as a bet that a policy-maker will break their word, in the same way that car insurance is a bet that an individual will crash their car, it is not a desirable outcome, but should it occur the bondholder will be compensated.

Local authorities could issue policy performance bonds as a type of municipal bond. In the case of green infrastructure, the choice of index allows the public sector to eliminate quite specific risks, taking away a policy confidence blockage and enabling private sector investment to flow. The ability to choose any of a range of indices provides flexibility to target one or more specific risks in a single structure. Policy performance bonds could easily be issued by any local authority without any need for a national initiative. Documentation would be simple. Most existing government treasury mandates already allow for these types of instruments.

Local authorities could issue debt linked to other areas they control, including biodiversity, education, healthcare or crime. If these markets grew, they would transform corporate risk management and give a new twist to public-private partnerships. Companies might locate corporate facilities in deprived or risky areas (flood risk, poor education rates or crime rates) and hedge the risks with local authority debt, although further research would be required to determine whether this would be feasible.

Although there are some complexities, such as auditing and authentication of performance figures, liquidity, leverage opportunities, stripping, etc, there is also the deeper question of the legitimacy of locking in policy goals across multiple election cycles. However, as traditional grey infrastructure could be considered the literal setting of policy objectives in stone, this may be overstated.

Given the benefits as a funding source, the idea of a deep market in policy performance bonds seems worth serious consideration, particularly as private sector organisations are now seeking finance from this source. Since first mooted by Long Finance in 2008 & 2009, the private sector began issuing these bonds, tying interest rates inversely to performance against social goals, as opposed to saying the proceeds will be used for social purposes only, in 2018:

- Louis Dreyfus - green goals such as CO2 reduction, power consumption, water usage, and landfill waste - <https://www.businessgreen.com/bg/news/3076513/louis-dreyfus-company-agrees-usd750m-green-loan-repayment-deal>
- Nokia - greenhouse gas emissions - <https://www.ft.com/content/6a41a968-9265-11e9-aea1-2b1d33ac3271>
- Enel - clean energy (SDG 7), industry, innovation and infrastructure (SDG 9), sustainable cities and communities (SDG 11), and climate action (SDG 13) - <https://renewablesnow.com/news/enel-issues-usd-15bn-sdg-linked-bond-668049/>

28. M Mainelli and J Onstwedder Environmental Finance, Fulton Publishing (February 2010) page 17 Living Up To Their Promises (index-linked carbon bonds)

29. RenewablesNow 2019 Enel Issues USD-1.5bn SDG-Linked Bond <https://renewablesnow.com/news/enel-issues-usd-15bn-sdg-linked-bond-668049/>



The outcomes of these pioneering instruments will bear closer scrutiny in coming years to determine how effective PPBs can be in enhancing ESG performance, and what lessons can be drawn for the public sector.

Impact Investment

A hallmark of impact investing is the commitment of the investor to measure and report the social and environmental performance and progress of underlying investments, ensuring transparency and accountability while informing the practice of impact investing and building the field.

Investors' approaches to impact measurement will vary based on their objectives and capacities, and the choice of what to measure usually reflects investor goals and, consequently, investor intention. In general, components of best practices for impact investing include:

- Establishing and stating social and environmental objectives to relevant stakeholders;
- Setting performance metrics/targets related to these objectives using standardized metrics wherever possible;
- Monitoring and managing the performance of investees against these targets;
- Reporting on social and environmental performance to relevant stakeholders

In recent years impact investment has moved from the fringes to become a mainstream financial offering by some major financial institutions. Private Swiss bank Lombard Odier³⁰ has developed an impact investing fund of funds. Big Society Capital³¹ is an independent financial institution established in 2012 to develop and shape a sustainable social investment market in the UK; and international bank Morgan Stanley launched its Investing With Impact platform in 2012³².

However, although impact investment may be well suited to green infrastructure investment, it must be remembered that impact investment is not philanthropy. The return rates for some impact investment products can be considerably higher than market rates, in order to reflect the risks associated with lending. Care should be taken in identifying impact investment products to ensure that both the costs and the impact goals are in line with those of the local authority.

Crowd-Funding

Traditional project funding requires the involvement of a small number of investors who are willing to invest large amounts of money. Crowd-funding is a way of raising money for a project by using the internet to ask large numbers of people to invest small amounts of money. The first online

crowdfunded project is thought to have occurred in 1997 when US fans of the prog-rock group Marillion raised \$60,000 to cover the costs of a US tour, that otherwise would not have taken place³³. There are three different types of crowd-funding: debt, donation and equity.

- Debt crowd-funding is a version of peer-to-peer lending, though it is usually themed, for example investment in renewable energy, environmental projects or international development. Examples of sites offering this type of service include <https://www.abundanceinvestment.com/>, <https://bnktothefuture.com/>, <https://www.pozible.com/> and www.trillionfund.com (all links active on 06/09/19)
- Donation/reward crowd-funding tends to be associated with a specific cause or event and does not provide a financial return. Rewards can include tickets to an event, acknowledgement in a book or on an album sleeve cover, promotional items, or just the satisfaction of donating to a worthy cause. Sites offering this type of service include: www.crowdfunder.co.uk, www.just-giving.com, www.peoplefund.it, www.spacehive.com and www.hubbub.net (all links active on 06/09/19) .
- Equity crowd-funding is similar to debt crowd-funding, but instead of interest money is exchanged for a small stake in the business. If the business is successful the value of the shares increases, if not, the value decreases or the money may be lost entirely. The equity crowd-funding market is still small (a report by Nesta³⁴ found that £193m was lent in 2013 through peer-to-peer business lending platforms, whereas £19.5m was invested through equity crowd-funding) however, it is growing. Sites offering this service include www.angelsden.com, www.crowdcube.com, www.ethex.org.uk, <http://communityshares.org.uk>, www.seedrs.com, and www.sharein.com (all links active on 06/09/19).

One of the most significant opportunities associated with crowd-funding is the ability of communities to raise funds for local infrastructure. Crowd-funding also introduces creative opportunities for governance – what to invest, where, who receives the returns – and democratic control of commonly held organisations. Generally the sums raised are relatively small – tens of thousands rather than hundreds of thousands, however, blending crowd-funding with other sources of capital is an effective way of generating a stake for local communities in green infrastructure programmes.

30. Lombard Odier 2019 <https://thegiin.org/research/spotlight/investor-spotlight-bertrand-gacon>

31. Big Society Capital 2019 <https://www.bigsocietycapital.com/what-we-do#card-681>

32. Morgan Stanley 2019 <https://www.morganstanley.com/assets/pdfs/articles/investing-with-impact.pdf>

33. Drake D 2013 Crowd Rocking the Fund: From Marillion Band to the #UKCrowdfundingDay <https://www.equities.com/news/crowd-rocking-the-fund-from-marillion-band-to-the-ukcrowdfundingday>

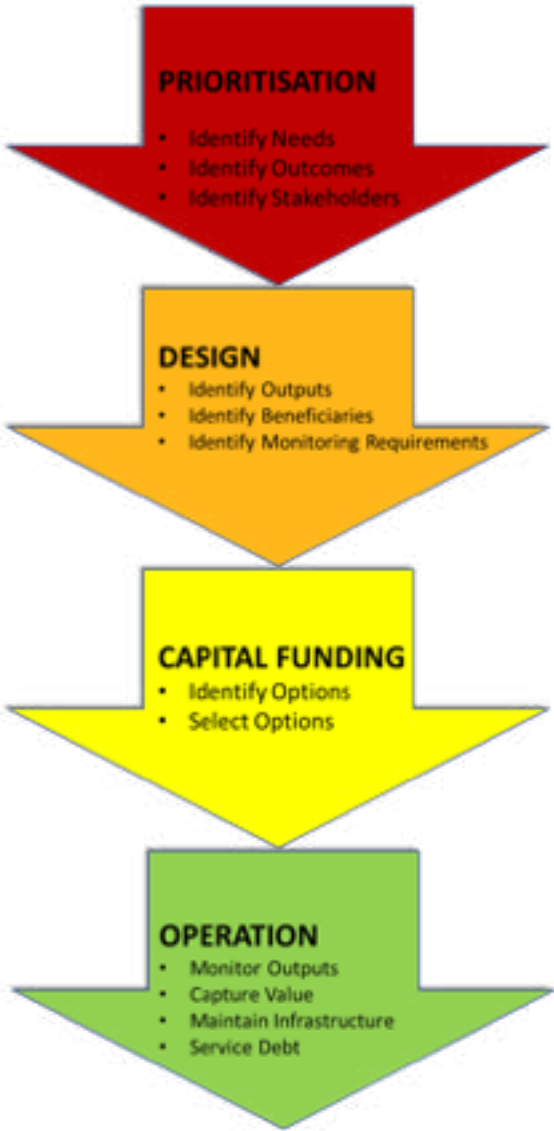
34. NESTA 2019 Crowdfunding <http://www.nesta.org.uk/project/crowd-funding>

Infrastructure Funding

Funding the management and maintenance of green infrastructure projects on a commercial basis presents local authorities with significant difficulties due to the complexities inherent in creating and capturing income streams directly associated with green infrastructure programmes.

The management and maintenance of a green infrastructure project is something which requires careful consideration at the planning phase of the project (see Figure 5).

Figure 5: Design and Planning for Green Infrastructure



Although, the development of viable income streams from green infrastructure projects is challenging, there are a number of promising routes that deserve closer inspection.

A summary of infrastructure funding vehicles is contained in table 3. Each source is examined in further detail in the subsequent text.

Table 3: Summary of Green Infrastructure Funding Vehicles

Source	Availability	Issues
Land Value Tax (LVT) A levy on the unimproved value of land. Unlike property taxes, it disregards the value of buildings, plant and other improvements to real estate. The fundamental idea of LVT is that pieces of land get their value from their location, and what gives a location value is what is going on around it. Green infrastructure investment could raise the value of the land surrounding it, and that value could be captured through an increase in LVT which could be used to fund the infrastructure.	Estonia levies an LVT which is used to fund local municipalities. It is a state level tax, but 100% of the revenue is used to fund Local Councils. The rate is set by the Local Council within the limits of 0.1-2.5%. It is one of the most important sources of funding for municipalities.	Advantages <ul style="list-style-type: none">• LVT allows local authorities to recoup the costs of green infrastructure improvements from organisations and individuals who directly benefit from schemes. Disadvantages <ul style="list-style-type: none">• The most significant barrier is political, as LVTs would impose costs on landowners, traditionally the wealthiest and most powerful citizens, who lobby strenuously against their adoption.
Quotas, Permits and Trading Schemes Quotas and permits for fishing, logging, and water abstraction are already issued by regulators. Markets in tradable permits can be effective in the management of environmental resources, as proven by carbon trading in the EU and NOX and SOX trading in the US.	Markets already exist for voluntary carbon offsetting schemes. CORSIA, the Carbon Offsetting and Reduction Scheme for International Aviation, addresses the increase in total CO2 emissions from international aviation above 2020 levels. No such offsets exist for surface water drainage and treatment providers to determine the feasibility of piloting such a scheme.	Advantages <ul style="list-style-type: none">• Directly applies value to ecosystem services. Disadvantages <ul style="list-style-type: none">• Requires legislation and markets in quotas and permits are not without controversy.• Require a stable policy environment to be effective, as an over-supply of permits can damage markets and the resources they seek to protect.
Pigouvean Taxes These are taxes levied to correct an inefficient market outcome by being set equal to the social cost of the negative externalities. Pigouvean tax incentives could support the management of the Green and Blue Infrastructure, through exemption from land tax, gift tax, deduction on property tax etc.	In France, an extension of the use of the 1% landscape and development levy has been launched (1% of infrastructure projects must be used for landscape purposes). In the UK The Community Infrastructure Levy (CIL) is a charge that local authorities can set on new development in order to raise funds to help fund the infrastructure, facilities and services - such as schools or transport improvements - which are needed to support new homes and businesses in the areas.	Advantages <ul style="list-style-type: none">• Incentivise developers to incorporate green infrastructure• Direct source of finance for green infrastructure. Disadvantages <ul style="list-style-type: none">• Requires intervention by policy makers to enable it.• Focuses on new development and may not cover areas with greatest need

Table 3: Summary of Green Infrastructure Funding Vehicles (Continued)

Source	Availability	Issues
Insurance, Pooling & Tail Risk A variety of instruments designed to pool risk have been successfully used to manage environmental and social risks for decades. Extending this concept to green infrastructure could deliver a number of benefits	Widely used for the restoration of contaminated land and in the housing sector.	Advantages <ul style="list-style-type: none">• Tried and tested instruments• Understood by developers Disadvantages <ul style="list-style-type: none">• Requires engagement with insurance industry to create new product• Likely to be suitable for only major developments or redevelopments
Payments for ecosystem services (PES) These generally involve a voluntary transaction between a "buyer" and a "provider" who effectively controls or manages the provision of an ecosystem service or a land use to secure its integrity.	Agri-environment schemes as part of the CAP fund biodiversity and rural green infrastructure programmes	Advantages <ul style="list-style-type: none">• Encourages businesses to build and maintain green infrastructure Disadvantages <ul style="list-style-type: none">• PES schemes are not currently available for urban green infrastructure projects. Local authorities could establish such schemes but would have to find the money to finance them.
Community Currencies These are a form of paper scrip issued at a local level, such as a town or community for use at local participating businesses. The objective of community currencies is to encourage spending at small, local businesses in order to maintain diversity and distinctiveness.	There are many successful examples of community currency programmes across Europe.	Advantages <ul style="list-style-type: none">• Encourages community engagement• Administration of community currencies has been simplified with the advent of "blockchain" technology. Disadvantages <ul style="list-style-type: none">• The success of any scheme would be reliant on the involvement of local businesses
Timebanks These are a means of exchange used to organise people and organisations around a purpose, where time is the principal currency.	Timebanks have been successfully operating at a local level across Europe for decades.	Advantages <ul style="list-style-type: none">• Encourages community engagement Disadvantages <ul style="list-style-type: none">• Unskilled volunteers require close supervision and public liability insurance.
Technology Testing This could provide a means to manage on-going maintenance costs for green infrastructure	There are many examples of commercial field trials of green technology.	Advantages <ul style="list-style-type: none">• Engagement with SMEs and academic institutions• Encourages development of green economy Disadvantages <ul style="list-style-type: none">• Field trials must be carefully managed, with consideration given to what happens to plant and equipment once a trial ends.



Analysis

Quotas, Permits, and Trading Schemes

Regulators already use systems of quotas and permits to manage the exploitation of public goods. Water abstraction, fishing and logging rights are all examples of this type of regulated activity. However, although the levels for abstraction or catches are, in the main, set in the light of scientific advice, the holder of a license is incentivised to exploit the resource to the maximum that a permit allows.

Establishing a market to trade surpluses, would incentivise permit holders to reduce over-exploitation as unused capacity still holds value to them. This type of market could be applied to green infrastructure though existing markets in voluntary carbon offsetting, or through the creation of licenses for the right to discharge to surface water drainage.

Land Value Taxation

Land Value Taxation (LVT) is a method of raising public revenue by means of an annual charge on the rental value of land. In this context 'land' means the site alone, not counting buildings or improvements. LVT is favoured by economists because there can be no supply response - the quantity of land remains unchanged, and if the market for land is efficient, no transactions would be deterred or encouraged. LVT would create enormous incentives for the sustainable use of land. In particular, an LVT would incentivise local authorities to invest in green infrastructure programmes, as the resulting increase in land values adjacent to the green infrastructure schemes would result in enhanced revenue from LVT.

In theory, LVT would also be a very efficient source of public revenue, as all land would make a full contribution to the Exchequer, allowing reductions in existing taxes on labour and enterprise. Furthermore, it would reduce avoidance and evasion as land cannot be hidden, removed to a tax haven or concealed in an electronic data system.

LVT would also encourage economic growth as it would deter speculative landholding thus encouraging landowners to develop vacant and under-used land properly or sell it. However, any LVT would have to be designed to reflect the conservation or environmental services value (e.g. flood prevention) use of undeveloped land.

To date, no nation has imposed a pure LVT (though some split LVTs have been used for municipal taxes). The biggest barrier to their adoption is political, as LVTs would impose costs on landowners, traditionally the wealthiest and most powerful citizens, who would lobby strenuously against their adoption. Most initiatives have been turned down as theoretically desirable, but having high practical challenges in setting initial valuations³⁵, moving the tax burden initially from occupiers to landowners, and the likely disruption in transition.

35. Wang D, Potoglou S and YiGong G 2015 Bus Stop,Property Price And Land Value Tax:A Multi-Level Hedonic Analysis With Quantile Calibration Land Use Policy 42 (2015) 381–391 <https://www.sciencedirect.com/science/arti>



Pigouvean Taxes

Pigouvean Taxes are named after economist Arthur C Pigou. They are taxes levied on any market activity that generates negative externalities (costs not internalized in the market price). Pigouvean taxes are intended to correct an inefficient market outcome by being set equal to the social cost of the negative externalities. Real-world examples of Pigouvean Taxes include tobacco, landfill and carbon taxes.

Pigouvean tax incentives, such as reducing land tax and capital gains tax or deductions on business rates or property tax, would provide a powerful incentive for developers and businesses to develop green infrastructure finance.

In the UK the Community Infrastructure Levy (CIL) is a planning charge, introduced by the Planning Act 2008 as a tool for local authorities in England and Wales to help deliver infrastructure to support the development of their area. However the CIL is a one-off levy on new development, and is not suitable for infrastructure funding and significant changes to these types of tax are not in the gift of local authorities and would require central government intervention.

Insurance, Pooling & Tail Risk

An often overlooked component of finance is insurance. Government entities have a large role as risk-takers and risk makers. Risk-takers in the sense that projects can often be enhanced if government accepts risks on behalf of the community, e.g. environmental clean-up costs or providing infrastructure such as a motorway exit. Risk makers in the sense that government uncertainty can destroy projects, e.g. late or failed planning applications, or opportunistic tax changes (think hotel taxes).

Insurance can play a part in both pooling risks across multiple parties, and in removing 'tail risk', i.e. some of the extreme liabilities. Further, government guarantees form a type of insurance or performance bond. Three examples include:

Infrastructure projects Contractors' Pollution Liability (generally known as "CPL" cover or Project Pollution Liability) is a specialist form of pollution liability insurance designed specifically to provide cover for liabilities arising from project pollution risks, whether associated with a construction or remediation project, or a contract to provide outsourced services to an employer (e.g. under a PFI/PPP contract). Such contracts and projects can give rise to differing environmental risk concerns. There are potential liabilities for statutory or third party clean-up or third party property damage and bodily injury. Some contracts will mainly be concerned with the risk of introducing new pollution (e.g. a leaking mobile fuel tank or the operation of facilities which use or process hazardous substances), whilst other projects will primarily be concerned with the mobilisation or exacerbation of pre-existing contamination (e.g. brownfield land redevelopment projects or remediation contracts). Cover can be extended to include first-party business interruption risks such as the financial consequences of delayed start-ups in construction projects.

Certa was a 1997 initiative, later taken over by Allianz. It closed nearly 200 deals, about 70% with private developers with policies for the redevelopment of closed landfill sites; for major utilities' portfolios, national housebuilders, local authorities and registered social landlords; for private finance initiative projects; and for the remediation and development of former power stations, gasworks and Ministry of Defence sites. Certa gave cover before and during remediation and for remediation schedule overruns. It also provided long-term cover (up to 25 years) for on-site and off-site risks; legal and regulatory cover; cover for migration of contaminants, and lending institutions' risks. The key innovation was to make available the ability to purchase an option to buy insurance (normally at a small percentage of the premium). This option was transferrable. The owner of a site could purchase the option, which capped the clean-up cost liability. On sale, the option could be exercised by the new owner. In any case, the old owner was the one who capped things, allowing sales negotiations to proceed much more smoothly with a fixed figure for clean-up.

The Housing Association Property Mutual (HAPM) was established in 1990 by 47 housing associations. Membership today includes hundreds of housing associations out of the nearly 2,000 in the UK. Membership is open to all not-for-profit social landlords. HAPM is run as a not-for-profit mutual insurance Club. HAPM emerged as a response to the Housing Act 1988, which placed increased financial risk on housing associations for the long-term nature of their housing stock. HAPM provides 20 and 35 year insurance policies for housing associations and other registered social landlords. The risks protected include building defects (structural and non-structural), demolition, debris removal, contractor insolvency, loss of rent, rehousing costs, legal and technical fees. The objective of HAPM is to provide positive claims handling, i.e. not seek to avoid or delay claims. There is a tremendous amount of risk management work, ranging from specialist design audits and site inspections through defect avoidance manuals, component life manuals, maintenance indicators and summary scheme reports (benchmarking on quality of design and workmanship).

These instruments could be mandated through planning conditions for new large-scale developments, as a means of countering a wide range of negative externalities, including increase flood risk and urban heat island effect. Should a developer fail to incorporate green infrastructure in their scheme, or should the green infrastructure fail to deliver the intended benefits, insurance would cover the costs of remediation. This would not only incentivise developers to create green infrastructure, but would underwrite any risks they took with innovative design or technology.

Payment For Ecosystem Services (PES)

Payments for ecosystem services (PES) represent a promising economic tool to manage green infrastructure. PES schemes generally involve a voluntary transaction between a "buyer" and a "provider" who effectively controls or manages the provision of an ecosystem service or land use to secure its integrity.



Existing PES schemes are either regulated (e.g. biodiversity offsetting or planning gain), private (i.e. when a business negatively impacts on ecosystems services delivery and voluntarily pays other businesses for their provision) or mediated (i.e. where a public agency or NGO coordinates PES payments), and currently concentrate on carbon sequestration, watershed management and biodiversity conservation.

A good example of a PES scheme are the Agri-environment schemes (AES) which form part of the EU's common agricultural policy. The extension of existing subsidy schemes to urban green infrastructure projects would provide new funding streams for the management and maintenance of green infrastructure.

Community Currencies

Community currencies are a form of scrip issued at a local level, such as a town or community for use at local participating businesses. They differ from "Time Banks" (see next section) in their involvement of local businesses. The objective of community currencies is to encourage spending at small, local businesses in order to maintain diversity and distinctiveness. Residents or visitors can exchange fiat currency for community currencies at local shops or public buildings, usually at a discount to encourage their use. Community currencies have a long history, e.g. Ithaca dollars in the US.

In recent decades new types of money have proliferated in small-scale community-based networks issuing their own forms of credit. In the UK, these networks can easily trace antecedents back to at least the 15th century, though equally things such as the 'Brixton pound' arose in the 1980s, and again in 2010. In some countries the modern equivalents are networks perhaps poised to grow substantially (Lietaer et al, 2010: 101), such as Germany's 'Chiemgauer' (Palmer and Colinson, 2011) founded in 2003 with 3,000 businesses in the network. These modern networks facilitate the exchange of skills, time or goods and services as well as credit among individuals, families, SMEs and local government agencies, in some instances with support or recognition from national governments³⁶. Their multiple forms include mutual aid networks, time banks and local trade exchanges such as the British Local Exchange Trading Systems (LETS – see appendix 17); the French SEL (système d'échange local)³⁷ (which work similarly to the LETS); the Argentinean Global Trading Network of 'barter clubs'³⁸; and Ithaca Hours³⁹ in New York. While differing in certain aspects, most of these social currencies share common features: they tend to be interest-free; they are issued by non-state, not-for-profit actors; and are based on trust among participants with strong community ties.

36. For example, the Argentinian government has recognised the value of, and supports the promotion of "multireciprocal exchange of goods and services" throughout the country. See Thomas Greco, "The Development of Moneyless Exchange in Latin America", in Globalisation, Money and Trade Workshop, 2001, 21.

37. See for example <http://selidaire.org/spip/>

38. For more information, see <http://trueque.org.ar/>

39. For more information, see <http://www.ithacahours.org/>

Social currencies - usually in the form of credits - are issued independently of central banks and for exclusive use within the defined community scheme thus aiming to contribute to socio-economic development between members at a local level (Powell, 2002: 2). Perhaps the most enduring of all is the Swiss WIR (see Box 1).

Box 1 | WIR Bank and the WIR Multilateral Exchange

WIR is a cooperative bank facilitating multilateral trading between, and extending credit to, member SMEs. It has been operating for over 75 years and is based in Switzerland. Founded by 16 entrepreneurs in 1934, the WIR Wirtschaftsring-Genossenschaft (economic circle cooperative) was set up in response to the Great Depression. It was intended to stimulate trade and create purchasing power between participants, in order to stimulate local economic growth and employment.

Since its inception, the WIR economic circle has undergone a number of reforms and changes and now resembles a commercial bank driven by cooperative interests⁴⁰ (favouring SMEs and local/national economic growth and with strong economic foundations). For example, it went from issuing interest-free credit to providing credit lines at advantageous rates (approximately 1.75% for members); and from charging a "demurrage" (or penalty) fee to members holding on to their WIR francs (CHW) to simply not paying interest rates on CHW deposits, in order to encourage money circulation. The organisation has also expanded the range of banking services to include Swiss franc-based services rather than WIR francs alone; and opened to the public in 2000.

WIR Bank performs different and complementary functions. First, it acts as a "central bank" issuing its own currency – the WIR franc (CHW), which is pegged to the Swiss franc (CHF) and released to members through loans and mortgages backed by collateral. The WIR franc comes into being on the strength of the contract with the borrower plus the willingness of a community to accept the money as a payment for goods and services, rather than through state/central bank authorisation⁴¹. The bank regulates the amount of WIR francs in circulation - WIR francs accounted for 0.2 % of CHF M1 in 2009⁴²; it also defines the rules of participation and the usage of WIR credits - e.g. WIR credit cannot be redeemed for Swiss francs; and sanctions members for illegal behaviour through exclusion - e.g. such as discounted market trading of WIR francs for Swiss francs.

Second, it acts as a "commercial bank" subject to relevant banking regulations in Switzerland since 1936 when it was first given the status of a bank. In this capacity, WIR bank provides a range of banking products (including business loans and mortgages) to its clients in Swiss francs, WIR credits or a combination of both. Since every WIR credit is matched by an equal and opposite debit, the system as a whole must net to zero.

Third, WIR bank acts as a "trade facilitator" by providing the WIR platform or system through which WIR members can exchange goods and services with each other using the WIR franc as a partial or full means of payment. In this context, WIR bank also provides a range of marketing and communication services and advisory services to members to enable them to trade within the system. The WIR system is also supported by independent local members' groups (e.g. Groupement WIR Suisse Romande) that act as local networking and discussion forums throughout Switzerland.

Naturally, given the explosion of other online and cryptocurrencies, there are several examples of Smart Ledger applications used in conjunction with community currencies.

40. Mainelli M, Rochford & S Von Gunten C 2011 Capacity Trade and Credit: Emerging Architectures for Commerce and Money https://www.longfinance.net/media/documents/Capacity_Trade_and_Credit_Full_Report_Web.pdf

41. Wüthrich, W. 2004 Cooperative Principles and Complementary Currency'. Current Issues (Zeit-Fragen). Article 1: Topical Questions # 30. Translated by Philip Beard (Sonoma State University).

42. In 2009, CHW 876.3 million were in circulation (WIR Bank, 2010). For the same year, the Swiss Central Bank reported M1 amounting to CHF 377,199 million in 2009.



These include:

- HullCoin⁴³ which resulted from a piece of research undertaken by Hull City Council. Hull coin is a cryptocurrency that can be used to pay for services that benefit the common good. The aim of the project is to reduce poverty, and ensure that resources go where they are best needed. HullCoin can be secured by individuals undertaking activities, such as litter picking, that are sanctioned through organisations on the app, and this information is stored and can be exchanged for goods at participating retailers or for council services such as sports centres.
- InvolveMINT⁴⁴ a currency operating in Pittsburgh. Similarly to HullCoin, InvolveMINT allows its users to find volunteer opportunities and projects they can give their time to in order to earn cryptocurrency. The app is used to track skills and time. The cryptocurrency can then be redeemed with a range of different partners that InvolveMINT has signed up.

Community currencies could be used to engage local communities and businesses to engage with the on-going maintenance of green infrastructure. For example, local businesses who benefit from proximity to green infrastructure could offer discounts and part payment in community currency to individuals and organisations, who could earn community currency by taking an active part in the maintenance of the infrastructure. In turn, these businesses could exchange the local currency for goods or services provided by other participating firms, or the local authority. However, the local currency cannot be used to pay debts incurred in fiat currency such as business rates, VAT or other non-local taxes. The administration of community currency schemes has been greatly simplified by advances in technology associated with “blockchain” and crypto-currencies⁴⁵.

Timebanks

Timebanks are “a means of exchange used to organise people and organisations around a purpose, where time is the principal currency⁴⁶”. In other words, for each hour a participants ‘deposits’, by giving a timebank member a service, such as gardening, tuition, repairs or maintenance, they can ‘withdraw’ the same amount of time from the same, or a different timebank member when they need it. The basic currency of a timebank is time and all time is counted equally- so an hour of French lessons is worth the same as an hour of decorating. Timebanks can be person to person, or agency to agency, for example exchanging use of a minibus or sports hall, with graphic design or accountancy advice.

A number of initiatives have been launched which aim to scale up the timebank concept and move it from a community-based activity to one with international reach.

- TimeRepublik⁴⁷ is an international online timebanking marketplace. Currently operating out of New York, Italy, Switzerland, Brazil, Spain, France, Germany, Denmark, Russia, and The Netherlands. TimeRepublik is a peer-to-peer platform with over 100,000 talents shared in more than 110 countries around the world. The company white labels the platform and licenses it to large corporations, municipalities, universities, and nonprofits who wish to improve collaboration, engagement, and their Corporate Social Responsibility profile.
- Seva Exchange⁴⁸ is a US-based initiative which is applying Artificial Intelligence to matching volunteers’ skill sets with recipients’ needs. The platform has ambitions to use exchangeable hours as an international alternative currency.

Local authorities could use time banks to encourage individual volunteers and voluntary groups to become involved in the maintenance of green infrastructure. Volunteers could exchange the time earned for council services i.e. an hour on maintenance for an hour in the municipal sports facility, or an hour of potter classes in the local higher education college.

Technology Testing

If green infrastructure is designed to incorporate technology field trial facilities, local authorities could derive a contribution towards maintenance. The integration of field trial facilities requires active, long-term, partnership with technology firms, academic or governmental institutions, however, it can yield significant returns.

There are many examples of this type of partnership focussing on traffic management⁴⁹, crime reduction⁵⁰ and energy reduction⁵¹. However, the long term maintenance of this type of programme requires considerable thought and significant skill. Thought must be given not only to the duration of the field-trial, but to succession planning – what happens when the trial ends, who owns the equipment and is responsible for its maintenance or removal, and what are the implications to the utility of the green infrastructure if a key component is not replaced? The development of long-term relationships with agencies or academic institutions is a critical factor in the success of this approach.

43. Hull Coin Homepage Accessed 10/09/2019 <http://www.hull-coin.org/>

44. InvolveMint Homepage Accessed 10/09/2019 <https://www.involveMint.io/>

45. O’Neill S 2018 The Saber Case: How Complementary Currencies Can Go Crypto And Change The World <https://coin-telegraph.com/news/the-saber-case-how-complementary-currencies-can-go-crypto-and-change-the-world>

46. Timebanking.org Homepage Accessed 11/09/2019 [https://www.timebanking.org/what-is-timebanking/](https://www.timebanking.org/what-is-timebanking/what-is-timebanking/)

47. Time Republik Homepage Accessed 11/09/2019 <https://timerepublik.com/>

48. Seva Exchange Homepage Accessed 11/09/2019 <https://www.sevaexchange.com/>

49. Van Lint H 2014 Traffic Monitoring For Coordinated Traffic Management - Experiences From The Field Trial Integrated Traffic Management In Amsterdam 17th International Conference on Intelligent Transportation Systems https://www.researchgate.net/publication/286646530_Traffic_monitoring_for_coordinated_traffic_management_-_Experiences_from_the_field_trial_integrated_traffic_management_in_Amsterdam

50. World Economic Forum 2018 How Smart Tech Helps Cities Fight Terrorism And Crime <https://www.weforum.org/agenda/2018/06/cities-crime-data-agile-security-robert-muggah/>

51. Energy Saving Trust 2011 Lit Up: An LED Lighting Field Trial <https://www.energysavingtrust.org.uk/sites/default/files/reports/LitupanLEDlightingfieldtrial.pdf>

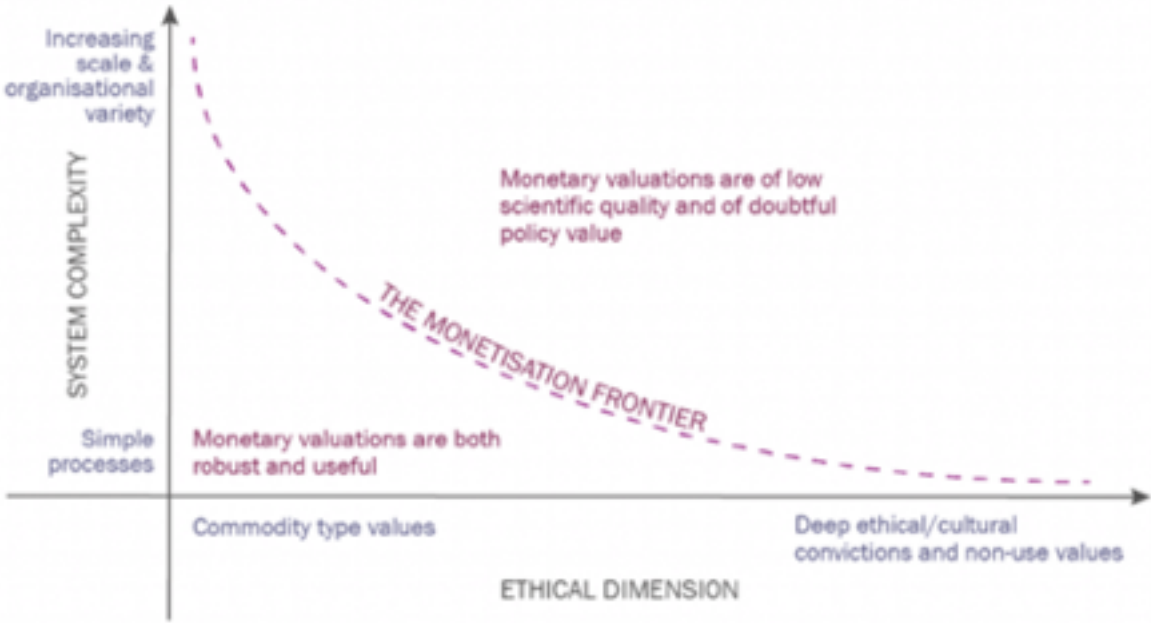
Creating an Environment for Success

Capturing Value

The most significant challenge facing local authorities seeking investment in green infrastructure comes from difficulties in creating and capturing value streams from projects. In their paper⁵² ‘The AICCAN*, the geGDP**, And The Frontier of Monetisation’, Martin O’Connor and Anton Steurer highlight the difficulty of translating a value concept into numbers.

The “monetisation frontier” is a conceptual approach to categorising the threshold at which a matter crosses from being a policy issue to being a priced one (and vice versa)⁵³. The monetisation frontier addresses this by considering two dimensions which are fundamental to the point and purpose of trying to translate outcomes into monetary terms:

Figure 6: The Monetisation Frontier



Source: Von Neuman 2019

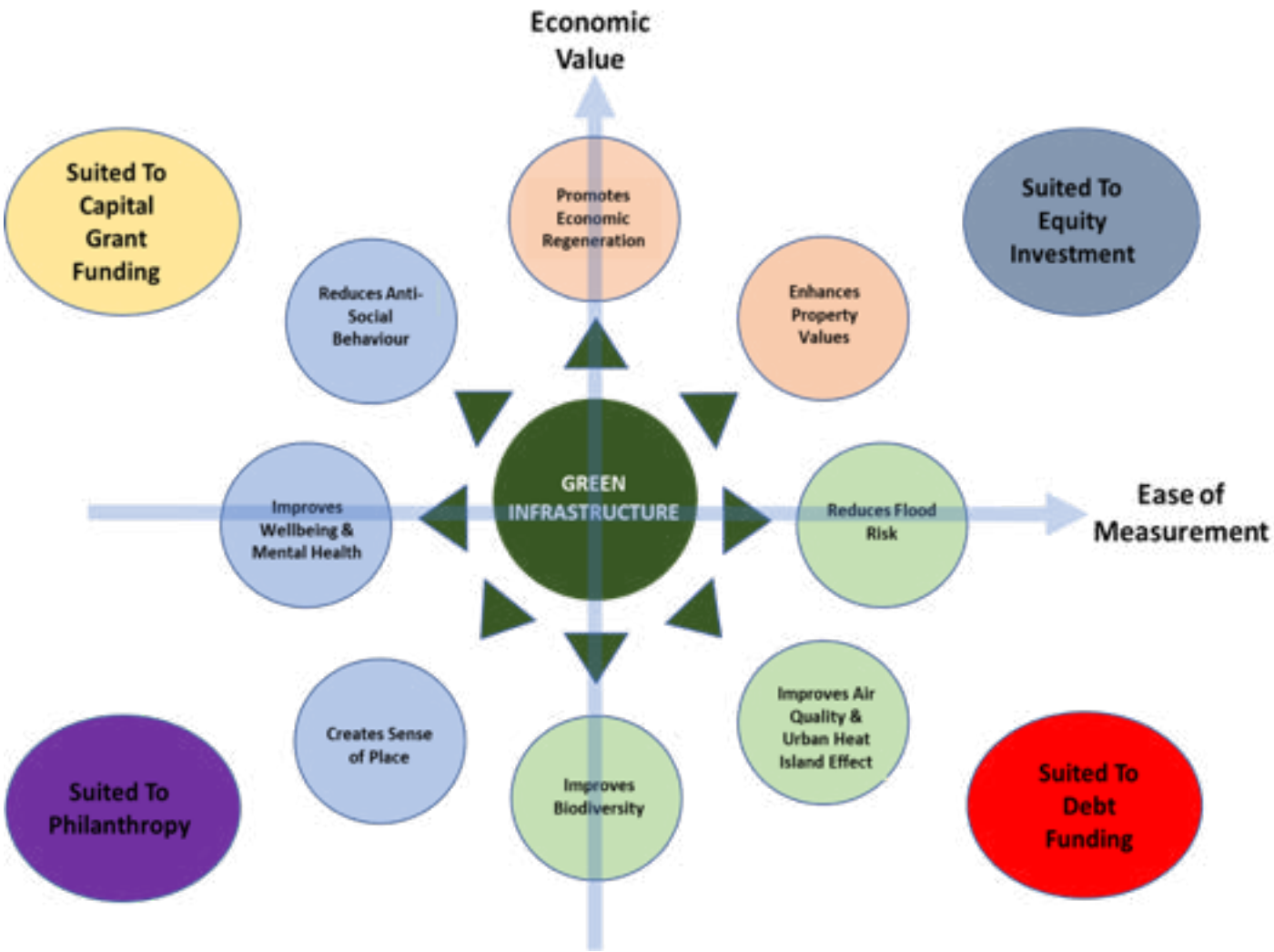
In short, the more complex a natural system is, and the higher its ethical and well being value, the less use monetary valuations are and the higher the need for policy intervention.

52. O’Connor M & Steurer The AICCAN, the geGDP, And The Frontier of Monetisation International Journal of Sustainable Development (IJSD), Vol. 9, No. 1, 2006 https://www.researchgate.net/publication/5172756_The_AICCAN_the_geGDP_and_the_Monetisation_Frontier_A_typology_of_‘environmentally_adjusted’_national_sustainability_indicators
*Aggregate Indicator of the Change, during the Current year, in the economic Assets of the Nation
** greened economy GDP
53. von Neumann J 2019 To Boldly Go...Exploring The Monetisation Frontier <https://www.terrafiniti.com/to-boldly-go-exploring-the-monetisation-frontier/>

This has real-world application to the planning of green infrastructure programmes. Figure 7, below illustrates the benefits that flow from green infrastructure projects. The vertical axis shows increasing economic value, the horizontal axis demonstrates the ease with which the impact and outputs can be measured.

Green infrastructure projects produce multiple benefits, however those located in the top right quadrant of Figure 7 are likely to be more attractive to equity investment as the economic value is easier to capture, and measurement and monitoring is relatively straight forward. Those in the bottom right are good candidates for debt finance. Those on the top left are good candidates for grant finance, and those on the bottom left are more likely to attract philanthropic funding.

Figure 7: Sources of Financing For Green Infrastructure





Measurement And Reporting

Adrian Henriques’ 2015 ICAEW paper⁵⁴ on quantifying natural and social capital describes three approaches to accounting for natural capital: Narrative, Quantitative and Monetised. He argues that the essence of natural capital, a public good which is inherently difficult to account for, requires a balanced approach to reporting and makes the following recommendations:

Balance

- 1. Ensure that a strong narrative account of social capital or natural capital accompanies attempts at quantification.
- 2. Support monetisation with the use of wider, non-monetised metrics.

Participation

- 3. Include the people and communities affected by quantification, and especially monetisation, in discussion of the overall aims of the quantification and in the development of the chosen metrics.
- 4. Consider all elements of the social or natural system in the choice of the proxies to be used as metrics.

Relevance

- 5. Use monetised methods only in relation to existing, well-functioning markets.
- 6. Ensure that indicators of outputs and of the resulting outcomes are used appropriately.
- 7. Use perceptual measures only where it can be independently shown that they are closely related to the capital under study.

Transparency

- 8. Describe the rationale and methodology for the choice of metrics used.
- 9. Disclose the known elements of the social or natural capital systems that are not reflected in the metric chosen.
- 10. Where these guidelines have not been followed, the quantified or monetised findings should be presented as indicative only and the associated level of uncertainty deriving from data limitations, methodology or other sources, declared.

Incorporating these recommendations into project design at the earliest phases of planning will enable the most effective financing and funding paths to be identified.

Market Failures

In February 2016 the United Nations Environment Programme published a report on the design of a sustainable financial system which “serves the long term needs of a healthy real economy, an economy that provides decent, productive and rewarding livelihoods for all, and ensures that the

natural environment on which we all depend remains intact and so able to support the needs of this and future generations.”⁵⁵ The report identified a number of criteria that identify whether a financial system is contributing to sustainable development these include :

- the encouragement of long-term investment;
- reflection of pricing signals and risk;
- the encouragement of development and growth;

Using these criteria as a yardstick, the following observations can be made:

- financial systems are failing to encourage long-term investment. Despite negative interest rates in most OECD countries, there a significant gap in infrastructure finance⁵⁶. While Gross Domestic Fixed Capital Formation (GDFCF) fell as a proportion of GDP fell between 2007 to 2012 across the G7 economies⁵⁷.
- financial systems are failing to effectively reflect pricing signals and risk – financial systems do not routinely take account of environmental costs or environmental limits. Four out of nine “planetary boundaries” have been crossed: climate change, loss of biosphere integrity, land-system change, and altered biogeochemical cycles⁵⁸.
- Financial systems are failing to encourage development and growth – there is a funding gap of approximately £22bn for SMEs in the UK alone⁵⁹.

The root cause of this failure is linked to short-term horizons for risk and reward, and a failure to deal effectively with externalities. These challenges, as pointed out in Mainelli and Gifford’s 2009 paper “The Road To Long Finance: A Systems View of the Credit Scrunch”⁶⁰, already pose significant risks to the global financial system, and, according to many commentators⁶¹, have not been addressed effectively in the decade since the financial crisis occurred.

54. Henriques A 2015 Quantifying Natural And Social Capital: Guidelines On Valuing The Invaluable https://www.icaew.com/~media/corporate/files/technical/sustainability/web_quantifying_nature.ashx

55. UNEP 2016- Imagining a Sustainable Financial System http://unepinquiry.org/wpcontent/uploads/2016/02/Imagining_a_Sustainable_Financial_System.pdf
56. World Economic Forum 2014- Strategic Infrastructure Steps to Operate and Maintain Infrastructure Efficiently and Effectively http://www3.weforum.org/docs/WEF_IU_StrategicInfrastructureSteps_Report_2014.pdf
57. C Driver & Paul Temple 2013- Capital Investment: what are the main long term trends in relation to UK manufacturing businesses, and how do these compare internationally? https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283884/ep8-capital-investment-trends-ukmanufacturing.pdf
58. W Steffan 2015- Planetary Boundaries - an update <http://www.stockholmresilience.org/21/research/research-news/201501-15-planetary-boundaries---an-update.html>
59. Bank Of England 2019 An Open Platform For SME Finance <https://www.bankofengland.co.uk/-/media/boe/files/research/an-open-platform-for-sme-finance>
60. Mainelli M & Gifford B 2010 The Road to Long Finance: A Systems View of the Credit Scrunch https://www.zyen.com/media/documents/Road_to_Long_Finance.pdf
61. IMF 2018 A Decade after the Global Financial Crisis: Are We Safer? <https://www.imf.org/en/Publications/GFSR/Issues/2018/09/25/Global-Financial-Stability-Report-October-2018>



There is an urgent need to assess risks at the macro-economic level. Central banks and supervisory authorities are responsible for mapping these risks, modelling their interactions with economic and financial systems, and taking steps to mitigate them.

Private financial institutions are driven by a simple ‘risk/return’ ratio, and shifting capital involves changing this ratio. There is, therefore, a need, first, to enhance the financial sector’s understanding of benefits of green infrastructure and to amend the return expected from activities they invest in by showing the hidden costs of economic activities and internalizing these negative externalities in production costs. If investing in environmentally harmful activities leads to lower returns and more risk than sustainable activity, financial institutions will automatically shift their investment.

But the players in the financial system find it difficult to see, think and act long term, when structural characteristics incentivise short-term returns. As private finance is currently ill-suited to green infrastructure investment, there is a need to address this issue at three levels:

- Firstly, to address market failures at a macro-economic level by extending time horizons and internalising externalities. As Mainelli and Gifford⁶¹ state, “Wicked problems cannot be solved by larger government intervention, but equally, we cannot just sit back and wait for the free market to save the day. What may be needed is bolder, yet more pointed, government intervention.”
- Secondly, finance from ‘mission-oriented’ financial institutions must be unlocked: that is, financial institutions which do not follow a logic only of profit, but also answer to a public interest mission (public and development banks), or to social and environmental criteria (ethical banks and impact investors).
- Finally, the value of green infrastructure must be recognised through the development of mainstream financial products such as loans, bonds or equities (see table 1), which derive income streams from the value streams generated by green infrastructure.

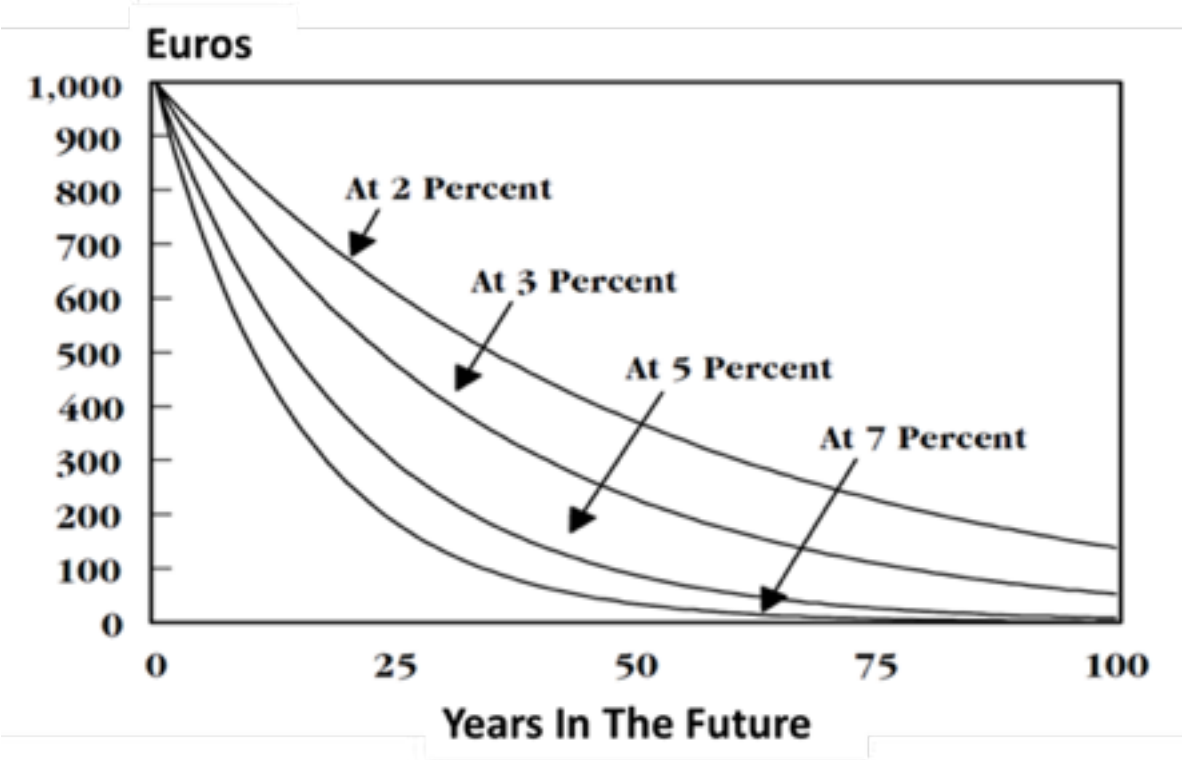
Discounting

The discounting of assets (see figure 8), is yet another hurdle which must be overcome in the creation of an investment case for green infrastructure. Discounting is an important accountancy tool which underscores the basic human preference for having something now compared to later and allows for the present value of future returns to be contrasted with the up-front investment costs.

Discounting is used to ask two main questions:

- What is the value of doing this now as compared to later? And
- Which of the options on the table provides the best return over time?

Figure 8: Curves representing constant discount rates of 2%, 3%, 5%, and 7%



Different governments apply differing discount rates for infrastructure investment (see table 3). The UK treasury Social Time Preference Rate (STPR), for use in UK government appraisal is set at 3.5% in real terms⁶³. Even 3.5% may be too high, given the historic low interest rates set by central banks⁶⁴.

61. Mainelli M & Gifford B 2010 The Road to Long Finance: A Systems View of the Credit Scrunch https://www.zyen.com/media/documents/Road_to_Long_Finance.pdf

63. HMT 2003 Further Supplementary Memorandum Submitted By HM Treasury <https://publications.parliament.uk/pa/cm200203/cmselect/cmpubacc/155/2120414.htm>

64. Freeman M, Groom B & Spackman M 2018 Social Discount Rates for Cost-Benefit Analysis: A Report for HM Treasury https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685904/Social_Discount_Rates_for_Cost-Benefit_Analysis_A_Report_for_HM_Treasury.pdf

Table 4: International Discount Rates

Country	Discount Rate
Australia	Recommendations vary by agency and state
Canada	* 8%
Denmark	* 4% for years 0-35 * 3% for years 36-70 * 2% for years 71+
France	* 4% for projects 0-30 years * 2% for years 31+
Germany	* 3%
Japan	* 4%
The Netherlands	* 5.5%
Norway	* 4% for years 0-40 * 3% for years 40-75 * 2% for years 75+
Sweden	Recommendations vary by agency
United States	* 7% for projects whose main effect is to displace private capital * 3% for projects whose main effect is to displace private consumption * Sensitivity testing at 1-3% encouraged for projects which have a significant intergenerational impact
United Kingdom	* 3.5% for years 0-30 * 3% for years 31-75 * Reducing to 1% over years 75-300+

There may be a case to apply different discount rates for green infrastructure as opposed to “grey infrastructure” (such as roads, standard flood defences and public buildings). The main differences between green infrastructure and conventional infrastructure are:

- The high proportion of intrinsic value to total value.
- A large contribution to social and environmental values rather than conventional economic values.
- The relatively low substitutability of some assets.
- The biological aspect of growing assets, goods and services.
- Its long-lived nature and maintenance of value over long time periods.

As Jeffery Sachs points out we are subject to the “tyranny of the present over the future”, particularly when the rate of interest diminishes the incentive to invest in green infrastructure and natural asset discounts to zero over the span of a few decades.

Technological Solutions

Smart Ledgers are shared databases, built using “blockchain technology” that incorporate features such as smart contracts which allow the automation of transactions when pre-defined conditions are met. Smart Ledgers are attracting attention for a variety of uses as they allow organisations to work together without giving central third parties a strong natural monopoly⁶⁵.

Although a great deal of hyperbole has been created around cryptocurrencies and the possibility of “tokenizing” urban assets⁶⁶ as a way of attracting and amalgamating investment into infrastructure, a more realistic prospect lies in the ability of Smart Ledgers to connect to the “internet of things” and incorporate features such as “smart contracts” and “artificial intelligence”.

Smart Contracts are “the implementation of contract terms as executable computer code”⁶⁷. A simple example of a smart contract is a weather derivative contract which pays \$50,000 on every day in July when the temperature recorded by a given field on the Met Office website is above 33 °C (see figure 9).

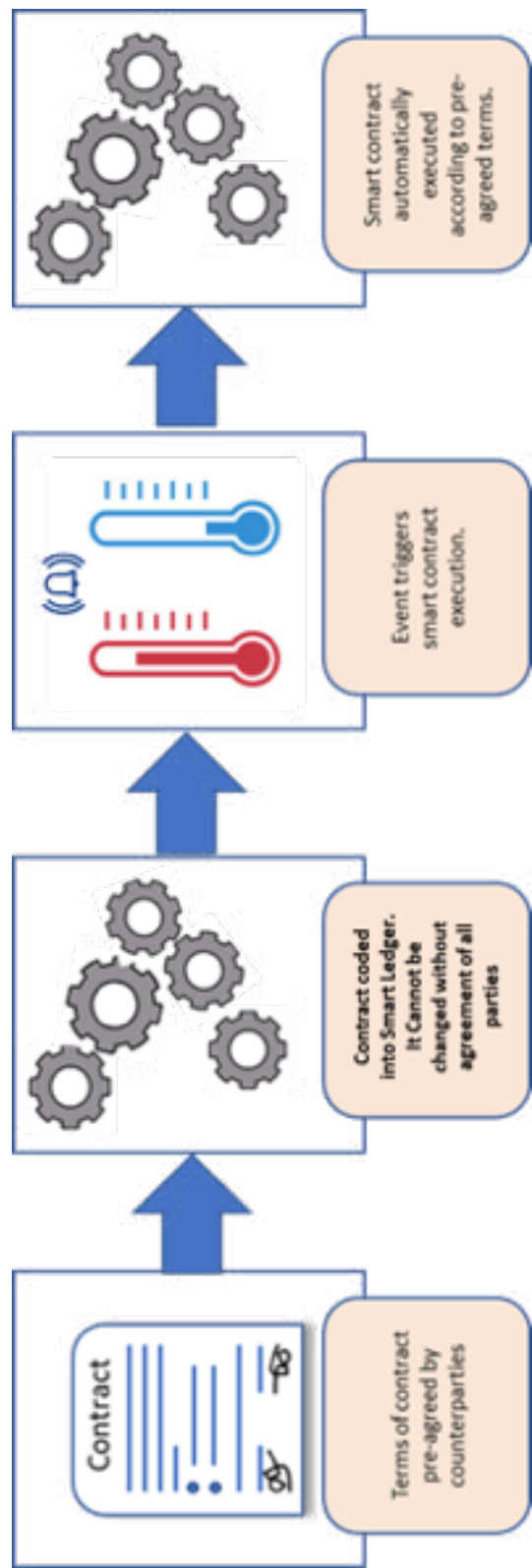
Smart ledgers could be used in conjunction with internet enabled sensors to reduce the costs of monitoring of green infrastructure, and potentially support risk management vehicles designed to underwrite its performance.

They could form the backbone of smart city networks, alerting citizens to risks and opportunities, creating new services and opportunities for entrepreneurs.

65. Mainelli M 2018 It's Never Gonna be Like it Was: Smart Ledger Futures for IFCs IFC Economic Report • Summer/Autumn 2018 https://www.zyen.com/media/documents/IFC_Economic_Report_summer_2018.pdf
66. Blue Whale Global 2019 Can Blockchain Lead The Way On A Smart City Transformation? <https://medium.com/blue-whale-foundation/can-blockchain-lead-the-way-on-a-smart-city-transformation-3-3-8889e3e34867>
67. Mills S & McDowell B. 2017 Responsibility Without Power The Governance Of Mutual Distributed Ledgers (aka Blockchain) https://www.longfinance.net/media/documents/Responsibility_Without_Power.pdf



Figure 9: A Smart Contract



Conclusions

This report has investigated different types of instruments for funding and finance. Each contains different advantages and disadvantages which would affect the implementation of green infrastructure by Local Authorities. These need to be considered carefully and will affect how and where they are appropriate. The cheapest option for the financing of green infrastructure will always be public sector grants however, as the funding of a green infrastructure programme solely using public sector funds may be challenging in the current economic climate, Local Authorities may wish to supplement available funds with private sector investment. The blend of products used to do this is, ultimately, as much a political as an economic decision. Equity schemes, cede control of public assets to private hands, bonds and loans extend debt across multiple electoral cycles and taxes and trading schemes may be controversial.

The provision of green infrastructure cuts to the heart of fundamental questions about the role of local authorities. In addition to providing the most immediate interface between a government and its citizens, ultimately a local authority epitomises Locke’s⁶⁸ view of a commonwealth, a body politic founded on law for the common “weal,” or good.

Adam Smith argued that governments should be tasked with three main roles; to supply a military to defend against external invasion, to maintain an impartial legal and judicial system and lastly is that of “erecting or maintaining those public institutions and those public works, which, although they may be in the highest degree advantageous to a great society, are, however, of such a nature, that the profit could not repay the expense to any individual or small number of individuals, and which it therefore cannot be expected that any individual or small number of individuals should erect or maintain.”⁶⁹

Markets can be extremely effective mechanisms for providing the goods and services which society needs and for enhancing wellbeing. However, they are much less effective at dealing with public goods, such as flood prevention, climate change or the preservation biodiversity, where uncoordinated exchange can leave everyone worse off than they were in the first place.

Goods are public if they exhibit nonrivalry and nonexcludability, and of these two, nonexcludability arguably poses the main greatest challenge for producing public goods privately. You cannot prevent a citizen, or business from enjoying the benefits of clean air, pleasant surroundings, low crime or reduced temperatures, even if they have not directly paid for them. Local authorities are ideally placed to manage this market failure, by acting as the regulator for the provision of public goods and providing a conduit, where appropriate, for private sector finance.

68. Locke J 1690 Second Treatise of Civil Government Chap. VIII. Of The Beginning Of Political Societies.
69. Smith A 1776 The Wealth of Nations Bk 5, ch. 1 Part III <https://eet.pixel-online.org/files/etranslation/original/The%20Wealth%20of%20Nations.pdf>



With respect to finance for green infrastructure projects, political decisions must be made as to whether private sector capital is the most appropriate source of funding. Local authorities are ultimately underwritten by the state and are comparatively low risk investments. Identifying the right product in a crowded marketplace is testing, although recent developments in products and services specifically designed to encourage sustainable outcomes means that project finance for green infrastructure can be gained at very competitive rates.

Project funding is a more challenging proposition, and requires careful thought at the initial design phase of a green infrastructure programme. The key to unlocking value is additionality. A green infrastructure scheme designed solely to reduce flood risk is unlikely to be financially self sustaining due to the difficulty of capturing value. A green infrastructure scheme aimed at reducing flood risk, which is part of an integrated regeneration strategy designed to encourage economic redevelopment, will yield capturable income streams.

Ultimately however, local authorities should not be seeking the implementation of green infrastructure programmes solely as a commercial proposition. They should be implementing green infrastructure because it is proven to enhance the wellbeing of their citizens. Although prudent planning and careful consideration of the design and objectives of green infrastructure schemes can allow the offsetting of some of the costs of maintenance and service delivery.



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Nature Smart Cities across the 2 Seas is an Interreg 2 Seas co-funded project to the value of €6,380,472. It consists of a total of 11 Partners from 4 EU Member States (Belgium, France, the Netherlands and the UK) who are working together to develop a business model that local authorities can utilise to justify the use of ‘city finance’ to fund urban greening programmes.

Southend Borough Council, as Lead Partner of the NSCiti2S project, commissioned this publication as part of the development of the business model and to detail the finance that is already available to city decision-makers.

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