



UNIVERSITY OF LEEDS

Financing infrastructure and built environment adaptation to climate change

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Project partners





Report context

WHAT DOES THIS REPORT AIM TO DO?

This report aims to highlight the principal challenges of financing public sector adaptation projects and identify some actions that government could take to address these challenges and make adaptation project finance easier to access. It is, necessarily, a high-level review of finance mechanisms and their application to adaptation projects and is not an in-depth case study, nor a guide to how to secure finance for adaptation projects.

WHO IS THIS REPORT AIMED AT?

This report is aimed at those in the public sector seeking to secure finance for adaptation projects, to help them predict and respond to the challenges of financing adaptation, and at policy makers, to help them identify what can be done to enable easier access to finance for adaptation projects. It may also be useful for potential adaptation project funders, to help them understand the specific challenges that these projects face and how finance mechanisms may be tailored to be more relevant to adaptation projects. This report was specifically focused on adaptation in Scotland but the majority of the insights and findings are relevant outside the Scottish context.

WHAT DO WE MEAN BY ADAPTATION ACTIONS AND PROJECTS IN RELATION TO INFRASTRUCTURE AND THE BUILT ENVIRONMENT?

Adaptation actions and projects are those which alter planned or existing infrastructure or built environment assets to protect their security and performance from the consequences of future climate change. To take a very simplified illustration of what this means in reality, imagine an area of land next to the coast used both as a business park and as public open space, with a major road running through it. It is possible that in the future this land will be at risk from coastal and surface water flooding as a result of increasing frequency of intense rain and sea level rise, which might make the public space and road unusable. The buildings on site might also be subject to high winds, driving rain and heatwaves which will affect their performance and make them less attractive to potential occupants. Adaptation of this site might include construction of coastal flood defences and improved drainage systems to prevent flooding. It might also include improvement of buildings to increase water-tightness to prevent rain ingress. The effects of heatwaves might be addressed by providing shading and ventilation systems in buildings and shaded areas in the public open space.

WHY ARE ADAPTATION ACTIONS AND PROJECTS HARD TO FINANCE?

Described in its simplest form, project finance requires an initial source of funding to invest in a project, a source of income to repay that funding (either directly using monetary income or indirectly by achieving outcomes, like jobs or economic growth for example, specified by the funder) and a mechanism for calculating and collecting income to enable those repayments. One of the main challenges for adaptation projects is in the repayment of funding. Adaptation projects themselves are unlikely to generate monetary income directly because we don't charge for the services (like flood protection) that they provide, meaning that the direct repayment of funding is difficult. Traditionally, some funders have been willing to invest in projects that deliver indirect economic benefits, such as jobs and economic growth. However, indirect benefits are far more difficult to quantify for adaptation projects because there are no established methods of quantification and because the benefits tend to include environmental and social benefits, as well as economic, and can be less tangible and more long-term.

Executive Summary

THE NEED FOR THIS WORK

Those responsible for infrastructure and the built environment in Scotland must respond to the consequences of a changing climate to protect its security and performance. We call this response climate change adaptation. Adaptation is essential to ensure the resilience of businesses and residents, who rely on infrastructure and the built environment for their health, wellbeing and economic prosperity.

Traditional infrastructure finance mechanisms are becoming constrained and may not be appropriate to support the infrastructure and built environment adaptation actions that are necessary. Alternatives are needed, which are appropriate to the geographic and temporal scale of adaptation projects and which maximise the potential of actions to create local social, environmental and economic value.

This report sets out:

- What alternative finance mechanisms are available to public sector organisations in Scotland for infrastructure and built environment adaptation;
- How the social, environmental and economic contribution of adaptation actions could be maximised through the use of alternative finance mechanisms;
- Where more research is required; and
- Where UK or Scottish Government intervention could remove barriers to accessing alternative finance mechanisms.

KEY FINDINGS

Current finance mechanisms

The predominant finance mechanisms currently available to fund adaptation actions include; government capital grants, user charges, the public works loan board (PWLB), and grant funding. However, accessing these mechanisms is becoming increasingly challenging because:

- Continuing fiscal austerity and the increasing costs of the PWLB are resulting in uncertainty about future funding availability;
- Integration of climate change adaptation into capital grant spending decisions is not uniform and adaptation can get excluded from capital programmes; and
- The focus of existing grant funds, and in particular Scotland's ERDF strategy, is squarely on climate change mitigation. The lack of guidance and support specifically targeting adaptation actions means they are underrepresented amongst grant recipients.

Alternative finance mechanisms

We found many alternative finance mechanisms that are relevant to the scale and outcomes of infrastructure and built environment adaptation actions and that comply with borrowing restrictions placed on the public sector. There are many advantages to alternative mechanisms:

- Many are established and relatively straightforward to set up;
- Some are able to account for multiple outcomes; and
- Many have wider benefits, including increased economic activity, raising awareness in the investor community and engaging people with projects and climate change adaptation more broadly.

However, the public sector faces many challenges during implementation:

- Many mechanisms rely on the monetisation of outcomes (mostly social and environmental but including potential cost savings or cost avoidance), which are hard to articulate and quantify. This presents a particular challenge in climate change adaptation, where outcomes or savings can be uncertain and long-term;
- Few mechanisms have been demonstrated for use in climate change adaptation and there is a lack of guidance and support for their application to adaptation actions;
- Some finance mechanisms face specific legal or policy barriers which prevent their use; and
- Adaptation actions can involve multiple partners with differing motivations and objectives. Negotiations to manage trade-offs and establish a shared programme of work can be time consuming and costly.

Even if a finance mechanism is technically suitable for an action and an organisation, it may not maximise the potential of the project to deliver many of the multiple outcomes possible in adaptation actions. We suggest that appropriate finance mechanisms are those that are not only technically suitable but also enable the delivery of local social, environmental and economic value.

IMPROVING ACCESS TO APPROPRIATE FINANCE MECHANISMS

A summary of the proposed responses to overcome many of the barriers to alternative finance mechanisms is presented below.

Barrier	Responses that could be implemented immediately	Responses that require legislative or policy change
Barriers to specific mechanisms: limits to role of public sector organisations; complexity in setting up nascent mechanisms; lack of focus on adaptation in climate change funding and support.	<ul style="list-style-type: none"> ■ Develop investment readiness tools for adaptation actions. ■ Include adaptation as a core objective in existing funding e.g. Climate Challenge Fund and ERDF. 	<ul style="list-style-type: none"> ■ Give general power of competence to Scottish local authorities. ■ Finance feasibility and pilot work and standard documents for social impact bonds, non-profit distributing models and tax incremental financing.
Barriers to financing multiple outcomes: social and environmental outcomes, which may occur in the long-term, are hard to articulate and harder to quantify so are often excluded from finance mechanisms.	<ul style="list-style-type: none"> ■ Develop methods to quantify social and environmental outcomes to enable projects generating these outcomes to compete effectively with those focussing on short-term economic outcomes. 	<ul style="list-style-type: none"> ■ Adjust project or finance appraisal methods for government supported finance (e.g. capital grants, Scottish Investment Bank) or those supporting access to finance (e.g. Scottish Futures Trust) to account for multiple and long-term outcomes and ensure they are considered equally and throughout the appraisal process.
Barriers to partnership working: balancing motivations, processes and timescales of multiple organisations is time consuming and costly.	<ul style="list-style-type: none"> ■ Provide financial support for partnership building and momentum building. 	<ul style="list-style-type: none"> ■ Ensure capital grants for relevant partners include a specific remit for adaptation.

1 Introduction

This report investigates the challenges and opportunities faced by public sector organisations in Scotland when trying to secure finance for climate change adaptation actions. Actions relating to infrastructure and built environment adaptation are crucial to the implementation of the Scottish Climate Change Adaptation Programme (SCCAP) (Scottish Government 2014a). The SCCAP aims to ensure sustainable economic and social development in Scotland and to protect ecosystems and species. It sets out the policies and proposals necessary to address the impacts identified for Scotland in the UK Climate Change Risk Assessment (Scottish Government 2014a; Defra 2012). Some of these policies and proposals can be addressed by research and provision of information. Many require investment in the natural and built environment, above and beyond planned spending, to increase resilience and adapt to a changing climate. This has potential to contribute to the local economy through avoided social and economic costs of extreme events and through positive social, environmental and economic contribution. Economic contribution may include job creation, economic activity associated with adaptation (such as consultancy, sustainable drainage construction) and other economic activity (Greater London Authority 2015). Social and environmental contributions can include better health, resilience and social relations and increased biodiversity and water quality.

Securing finance that is appropriate to the geographic and temporal scale of adaptation actions and that maximises the potential to create local value presents significant challenges for public sector delivery bodies. Despite the importance of adaptation finance and the high level of interest in this area, there is little research to identify how national-level policy making can alleviate constraints and exploit opportunities. This report investigates how access to appropriate finance could be improved for public sector organisations in Scotland and how the contribution of adaptation to the local economy could be maximised.

Some of the adaptation actions discussed in this report also address adaptation in the natural environment and society but the primary focus is on infrastructure and the built environment. Furthermore, the report focuses on the actions of public sector organisations, regulated utilities, local authorities and communities, hereafter called public sector organisations. We recognise that private organisations have an important role in adaptation of buildings and infrastructure, for example through developer contributions; however this report is focused on the role of the public sector.

The public sector aims to attract private finance and pension funds to invest in infrastructure and the built environment (Subacchi et al. 2014). However, not all adaptation actions are of an appropriate scale for these finance mechanisms and not all can guarantee sufficient financial returns in the short-term. In addition to attracting large-scale investment, alternative finance mechanisms for adaptation are needed, which enable locally relevant projects to generate and retain value locally. This report aims to address the research gap associated with this challenge through analysing alternative finance mechanisms, evaluating their relevance to adaptation of infrastructure and the built environment and identifying their potential contribution to the Scottish economy.

2 Adaptation actions

The SCCAP identified some of the consequences of climate change to which infrastructure and the built environment must respond, such as:

- Increased risk of flooding – pluvial and fluvial, ground water and drainage surcharge as a result of an increase in frequency of intense rainfall events;
- Increased frequency of extreme weather – including high wind, rain and heatwaves;
- Reduced availability and quality of water – as a result of a decrease in summer rainfall; and
- Sea level rise – causing coastal flooding, erosion and coastline retreat.

These consequences will affect the security and performance of infrastructure and the built environment and the resilience of businesses and residents, who rely on this infrastructure for their health, wellbeing and economic prosperity. Those responsible for the delivery and operation of infrastructure and the built environment must plan for, and manage these consequences. This is an on-going process and requires a range of responses by different organisations. These responses, or adaptation actions as we call them, are additional to routine maintenance and can require additional investment and/or that existing spending is delivered in a new way.

The nature of adaptation actions is highly dependent on the type of infrastructure involved and on the organisation delivering the activity. For the purposes of this report we categorise adaptation actions by four types of infrastructure on which actions are implemented:

- Core infrastructure; including road, rail, water and energy networks (for example sewers and electricity networks) and assets (for example railway stations and energy generation facilities).
- Existing built environment which may be retrofitted; including domestic and commercial buildings and public open space.
- New built environment; including regeneration and community growth areas, new build or large scale regeneration in post-industrial areas (e.g. Ravenscraig New Town or the Clyde Gateway) and locations identified for new housing developments.
- Green infrastructure; including protection of upper catchments and incorporating green infrastructure in lower catchments; both in parks and green spaces and more built-up areas.

And we identify three types of organisations that implement actions:

- Agencies or utilities; who receive an element of government funding or are highly regulated by economic regulators, including Scottish Water, the Scottish Environmental Protection Agency, Scottish National Heritage, the Forestry Commission, energy companies, Transport Scotland and Passenger Transport Authorities. Some of these organisations are private sector but are highly regulated so are included in this analysis.
- Local authorities; who are responsible for local roads, public open space, creating the environment for economic development and may have responsibility for social housing.
- Third sector or communities; social enterprises or community groups running projects to improve the environment or resilience of local areas or particular groups.

Table 1 presents an indicative range of adaptation actions, listed by the type of infrastructure and the type of organisation that would lead any activity. The far right-hand column in table 1 illustrates the wide range of outcomes delivered by adaptation actions, including mitigation of climate change, health and well-being and economic development. Importantly, adaptation is unlikely to be the primary motivation for many of these actions. For example, regeneration of the public realm is likely to be instigated for economic development purposes (to increase the attractiveness of an area to businesses and shoppers) but the project could be specified in a way that enables adaptation. This has significant implications for financing of adaptation actions – it is the primary motivation of the action that is more likely to attract finance, rather than the adaptation itself. However, the planned finance needs to be specified in new ways to enable adaptation and/or additional finance needs to be sought to pay for additional adaptation measures.

Table 1: Illustrative range of public sector organisation adaptation actions requiring investment

Type of infrastructure	Agencies/ Utilities	Local authorities	Third sector/ community	Potential multiple outcomes
Core infrastructure: Increase resilience to impacts such as flooding, landslides, severe weather and overheating.	<ul style="list-style-type: none"> ■ Drainage and landslide protection on trunk road network, rail network. ■ Protection of water supply and distribution. ■ Protection of power and communications networks. 	<ul style="list-style-type: none"> ■ Drainage and landslide protection on non-trunk road network . ■ 'Hard' Flood Risk Management infrastructure. 	<ul style="list-style-type: none"> ■ Local energy generation and storage to reduce disruption during storms. 	<ul style="list-style-type: none"> ■ Reduced disruption to businesses and people. ■ Investor confidence. ■ Reduced repair costs. ■ Increased community resilience.
Retrofit of built environment and public realm: Increase resilience to increased risk of flooding, increased frequency of extreme weather, reduced availability of water, sea level rise and long term temperature increases.	Retrofit to increase resilience of own buildings and ensure contribution to resilience including: <ul style="list-style-type: none"> ■ Green walls/ roofs; ■ Rain gardens; ■ Insulation and weather proofing; and ■ Retrofit blue and green infrastructure to any public realm (street trees, SUDS, permeable surfaces). 		<ul style="list-style-type: none"> ■ Retrofit to increase resilience of own buildings and ensure buildings contribute to resilience. ■ Green walls/ roofs. ■ Rain gardens. ■ Insulation and weather proofing. ■ Access to land for community use e.g. stalled spaced and use for community growing/ greenspaces. 	<ul style="list-style-type: none"> ■ Reduced energy use and carbon emission generation. ■ Health and wellbeing benefits. ■ Increased property values. ■ Biodiversity benefits. ■ Increased economic activity.
New built environment and public realm: Increase resilience to increased risk of flooding, increased frequency of extreme weather, reduced availability of water, sea level rise and long term temperature increases.	<ul style="list-style-type: none"> ■ New/ upgraded transport, communication, energy and water infrastructure specified to be resilient to future climate. ■ New buildings specified to be resilient to future climate. ■ Green and blue infrastructure included as 'core infrastructure' rather than add-on. 		<ul style="list-style-type: none"> ■ Allotments and green space provided for community use. 	
Green infrastructure: Increase contribution of green areas to reduce flooding and effects of heatwaves.	<ul style="list-style-type: none"> ■ Purchase of land and compensation to enable Natural Flood Risk Management and managed realignment or retreat at coast. ■ Afforestation across catchment. ■ Peatland restoration. 		<ul style="list-style-type: none"> ■ Property level flood protection. Community owned land: <ul style="list-style-type: none"> ■ Peatland restoration. ■ Aforestation. 	<ul style="list-style-type: none"> ■ Biodiversity benefits. ■ Carbon storage. ■ Water quality improvements.

3 Methods

This report presents the results of research to identify potential alternative finance mechanism, define high-level implications for infrastructure and the built environment and propose areas where UK or Scottish Government intervention, or where more research would be of benefit.

We used desk-based research and a series of interviews to review the current dominant finance mechanisms for infrastructure and their limitations for adaptation of infrastructure and the built environment by public sector organisations. A systematic review was then undertaken of alternative finance mechanisms, currently in use in the UK and Europe, to create a ‘map’ of options. This systematic review identified key characteristics of alternative finance mechanisms, their benefits, implications and relevance to infrastructure and the built environment adaptation by public sector organisations identified above. We interviewed individuals who were involved in brokering or managing alternative finance mechanisms to gather information about alternatives. Interviewees are listed in Appendix A to this report.

A second phase of interviews was undertaken with a range of public sector organisations that might use alternative finance mechanisms to identify specific challenges and opportunities in securing finance for adaptation actions. The results of these interviews were used to identify specific interventions that could improve access to alternative finance mechanisms and maximise the potential contribution to the local economy.

4 Finance and adaptation projects

Described in its simplest form, project finance requires an initial source of funding to invest in a project, a source of income to repay that funding and a mechanism for calculating and collecting income to enable those repayments. Initial funding can come from a range of sources including banks, institutional investors (like hedge funds and pension funds) the government and charities. For traditional projects repayment can either derive directly from monetary income (such as an increase in water rates used to repay a water company's investment in building new assets) or be indirect, by achieving outcomes, like jobs or economic growth for example, specified by the funder (which would usually be the government or a charity). Finance mechanisms come in a range of forms differentiated by whether they are short-term or long-term, cash-based or security-based and debt-based or equity-based . Some of the principal forms of finance relevant to adaptation actions are described in Appendix B. Specific mechanisms are analysed in detail in section 6.

One of the main challenges for adaptation projects is in the repayment of funding. Adaptation projects themselves are unlikely to generate monetary income directly because we don't charge for the services (like flood protection) that they provide, meaning that the direct repayment of funding is difficult. Traditionally, some funders have been willing to invest in projects that deliver indirect economic benefits, such as jobs and economic growth. However, indirect benefits are far more difficult to quantify for adaptation projects because there are no established methods of quantification. There is currently little evidence, beyond anecdotal evidence, to support claims for some social and environmental outcomes, which reduces investor confidence. It is particularly hard to quantify the future outcomes of adaptation actions, such as cost reduction and economic resilience. This is compounded by the uncertainty associated with forecasting the future effects of climate change.

5 Securing finance for climate change adaptation

5.1 Challenges faced in securing current finance

Funding for adaptation of infrastructure and the built environment has traditionally been delivered through four principal mechanisms; government capital grants, user charges, the public works loan board (PWLB), and grant funding. This finance landscape presents a number of challenges for climate change adaptation. Firstly, continuing fiscal austerity means that there is a great deal of uncertainty over future capital budgets. Furthermore, existing capital grants are directed at the biggest projects, and tend to focus on flood alleviation, at the expense of other adaptation actions. Funding adaptation through user charges can conflict with the economic regulator's role to control price increases and negatively affect those in fuel or water poverty. The main alternative to capital grants, the PWLB, is becoming increasingly expensive as the government encourages the public sector to borrow from sources that aren't recorded on the national balance sheet (which is a useful deficit reduction measure). Partnership working can be extremely challenging and requires a great deal of time to align motivations and finance. Finally, there is a significant gap in funding for community-scale adaptation projects, particularly for on-going actions. Further detail of current finance mechanisms and their challenges is presented below.

5.2 Current finance mechanisms

5.2.1 Capital grants

The funding for capital grants is provided by the government and repayment is in the form of demonstrating the achievement of the objectives of that particular grant. Capital grants for adaptation are in a period of transition in Scotland. Currently, local authorities bid for a share of the general capital grant specifically ring-fenced for flood alleviation projects. For the spending review period 2012-2015 the flooding component of the capital grant was £126 million, with £53 million allocated to projects already in train (Scottish Government 2011). Local authorities can bid for the remaining £73 million for flood alleviation projects, subject to a number of limitations. The fund is for projects over the value of £2 million and covers 80% of the cost of the schemes with the remainder usually coming from local authority budgets. From June 2016 funding will be prioritised for schemes identified in one of the 14 flood risk management plans (which are catchment based and cover all of Scotland) and influenced by the relative cost-benefit ratios identified in these schemes (Scottish Government 2011). It is possible that the £2 million threshold will be removed, but the most significant change is that the funding could be flexible so could be used to fund activities not directly relating to flood alleviation. However, there is no guarantee that this flexibility will reduce the prioritisation of flood alleviation actions over other adaptation actions which has become established under the current system. It is anticipated that the total pot will remain the same.

Many other government agencies receive capital grants for maintenance of infrastructure networks (such as Transport Scotland and regional transport partnerships) or of assets that could increase the resilience of infrastructure and the built environment (such as Scottish Natural Heritage and Forestry Commission Scotland). These grants are not ring-fenced for adaptation actions so more immediate drivers can take priority. Some organisations, such as Transport Scotland have a statutory duty to assess and manage climate risk and therefore adaptation has been well integrated into decision making criteria (Transport Scotland 2011). However, this is not universal across agencies and utilities.

5.2.2 User charges

Payments for the use of infrastructure (user charges such as water rates or energy bills) are used to repay investment by infrastructure operators (such as water and energy companies) which could include investment in adaptation of their infrastructure. Scottish Water is a state-owned company responsible for managing surface and foul water drainage, including the risk of flooding from surface water and combined (surface water and foul) sewers that results from higher than usual rainfall events. This work is delivered in partnership with local authorities and SEPA but financed through Scottish Water's capital investment programme, which is funded by user charges. Water user charges are regulated by the Water Industry Commission (WIC) in Scotland (the economic regulator for the water sector in Scotland). WIC sets limits (over 5-year periods) on how much Scottish Water can increase prices to cover investment programmes, including those to implement adaptation actions. As a state-owned company Scottish Water does not pay dividends to shareholders.

Other utilities, such as electricity and gas network operators and operators of energy generation facilities must fund adaptation investment from use-of-system charges (per unit of energy transmitted) or through sale of units of energy generated. Network operator charges and investment are regulated in a similar manner to those in the water sector by Ofgem (the economic regulator for energy) but wholesale energy prices are not controlled and are subject to market fluctuations. The majority of energy companies in the UK are private companies listed on the stock exchange so they are motivated to deliver returns to shareholders.

The economic regulators of the water and energy sectors control user charges, which protects the interest of customers now. However, the combination of price control and the need to provide returns to stakeholders (for energy companies) can restrict the capital available to invest in adaptation actions, which may only benefit customers in the distant future.

5.2.3 Public Works Loan Board

Local authorities are able to borrow to supplement capital grants, subject to the requirements of the prudential borrowing code. Total local authority borrowing in Scotland in 2014-15 amounted to £12.3 billion, of which 71% came from PWLB (DCLG 2015). The PWLB gets capital from the National Loan Fund, which is in turn capitalised by issuance of Treasury securities (government bonds); therefore funding is provided by the government and PWLB loans are recorded on the national balance sheet. Local authorities must repay these loans from their own budgets and income but interest rates are typically lower than commercial banks because the capital is under the protection of government credit ratings (UK Debt Management Office 2014). However, the 2010 spending review raised the PWLB interest rate by 1% to 'better reflect the availability of capital funding' (House of Commons 2010; 150) and to restrict or reduce local authority borrowing as part of the macro policy of fiscal consolidation.

5.2.4 Grant funding

Grant funding by the government and charities for adaptation actions is limited. Grant funds are 'repaid' by the project achieving outcomes specified by the government or charity. Some funding was made available to individuals and businesses through the Repair and Renew grant in the wake of the 2013 floods. However, this is limited to properties directly affected by the floods and to individual property measures, rather than area-wide measures. In Scotland, the Climate Challenge Fund has recently included adaptation and resilience as a theme and has an annual fund of £10 million to spend on community projects relating to climate change. Grants of up to £150,000 per year are available for projects, which can include multi-year projects. The fund has been running since 2008 and has a wide range of successful projects; however there is little guidance on applying for adaptation projects and very few have been funded to date.

The European Union has a range of grant schemes of relevance to climate change adaptation, including the European Regional Development Fund (ERDF), which funds projects that promote sustainable economic growth, and the LIFE+ scheme, which funds projects that promote environment and climate action. EU ERDF funding specifically highlights the role of green infrastructure and climate change adaptation in sustainable economic growth (European Commission 2013). Adaptation is mentioned as a high level topic in Scotland's ERDF strategy document, however the specific climate change actions of the strategy relate entirely to mitigation (Scottish Government 2014b). This overlooks the potential of this fund to address adaptation actions.

5.2.5 Partnerships and multiple finance streams

There is an increasing trend for a number of organisations to partner on projects and use multiple forms of finance for shared projects. This can have significant benefits with regard to the breadth of outcomes from investment, economies of scale and pooling knowledge. Combining activities that have less tangible and more long-term benefits, with those that have more easily quantifiable and short term outcomes can make the combined project a lot more attractive to potential investors. The Flood Risk Management Act in Scotland makes clear the responsibility of those with a statutory duty to work in partnership and funding is provided to deliver flood risk management actions. There have been many examples of where this clarity and financial backing have delivered better outcomes for all partners.

One of the principal challenges of forming partnerships for adaptation actions other than flood risk management projects is that responsibilities and requirements to work in partnership are less clear and it can be more difficult to articulate and agree the role of individual organisations. Furthermore, the lack of funding specifically ring-fenced for a broader range of adaptation actions can force organisations to focus on flood risk management projects.

The majority of partnerships involved utilities, agencies and local authorities. However, the Scottish Flood Forum is a partnership formed by SEPA and third sector organisations to support communities that have been flooded to become more resilient to future floods .

Despite the demonstrable benefits of partnerships, the duties and motivations of partners can differ significantly. It requires significant investment of time and funding to create shared objectives and outcomes, build momentum and co-ordinate actions of organisations with diverse motivations and remits. An example of this is given in Box 1.

Box 1 – Metropolitan Glasgow Strategic Drainage Partnership

The Metropolitan Glasgow Strategic Drainage Partnership (MGSDP) is a partnership formed by organisations involved within the Metropolitan Glasgow area, including; Scottish Water, Glasgow City Council, Scottish Canals, South Lanarkshire Council, Clyde Gateway, Scottish Enterprise, Renfrewshire Council, East Dunbartonshire Council and SEPA. MGSDP's objectives are to reduce flood risk, improve river water quality and to enable economic development. MGSDP recognises that its objectives can best be delivered through an integrated approach to water management. As a result it has planned and delivered a number of projects that have demonstrated the value of integrated, partnership working, particularly in relation to integrated investment planning. For example the £4.2 million South Dalmarnock Regional Sustainable Drainage System (SuDS) project produced a strategic integrated urban infrastructure drainage plan aimed at delivering surface water management, amenity, access and biodiversity benefits. No individual organisation would have been able to cover the whole cost or deliver the range of outcomes that an integrated scheme has enabled. However, the partnership required a great deal of funding to establish shared goals and ways of working, which had to be funded by members (MGSDP 2014).

5.3 Summary

There are examples of effective frameworks of governance in Scotland for some adaptation actions and some public sector organisations. For example the integration of climate change adaption into Transport Scotland's decision making processes and the clear allocation of responsibility and support for partnerships for flood risk management. However, this is far from uniform across all responsible organisations and all adaptation actions. This is preventing the integration of adaptation outcomes into public programmes and limiting the potential of partnership working, which is essential to adaptation actions. Ring fencing of funding and support for flood risk management is important but without similar institutional support for other adaptation actions flood mitigation could dominate at the cost of more integrated solutions.

Grant funding is still available for activities relating to climate change, which should be applauded. However, the focus of these grant funds, and in particular Scotland's ERDF strategy, is squarely on climate change mitigation to the detriment of adaptation actions. Adaptation is not explicitly excluded by current schemes but the lack of guidance and support specifically targeting adaptation actions means they are underrepresented amongst grant recipients.

6 Alternative finance mechanisms

New finance mechanisms are emerging that are relevant to climate change adaptation actions and that could address many of the challenges associated with current finance mechanisms. These alternatives are grouped by the type of finance that they represent (described in Appendix B) and described in more detail below. The key characteristics of each finance mechanism are summarised at the beginning of each section followed by a more detailed description of its features, its relevance to adaptation, the scale and timescales of finance packages, its complexity to set up and run and the wider benefits, for example to the local economy.

6.1 Revenue financing

6.1.1 Tax Incremental Financing

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	✓	✗	✗	✓	✗

Tax Incremental Financing (TIF) allows local authorities to capture locally generated non-domestic rates (NDR) revenue that has arisen as a direct result of public sector investment in enabling infrastructure. The captured NDR revenue is used to repay the debt raised (usually from banks or institutional investors) to fund the infrastructure.

TIF was enabled in Scotland by Scottish Statutory Instrument No. 391, which includes the Non Domestic rating contributions (Scotland) amendment regulations 2010 (Scottish Government 2010). This provided for retention by local authorities of an element of incremental NDR prior to remitting the remaining NDR to the Scottish Government. The regulations allowed for six pilot TIFs and Scottish Futures Trust has been tasked with providing support and evaluating TIF pilots (Scottish Futures Trust 2011b).

The TIF is predicated on a particular geographical area (the red line area) with the ability to deliver regeneration and economic growth. The red line area must be carefully defined to ensure that the full benefits of economic uplift are captured. The red line area is usually a commercial area, because rates are captured from non-domestic properties. It is important that NDR revenues on which the TIF is based are additional to business as usual, which can be quite hard to quantify. This is often described as the ‘but for’ test – i.e. but for the TIF the anticipated outcomes would not occur or would not occur in the time frame that the TIF would enable. Furthermore, the infrastructure that enables economic growth should not be able to be funded by traditional means (for example, local authority budgets).

TIF in Scotland can only be used to fund infrastructure which enables an uplift in NDR, so is usually associated with large regeneration schemes and requires additional sources of finance to fund the core regeneration work (Scottish Futures Trust 2011b). It is possible that TIF could be used to fund adaptation actions such as flood defences or sustainable drainage systems. This could enable the release of flood prone sites that were previously unsuitable for development. It could also enable local authorities to charge higher business rates in developments which are currently affected by the consequences of climate change. However, there are no examples in Scotland where TIF has been used explicitly for adaptation actions.

TIFs can range in scale, from ‘small’ regeneration projects (in the order of £20 million) upwards. The scale of debt is limited by the ability to increase NDR revenue above the baseline in sufficient scale to repay the debt. TIFs are usually set up over 25 year timescales but in the event that the debt is repaid early the local authority is able to retain half of the TIF revenue to be used for further infrastructure investment.

TIF structures are bespoke contracts based on complex calculations of additional NDR revenue uplift. They are necessarily based on a series of assumptions about baseline and future NDR growth and are predicated on continual growth over the period of the TIF. The local authority leading the TIF takes the risk of generating increases in NDR revenue and would have to repay initial funding if the forecasted increase in revenue were not generated. This could be challenging and presents risks to projects where there is a great deal of uncertainty. There is some consideration of displacement from other areas of the local authority, which is discounted, and to some extent from neighbouring authorities, but these calculations are again complicated and based on assumptions.

6.1.2 Private Finance Initiative

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	✓/ X	X	✓	✓	X

The Private Finance Initiative (PFI) and Public Private Partnerships (PPP) have been widely used to deliver revenue-financed infrastructure projects. Funding is provided by private sector partners, who also deliver the project (usually design, build and operation of a facility). The private investment is repaid through performance-based payments from the public sector recipient of the facility. However, PFI has been subject to a great deal of criticism as a result of poor representation of the public sector partner and the very high levels of private sector returns. The Non-Profit Distributing (NPD) model was introduced in Scotland to address these concerns and has since superseded the traditional PFI model (Scottish Futures Trust 2011a). The NPD model includes enhanced stakeholder engagement in the management of projects, no dividend bearing equity and capped private sector returns. Any operational surpluses generated by projects are intended to be reinvested in the public sector.

NPD is widely used in schools, health and transport and it is possible that it could be translated to projects where an adaptation service is provided alongside other services. In this case the private sector could be compensated for the adaptation service. Alternatively any savings in operational costs (e.g. reduced cost of emergency response or damage to properties) could be used to pay back private sector investment. However, there are no examples of quantifying adaptation services or savings in this way to date.

There is no limit to the scale of NPD projects, however most are greater than £20 million and the investment must be covered by some form of repayment. Savings resulting from avoidance of climate damage can be difficult to predict and may only occur some distance in the future so regular payments may be difficult to achieve. However, adaptation services could be included in a contract with other, more predictable and short-term revenues, such as energy savings, to off-set this problem. Most NPD projects are set over 25 year timescales, which also increases the likelihood of weather events occurring within the contract period and achieving savings.

Standardised contracts have been developed for NPD projects, however these are related to health and education and bespoke arrangements would be needed for adaptation projects. In particular the service level specification would need to include specific performance-based measures against which payment could be made.

If any operational surpluses are generated by an NPD project these could be reinvested in the public sector, which presents an opportunity to reinvest these profits in local adaptation projects, retaining more value locally. However, the likely small scale of any surpluses and the timing of their generation may preclude this potential.

6.2 Bonds

There are many different types of bonds, some of which are particularly relevant to financing adaptation. Funding is provided by investors who buy the bonds and this is repaid at the end of a project with an agreed rate of interest. Therefore, projects must have a source of income to repay the initial bond purchaser.

6.2.1 Climate bonds

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	x/✓	✓	✓	✓	x

Climate bonds are used to finance projects which specifically address climate change mitigation or adaptation. These bonds are usually issued by national governments, large corporations or international financial institutions (such as the World Bank). They are usually held by corporate investors and pension funds who want to know their funds are being spent addressing climate change (Mathews et al. 2010). Climate bonds offer similar returns to traditional bonds but can contribute to corporate or individual social responsibility. The Climate Bond Initiative (CBI), which promotes the development of climate bonds, has developed a climate bond standard to ensure that projects funded by the bonds specifically address climate change (Climate Bonds Initiative 2014). The focus on climate change projects makes them directly relevant to adaptation projects, but the bond issuer must have the capacity to repay the initial debt and any interest. The main advantage is a lower interest rate, compared to traditional debt finance.

Climate bonds require a project or projects of sufficient scale to be attractive in the bond market (usually over £250 million), which limits the scale of project for which they are relevant. It is unlikely that many local authorities will have projects of sufficient scale to be attractive for climate bonds. Therefore this finance mechanism may be more suitable for agencies with large projects or a portfolio of similar projects. Furthermore, the issuer must have a credit rating to justify a sufficiently high bond value (and low interest rate) to make it attractive to bond holders. Many local authorities and public sector bodies have the potential to have high credit ratings but their rating is dependent on the financial health of central government. This recently resulted in the downgrading of a number of public sector credit ratings, independently of their own risk profile (Pickard & Hammond 2013). This can present an unacceptable uncertainty to potential bond holders.

Climate bond contracts are bespoke and as a result complex; however there are a number of brokers which can help with the process. For example Rockfire Capital manages a climate bond on behalf of Big60Million and Triodos Bank has offered a climate bond for a number of years. In order to attract social investors it is desirable to verify that the objectives and scope of the project financed by the bond are relevant to climate goals (in accordance with the CBI standards) which requires third party certification.

Issuing bonds for the specific purpose of climate change adaptation can raise awareness of climate change in the investment community (Mathews et al. 2010). However, this can have a limited impact on the local economy unless the bond specifies that a certain proportion of investors must be local.

6.2.2 Municipal Bonds

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	✓	✓	✓	Not in UK	✗

Municipal bonds are issued by local government organisations and are widely used in the United States. There have been a number of instances where public bodies in the United Kingdom have issued bonds themselves for large capital projects (for example; Transport for London and Manchester City Council). In the same way as climate bonds, this requires a project of sufficient scale to be attractive in the bond market (usually over £250 million). Furthermore, the issuer must have a credit rating to justify a sufficiently high bond value (and low interest rate) to make it attractive to investors.

The Local Government Association (which covers England only) has recently set up the Municipal Bonds Agency (MBA). The MBA is able to aggregate the debt needs of a number of local authorities and issue the aggregated debt in a combined bond issue of sufficient scale (Local Government Association 2014). There is no limitation on what the debt is for (subject to the requirements of the prudential code) and bond issues can fund projects with differing purposes. It is designed to offer interest rates that are competitive with, ideally below, the PWLB. The credit rating of the MBA is affected by the credit-worthiness of the participating local authorities but could be as high as AAA rated.

This high credit rating is made possible by the enforcement of a joint and several guarantee for participating local authorities, which means that if one party defaults, all parties are liable. This presents a barrier to Scottish local authorities and public sector organisations, which are not able to sign up to joint and several guarantee because they do not have the general power of competence. Town and parish councils were considered as potential borrowers during the development of the MBA but considered to be too small to take on the risk.

There is no limit to the amount that an individual local authority can borrow but an individual bond issue (of £200-300 million) would need a spread of councils to avoid detrimental effects on the MBA credit rating. Therefore, it is likely that each local authority would borrow less than £50 million per bond issue. Agreements between the MBA and the local authorities would conform to the prudential code and would not change any restrictions they face from existing regulations on prudential borrowing.

The MBA has developed a process for credit scoring and lending but this is not yet publicly available so it is not possible to confirm exact requirements. However, it will not be as straightforward as accessing finance from the PWLB, which requires no credit rating. Nevertheless, the MBA is specifically designed to support local authorities and aims to make the process as straightforward as possible. The MBA believe that the credit process will become more flexible as the number of bonds issued increases because terms can be spread more easily.

There is potential for the role of the MBA to extend beyond issuing bonds (Local Government Association 2014). Firstly, the MBA represents a public sector investment opportunity; the initial funding required to launch and run the MBA until it breaks even is estimated at £8-10 million. This funding is being raised by equity finance and 37 local authorities and the LGA have already invested £4.5 million as shareholders in the MBA. Secondly; the MBA could be used as a mechanism to

broker council-to-council lending and direct lending from local authority pension funds. Finally; the MBA is in talks with the European Investment Bank (EIB) to discuss the EIB lending to the MBA, which would then on-lend in smaller amounts to local authorities. This would open up access to EIB finance: although the EIB’s remit includes lending to UK local authorities, the scale of EIB investments (£100s of millions) does not match the scale of typical local authority projects.

6.2.3 Social Impact Bonds

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	✓	✓	?	Not in adaptation	✗

Social impact bonds (SIB) are an emerging form of bonds where investors provide funding for preventative services to improve social outcomes and are repaid only if desired outcomes are achieved (which differentiates them from traditional bonds). The greater the improvement in outcomes, the greater the financial return to the investor (Bridges Ventures 2014). This presents a crucial challenge as it can represent a high risk for potential investors.

Cabinet Office, as part of its social investment taskforce, is supporting the development of SIBs and has developed, through partners, guidance and training in setting up and running a SIB. The Big Lottery Fund is providing funding to undertake feasibility studies to explore the potential of SIBs in social care delivery. This support is accessible to Scottish local authorities and social enterprises, but to date only one SIB has been set up in Scotland. This is the living balance programme run by Perth and Kinross Council and Perth YMCA.

The basis of a SIB is a contract between the service provider (usually a social enterprise but in the case of adaptation this could include Scottish National Heritage, Forestry Commission Scotland, RSPB etc.) and the outcome payer (usually a government department or local authority). The outcome payer defines the outcomes, the target beneficiaries and the cost per unit of outcome (Social Finance 2013). This arrangement has a number of benefits for both the service provider and for the outcome payer. The service provider has a new form of income – from payment by results – but does not have to hold reserves to cover the working capital necessary to deliver or grow the services. The focus on outcomes can stimulate innovation in service delivery. It can also reduce the need to divert funds from existing activities until the efficiency of new approaches has been demonstrated, significantly reducing the risk of innovation. Furthermore, specification of target groups can reduce the potential for service providers to ‘cherry pick’ the cheapest outcome receivers.

SIBs face a number of challenges which may constrain their uptake (Bridges Ventures 2014). Outcome payers must be able to ‘price’ outcomes and service providers must be confident that they can deliver at lower cost than the current means of service delivery. It would be easy to focus on the most easily priced outcomes at the expense of more important, but more difficult to cost outcomes. Strong performance management is required to ensure that partners are on track to deliver and to adapt approaches in the event of non-delivery. The costs associated with these management systems are not usually included in the capital costs of the intervention. Finally, the bespoke nature of SIB contracts and the high number of partners mean that transaction costs are high.

SIBs have previously been limited to social care-related issues, such as education, adoption and reoffending but it is possible that they could be used to finance socio-environmental outcomes, such as adaptation. If outcomes could be defined and monetised, which might include reductions in reinstatement costs or insurance pay outs, or environmental benefits, the future cashable saving could be quantified and form the basis of an SIB. Importantly, socio-environmental projects are not currently eligible for feasibility funding, which is a significant constraint in complex projects. It is likely that more than one outcome payer would be required, including local authorities, insurance companies and SEPA, for example. The natural agencies (including the National Trust and the Woodland Trust in England and Wales) are actively investigating opportunities to manage green infrastructure in areas of high flood risk and become service providers in SIBs.

It is likely that adaptation SIBs would need to be arranged over longer periods (in the order of 20 years) because of the challenge of quantifying outcomes and the timescales over which outcomes might be achieved. There is no limit on the scale of SIBs, other than the value of the outcomes delivered over the period that the SIB is intended to run.

SIBs are complex financial instruments requiring bespoke contracts and management arrangements (Cabinet Office n.d.). They frequently involve a number of service providers and outcome payers which further increases the complexity. Furthermore, the definition and measurement of outcomes can be problematic if there are no precedents. The feasibility stage is crucial in establishing SIBs, which can take in the order of 12 months to bring to fruition. Guidance documents and experience are reducing the costs associated with developing an SIB but these are still substantial.

SIBs can have a number of wider benefits, beyond the direct outcomes of the project. The increased focus on innovation and scrutiny can improve the capabilities of the social enterprise and have knock-on effects for other services they offer. It is possible to limit the location of investors, as has been done for the Perth and Kinross example, to try to maximise the opportunities for local investors. They can attract new investors to adaptation because they are akin to venture capitalism and may attract more risk-seeking investors who are hoping to catalyse entrepreneurial solutions to pressing social problems.

6.3 Crowd-source funding

6.3.1 Debt-based crowd-source funding

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
X	X/✓	X	X/✓	✓	✓

Debt-based crowd-source funding is similar to a traditional loan, with funding provided to an organisation, which is repaid to lenders with some form of return. The main difference to traditional lending is that crowd-source lending involves many lenders contributing to the same loan. Peer to peer lending usually involves many individuals lending to a business, not normally business to business. There are different types of debt-based funding, depending on the type of debt and the type of interest or return. Specific types can include peer-to-peer lending, debt-based securities and reward-based crowd funding. Peer-to-peer lending to businesses represents the largest share of the current market in the UK (over £750 million in 2014) and is growing significantly (up 250% between 2012-14) (Nesta 2014). However, loan amounts in the UK are on average £75,000 and pay back periods tend to be quite short. Rewards-based crowd-source funding offers slightly different repayment models where lenders donate to specific projects but with expectations of receiving a tangible (but not financial) reward or product at a later date.

It is possible that debt-based crowd-source funding could be used to finance adaptation projects if income or savings could be generated to pay back investors. There is evidence that some forms of crowd-based funding attract investors willing to take lower returns if the project delivers social and environmental outcomes (Nesta 2014). Furthermore, investors frequently offer to contribute non-financial investments of time, goods, services or space. However, debt-based investors do tend to invest for financial reasons and tend to have less of a direct connection to projects so this may not be as significant an advantage in this case (Nesta 2014). The exception to this is reward-based crowd-source funding, which tends to attract investors who know the project and frequently volunteer with the project.

Debt-based securities offer larger loan amounts and longer pay-back periods. Debts are non-collateral obligations and are similar in nature to bonds, with different rights and obligations (Nesta 2014). An average loan amount is £750,000 but this is a relatively new instrument so the total market was only £4.4 million in 2014. This form of crowd-source funding is widely used for renewable energy projects.

Debt-based crowd-source funding can involve hundreds of transactions to fund each loan; therefore some form of on-line platform is usually used to broker debts. However, there are many different platforms that reduce complexity and increase the profile of borrowers.

6.3.2 Equity-based crowd-source funding

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
X	X/✓	X	X/✓	✓	✓

Equity-based crowd-source funding follows similar principles to debt-based schemes but involves the sale of a stake in a business to a number of investors in return for investment. Sales tend to be in the order of £200k but the UK market increased by over 400% between 2012-14 to £84 million (Nesta 2014). The investment attracts interest of some form and the share issuer must be able to repay the investor if the shares are redeemed. This type of share sale is eligible for Enterprise Investment Scheme and Seed Enterprise Investment Scheme tax relief. There are numerous on-line platforms that broker share offers, which reduce the complexity and fundraising times significantly.

Co-operatives and community benefit societies can issue community shares, which are based on withdrawable share capital, but do not offer tax relief yet. Community share offers tend to be less reliant on on-line platforms and many investors support a project they know. Although the community share market was only £34 million in 2014 it had shown an average growth rate of 95 per cent over the previous three years and could be expected to continue to grow in significance (Nesta 2014). Social and environmental aims are much more important to community share investors who often invest in a project they know and might benefit from (Nesta 2014). Perhaps as a result, investors are often willing to take a lower rate of return and engage directly with the project through volunteering.

6.4 Investment funds

Long-term	Appropriate scale	Interest comparable to PWLB	Does not require match funding	Established	Straightforward to set up
✓	✓	✓	x/✓	✓	x/✓

Investment funds have become an increasingly important mechanism for financing infrastructure. The initial investment typically comes from either a governmental organisations (both the UK or Scottish Government and the EU) or from income or savings from an initial project, such as the energy saving scheme at Woking Borough Council, the savings from which formed the basis of an energy efficiency fund. The initial fund is used to invested in projects and the repaid capital (and the interest on this capital) or the further savings accrued are used to fund future projects. In a further example, the North West Evergreen fund – a regional infrastructure fund – gives loans to part-fund infrastructure projects that cannot access loans from commercial banks, and uses loan interest to fund future loans.

Many investment funds have specific objectives, such as economic development or energy efficiency, against which potential investments are assessed. It is possible that investment funds could be created that include climate change adaptation as one of their objectives. Income could be derived from future savings or from interest on loans. More cost effective or revenue generating projects could be used to offset those with low potential for revenue generation. One of the greatest challenges associated with creating an investment fund for adaptation projects is that savings or impacts are likely to occur in the long-term and must compete with projects designed to address more immediate problems like economic growth and fuel poverty. Some way of valuing this long-term benefit and comparing with short-term issues would be needed to enable fair appraisal.

There is no limit to the timescales over which investments must be paid back in investment funds. However, it is possible that repayment periods may be shorter than TIF and NPD because of the need to recycle the capital for other investments. Neither is there a limit on the scale of investment but it is possible that the amounts will be lower than TIF so that the maximum benefit can be derived from initial capital or savings.

Some form of legal entity is required to hold capital or income and a governance structure is necessary to ensure spending or investment decisions meet the aims of the fund. ESCos are becoming an increasingly popular entity for local authorities to administer small investment funds in relation to energy. For example the City of Edinburgh Council has approved the establishment of an ESCo to co-ordinate investment on energy generation and energy efficiency (City of Edinburgh Council 2015). Regional Infrastructure Funds, such as the North West Evergreen Fund, are frequently used for infrastructure and economic development with initial capital coming from ERDF, JESSICA or the UK government.

One of the key benefits of investment funds is that the sequential funding of projects could significantly reduce the initial investment capital necessary to fund the same total project value. This can make projects more flexible and adaptable – one stage can learn from another – and can significantly reduce risk. This also means that the interest from investment is used to directly create value locally.

6.5 Focus on City Deals

The evolution of City Deals provides a good illustration of some of the challenges of implementing the finance mechanisms described above. The concept of ‘City Deals’ was introduced by the Conservative and Liberal Democrat coalition government in 2011 as a means to decentralise the funding and delivery of infrastructure and other economic development interventions to coalitions of local governments (O’Brien and Pike 2015). To date, 30 city-regional groups of local authorities have entered into negotiations, with 28 deals formally agreed (O’Brien and Pike 2015). The City Deals under negotiation have made use of a range of the finance mechanisms described above to administer funding including: a ‘TIF-style’ scheme (Greater Manchester Combined Authority 2012); and staged-investment funds with funds released from central government based on City Regions achieving agreed economic development targets (Glasgow and Clyde Valley 2014).

In theory, City Deals could include investment in adaptation of infrastructure and the built environment. However, in practice City Deals have been almost exclusively targeted at transport and housing. The focus of City Deals on economic development has led to prioritisation of projects for which economic outcomes are easy to estimate or for which there are long-established methods of estimation (for example transport). Adaptation projects, which do not have such established methods of estimating economic outcomes, have been largely overlooked. The exception to this is the Glasgow and Clyde Valley City Deal, which included adaptation projects within its first-stage proposals to government (Glasgow and Clyde Valley 2014). The inclusion of these projects represents a significant step forward in financing adaptation but will still require the City Region to demonstrate the economic benefits that result from these projects to ensure funds are released from central government and that adaptation projects progress through funding appraisal processes.

6.6 Summary

The key characteristics of the finance mechanisms described above are summarised in table 2. There are many finance mechanisms that are relevant to the scale and outcomes of adaptation actions and that comply with borrowing restrictions placed on the public sector. Many are established and relatively straightforward to set up but have not been used to finance adaptation actions thus far. Many mechanisms have wider benefits, beyond just making funding more accessible, including improved monitoring and financial competence, increased economic activity, raising awareness in the investor community and engaging people with projects and climate change adaptation more broadly. However, all require the generation of income to repay funding and many rely on the monetisation of outcomes, including social and environmental outcomes to do this. This presents a particular challenge in climate change adaptation, where outcomes are more difficult to quantify or may only be realised in the distant future. This will require new approaches to the quantification of adaptation outcomes that are able to compare short-term and long-term outcomes, and new project appraisal processes to ensure that adaptation projects can be fairly compared with more traditional projects.

Table 2: Summary of alternative forms of finance

Type of finance mechanism		Scale/type of project	Complexity/ease of set up	Eligibility	Relevance for resilient infrastructure	Contribution to local economy	Case study
Revenue financing	Tax incremental financing	More than £20 million.	Complex contracts but agency tasked with supporting Local Authorities (Scottish Futures Trust).	Local authorities only.	Could be included as part of a wider redevelopment scheme but only in commercial areas.	Increased economic activity.	Edinburgh Waterfront (City of Edinburgh 2010)
	Non-profit distributing	More than £20 million.	Complex contracts but agency tasked with supporting (Scottish Futures Trust).	Public sector agencies and local authorities.	Could be relevant is adaptation service could be quantified or if savings achieved.	Surplus can be used to invest in local projects.	Transport Scotland http://www.scottishfuturestrust.org.uk/our-work/funding-and-finance/non-profit-distributing/transport/
Bonds	Climate Bonds	Over £250 million for bond issue.	Complex but brokers are available.	All but scale probably limits relevance to agencies.	Highly relevant.	Limited.	Transport for London https://www.tfl.gov.uk/cdn/static/cms/documents/dnv-gl-green-bond-opinion.pdf
	Social Bonds	No limit.	Numerous brokers but complex arrangements that can be time consuming to set up.	Social enterprises who can demonstrate social outcomes.	If avoidance of flood/extreme weather damage could be defined as an outcome they might be relevant.	Strong potential to stimulate social enterprises contributing to local outcomes.	Perth and Kinross Living Balance Programme (http://www.ymcaperth.com/living-balance-2/)
	Municipal bonds agency	Via Broker – typically less than £50 million Own bonds – £250-300 million benchmark.	Complex but precedents from Transport for London. Can be brokered by Municipal Bonds Agency from May 2015.	Only local authorities can use MBA. Anybody can invest. Public bodies can set up own bonds	Only for capital investment.	It's possible for LA pension funds to buy bonds and shares in the MBA.	Swedish Municipal Bonds Agency (Kommuninvest http://kommuninvest.se/en/)
Crowd Source Funding	Crowd source funding (lending)	Average of £75k.	Several platforms or brokers can help.	All, but scale probably limits relevance to third sector/ community organisations.	Relevant for projects with clear income stream to repay loan.	Can set limit for how much needs to be raised within locality so revenue remains local.	Oakapple Berwickshire https://www.trillionfund.com/ProjectDetails.aspx?projectId=26
	Crowd-source funding (equity)	Average of £200k for revenue generating projects.	Several platforms or brokers can help.	All, but scale probably limits relevance to third sector/ community organisations.	Relevant for projects with income stream to pay dividends.	Can set limit for how much needs to be raised within locality so revenue remains local.	Whalley Hydro (https://www.trillionfund.com/ProjectDetails.aspx?projectId=25)
Investment funds	ESCos	Variable.	Can be very simple but a legal entity may be required and appropriate governance structure.	All.	Income or savings could be diverted to spend on adaptation actions if remit was appropriate.	Reduce total investment needed. Retain value locally. Improve learning between projects. Reduce project risk.	City of Edinburgh ESCo (City of Edinburgh 2015)
	Infrastructure funds	£10s of millions.	Must be investment-ready – short turnaround.	Local authorities, agencies and utilities.	Could include adaptation actions but usually need to demonstrate contribution to economic development.	Increased economic activity.	North West Evergreen Fund (http://www.northwestevergreenfund.co.uk/)

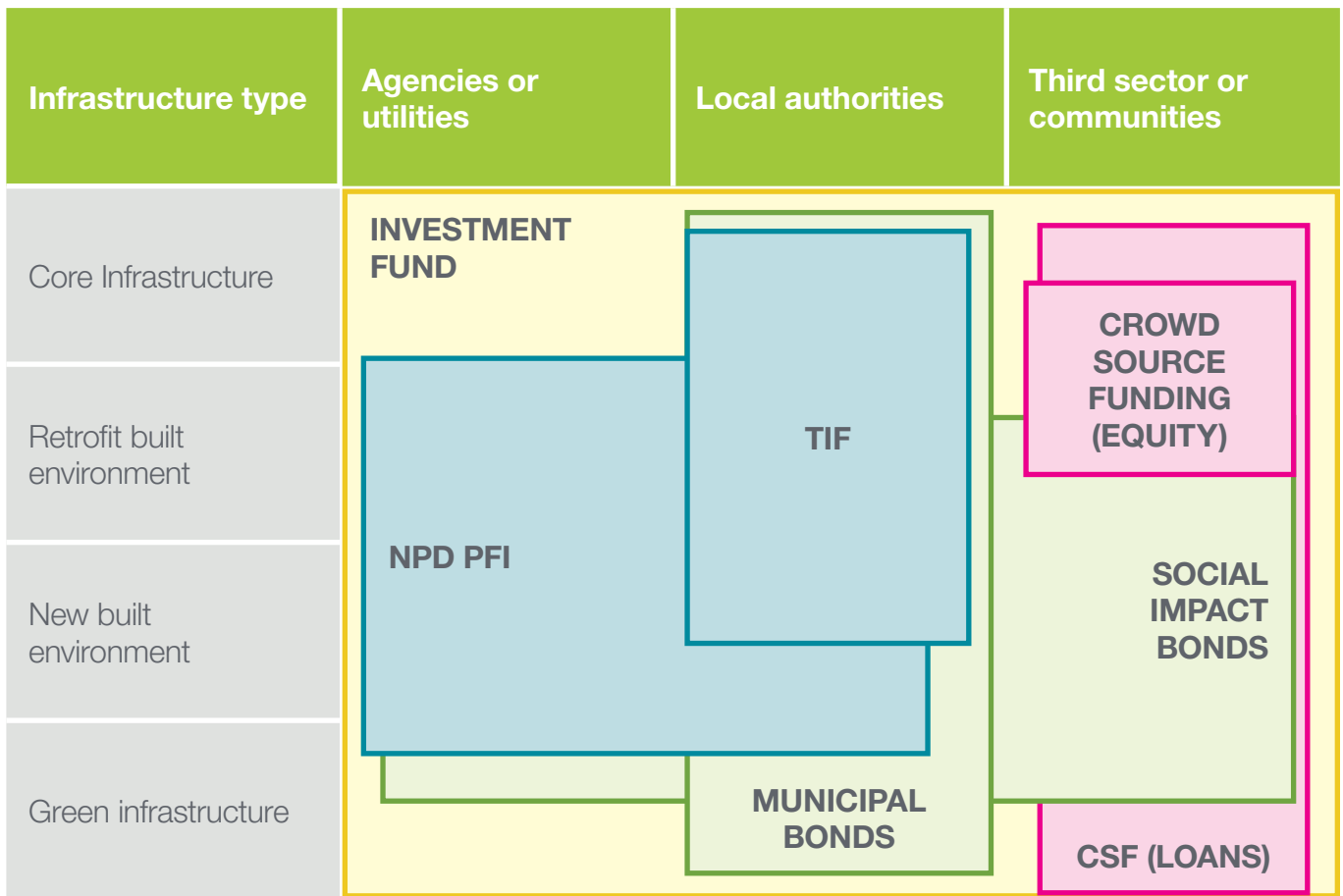
7 Discussion – accessing appropriate finance mechanisms

7.1 Appropriate finance mechanisms

7.1.1 Technical suitability

Not all of the finance mechanisms described in section 6 are technically suitable for all types of adaptation activity. Figure 1 provides an indication of which finance mechanisms are relevant for each type of infrastructure and organisation identified in section 2.

Figure 1: Mapping projects and finance



Key

- Revenue financing
- Crowd source funding
- Bonds
- Investment funds

Figure 1 illustrates that some finance mechanisms are only suitable for certain organisations as a result of scheme remit (such as TIFs, which can only be repaid by non-domestic revenue, which only local authorities can collect). Some are only relevant at a certain scale of finance (for example the scale of crowd-source funding is unlikely to be sufficient for projects implemented by local authorities, agencies or utilities). Other finance mechanisms are likely to be suitable for only certain types of infrastructure. For example equity-based crowd-source funding is likely to be suitable only in cases where revenue is generated (for example from community energy generation) or savings made (for example in energy efficiency projects). Social impact bonds could involve any of the organisations identified but are unlikely to be relevant to core infrastructure, unless initiators can identify projects that social enterprises could deliver.

7.1.2 Delivery of local value

Even if a finance mechanism is technically suitable it may not maximise the potential of adaptation actions to deliver many of the multiple outcomes identified in table 1. For example, a community group could get a loan to retrofit a community facility to improve resilience to climate change and reduce heating and cooling costs. The savings would be used to repay the loan and interest to a bank. This would deliver little benefit to the local economy (unless the bank was local). Alternatively, they could set up a crowd-source share scheme with a proportion of shares allocated for local residents and a proportion of savings distributed to those residents. There is some evidence to suggest that local investment like this can increase engagement in environmental issues (Nesta 2014). Furthermore, a proportion of revenue (which will be higher because no interest is paid) could be used to fund locally important projects, as determined by shareholders, contributing to the local economy and social development. In this report, a finance mechanism that is both technically suitable for a particular adaptation action and able to deliver local social, environmental and economic value is termed an appropriate finance mechanism.

7.1.3 Finance portfolios

In many cases, one finance mechanism in isolation is insufficient to deliver the desirable scale of actions or range of outcomes. In light of the increasing trend for partnership working on adaptation actions the most appropriate finance mechanism may be a portfolio of different mechanisms implemented at different stages of an overall project. In the case of a portfolio, savings or income from one stage of a project could be used to finance subsequent stages, similar to an investment fund.

7.2 Barriers to accessing appropriate finance mechanisms

Public sector organisations face a series of barriers when trying to access appropriate finance mechanisms for adaptation actions. Some are related to the requirements of specific mechanisms but others are more general and are related to the valuation of multiple outcomes or the challenges of partnership working. These barriers are discussed in detail below.

7.2.1 Barriers to specific forms of finance or adaptation organisations

A very specific barrier identified in this research was the inability of Scottish local authorities to accept joint and several guarantee. This prevents them from accessing finance from the Municipal Bonds Agency. The Localism Act 2010 (which is where the general power of competence was introduced) was not implemented in Scotland. Changes to the Local Government in Scotland Act 2003 would be needed to enable local authorities to accept joint and several guarantee and to access the services of the Municipal Bonds Agency.

A number of finance mechanisms have received government support to develop standard documents and pilot demonstration projects in relation to regeneration (e.g. TIF), social care (e.g. SIBs) and public sector buildings (e.g. NPD). This support can help to reduce the transaction costs and complexity associated with setting up these finance mechanisms. Although potentially relevant to adaptation, more detailed feasibility studies would be needed to identify appropriate payment mechanisms for social impact bonds. Feasibility analysis would also be required to define adaptation services that might form the basis of performance-related payments in many mechanisms.

The Scottish Government's strategy for leveraging ERDF funds includes numerous references to low carbon technology deployment (Scottish Government 2014b). However, it does not exploit the opportunity to direct this funding to adaptation actions, despite numerous examples of adaptation actions which have released sites for development and contributed to economic development (for example South Dalmarnock Regional SuDS scheme).

The third sector and community groups are under-represented in adaptation actions. A great deal of work has been undertaken to improve the investor-readiness of community energy groups and to support the feasibility stage of projects. However, guidance and support for adaptation actions is far less prevalent and there has been low uptake of support that is available; only one Climate Challenge Fund project relates directly to climate change adaptation (Sustaining Dunbar's Local Resilience Action Plan).

7.2.2 Barriers to financing multiple outcomes

Many of the potential outcomes of adaptation actions are social or environmental outcomes which are hard to articulate, harder to quantify and may occur over the long-term. This makes it difficult to justify investment in adaptation projects in comparison to more traditional projects, which have more tangible outcomes in the short-term, established methods and a long track record of outcome quantification (for example the economic uplift that results from road schemes). There is currently little evidence, beyond anecdotal evidence, to support claims for some social and environmental outcomes, which reduces investor confidence. It is particularly hard to quantify the future outcomes of adaptation actions, such as cost reduction and economic resilience. This is compounded by the uncertainty associated with forecasting the future effects of climate change.

7.2.3 Barriers to partnership working and finance portfolios

Involvement of multiple partners can offer significant advantages in terms of access to additional capacity and sources of finance. Combining partners' adaptation actions that have less tangible and more long-term benefits, with those that have more easily quantifiable and short-term outcomes can make the combined project a lot more attractive to potential investors. However, each partner will inevitably have different motivations, remits and timescales. Negotiations to manage trade-offs and establish a shared programme of work to address all partners' motivations are time consuming and costly. There are very few sources of funding available for this momentum-building phase. Furthermore, the expectation to work in partnership is less clear outside flood risk management actions, where roles and responsibilities are clearly mandated.

The corporate objectives, existing partnership agreements (such as single outcome agreements) and strategic risks recognised at senior level by some public sector organisations do not include adaptation. This constrains the way in which adaptation is prioritised (or not) when it comes to funding and investment, despite the high risk faced by these infrastructures. For example, Passenger Transport Authorities can only commit funding to parts of projects that directly contribute to core objectives (such as increasing cycling). As a result, contribution to adaptation actions can be limited.

The different finance mechanisms to which partners have access come with different timescales and requirements (for example some require that planning permission is in place prior to release of funds). This can make project planning extremely difficult and creates a great deal of uncertainty.

Partnerships thus far tend to be limited to local authorities, agencies and utilities. The benefits of engaging the third sector or community groups in project delivery, beyond the Scottish Flood Forum, have yet to be fully exploited.

7.3 Improving access to appropriate finance

7.3.1 Support for specific forms of finance or adaptation organisations

Here we identify, based on our research and interviews with alternative finance providers, local authorities and public sector agencies, a series of responses to reduce barriers to specific forms of finance or of particular adaptation organisations:

- Amend the Local Government in Scotland Act 2003 to give general power of competence to Scottish local authorities.

- Finance feasibility work (in partnership with the Cabinet Office, who financed social care SIB work) to investigate the application of Social Impact Bonds to adaptation actions. This will need to identify how adaptation 'services' would be quantified and monitored and how uncertainty over the frequency and severity of climate events (to which adaptation actions would need to respond) could be accounted for in contracts.
- Finance feasibility work to investigate the application of the NPD model to adaptation services including quantification and monitoring as above.
- Provide finance for support of pilots for adaptation TIF, NPD and SIB.
- Develop standard documents and guidance for adaptation actions for TIF, NPD and SIB, if appropriate.
- Develop investment readiness tools for social enterprises and community groups reflecting the specific challenges of adaptation actions. These have been very effectively deployed for renewable energy projects, for example by Local Energy Scotland*, but could be modified to be more relevant to adaptation actions.
- Provide more detailed guidance for Climate Challenge Fund applicants on adaptation actions.
- Include adaptation as a core objective in Scotland's strategy for attracting ERDF funding.
- Include specific requirements in support for renewable energy and energy efficiency projects (for example through the Climate Challenge Fund) to consider incorporating adaptation actions in current project. For example ventilation as well as insulation in building retrofit, or to recycle revenue into adaptation actions.

7.3.2 Support to enable financing of projects with multiple outcomes

Perhaps one of the most significant, and deep-rooted, barriers to access to appropriate finance is the articulation and quantification of multiple outcomes, particularly social and environmental outcomes and future outcomes. A series of responses is needed to address these barriers.

- Develop methods to quantify social and environmental outcomes. A more robust approach to quantification is necessary to enable projects generating these outcomes to compete effectively with those focusing on economic outcomes.
- Develop more appropriate approaches to comparing long-term outcomes with short-term outcomes.
- Adjust project or finance appraisal methods for government supported finance (e.g. capital grants, Scottish Investment Bank) and those supporting access to finance (e.g. Scottish Futures Trust) to account for multiple outcomes. Ensure that they are considered equally and throughout the appraisal process.

7.3.3 Support for partnership working and finance portfolios

More efficient use could be made of public money if partners engaged in adaptation activities could spend more time developing integrated schemes and if there was a more universal driver to address climate change adaptation. In order to promote this it is necessary to:

- Provide financial support for partnership and momentum building.
- Ensure that capital grants for relevant partners include a specific remit for adaptation, not just flood risk mitigation.
- Develop funding criteria and structures that help organisations to bring together adaptation actions that have less tangible and more long-term benefits, with activities that have more easily quantifiable and short-term outcomes, to increase potential for repayment of funding.
- Provide guidance for the development of infrastructure funds with a wide remit, which includes adaptation actions.

*www.localenergyscotland.org/investmentready



8 Conclusions

Infrastructure and built environment adaptation in Scotland is essential to avoid the consequences of climate change but can also present opportunities to deliver a range of social and environmental outcomes and contribute to local economic activity. Financing adaptation actions presents a series of challenges for public sector organisations in Scotland. Continuing austerity means that capital grants are reducing and grant funding is becoming increasingly scarce. Furthermore, access to low-cost loans through the PWLB is becoming increasingly difficult as interest rates rise.

New finance mechanisms are emerging that are relevant to the scale and outcomes of adaptation actions and the restrictions placed on public sector organisations (through the prudential borrowing code). However, many of these new mechanisms have not been used thus far to finance adaptation projects. Many are technically suitable but when identifying appropriate finance mechanisms it is important to also consider how to maximise the creation of a wider range of outcomes, which might limit finance options further.

Accessing appropriate finance can be difficult because of legal barriers, lack of experience or guidance and lack of capacity. Adaptation actions face particular problems when competing for finance because many of the outcomes can be less tangible and more long-term than those generated by more traditional projects with established appraisal methods and more immediate outcomes. Furthermore, many adaptation actions require collaboration between different partners, which can present challenges in aligning priorities and financing.

There are some immediate things that the Scottish Government can do, in partnership with others, to alleviate some of these challenges including; extension of feasibility finance to support the application of new forms of finance to include adaptation actions; and, improving guidance for existing grant funds to encourage adaptation actions or to divert income from existing projects to fund adaptation actions.

However, some barriers require more substantive action to remove barriers, such as the limitation on local authorities accepting joint and several control and the need to develop new approaches to quantifying and appraising social and environmental benefit alongside economic benefits and accounting for benefits in the long-term.

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Appendix A – List of organisations interviewed

List of organisations interviewed

Finance providers and brokers

- Edinburgh Centre for Carbon Innovation
- Scottish Investment Bank
- Scottish Futures Trust
- Municipal Bonds Agency
- Scottish Green Investment Portfolio
- Social Finance

Public Sector Organisations

- Strathclyde Passenger Transport
- Glasgow City Council
- SEPA



Appendix B – Finance mechanisms

B.1 Capital grants

Capital grants are intragovernmental transfers of cash from central government tax revenues to agencies (e.g. Scottish Environmental Protection Agency (SEPA) and Passenger Transport Authorities) and local authorities. Grants are often ring-fenced for a specific purpose (e.g. flood alleviation or transport) but several streams of money can be transferred to different organisations for similar purposes. Some grant streams are directly awarded, others are discretionary (managed by competitive bid). Capital grants are usually awarded annually but are decided in advance in the Spending Review held periodically (from every year up to every four years) (HM Treasury 2013).

B.2 Loans

A loan is a debt-based financial mechanism where the borrower receives an amount of money (called the principal) from a lender and is obligated to pay back the principal by an agreed date and with a specified rate of interest. Repayment timescales are usually relatively short (less than ten years) so may be unsuitable for infrastructure projects. A loan may be secured (in which the borrower pledges some asset as collateral) or unsecured (which are not secured against the borrower's assets). Loans can be securities; in some circumstances they can be sold between financial institutions.

B.3 Revenue financing

Revenue financing is a debt-based mechanism where revenue that will be generated as a result of investment is used to repay debt raised to finance the investment. Revenue is usually either an increase in income (such as local taxes in the case of Tax Increment Finance) or performance-based payment in return for service delivery by the investment (as in Private Finance Initiative projects). The revenue is forecast at the time of contract development and, in combination with repayment timescales, constrains the total amount that can be borrowed. Repayment time-scales are usually relatively long, over 20 years.

B.4 Bonds

Bonds are a type of debt security, used to finance projects. The issuer of the bond (the debtor) owes holders (people who buy the bonds; the creditors) a debt. Depending on the terms of the bond, the issuer is obligated to pay interest (called a coupon) and to repay the cost of the bond at a later date (the maturity date). This is generally much longer than a loan, therefore more attractive for infrastructure projects. Interest is paid at fixed intervals. Sometimes the bond is tradable and the ownership can be transferred in the secondary market.

Bonds can be divided into two principal categories:

- **Organisation guarantee** – are bonds where the creditworthiness of the issuer is key to the interest rate the bonds will pay – the higher the creditworthiness, the lower the risk and the lower the interest.
- **Asset linked** – are bonds where the interest and creditworthiness are tied directly to the cash flow of specific assets, such as wind farms.

In reality, for project financing, bonds would include a combination of asset-linked guarantees with some aspects of organizational guarantee.

B.5 Crowd-source funding

Crowd-source funding is a relatively new finance mechanism where multiple funders (the crowd) provide funding to a project or organisation, usually through some form of broker or online platform. The agreement between the funders and the borrower can vary dramatically but can be categorised broadly as being debt-based or equity-based. The scale of each project tends to be smaller than many of the forms of funding discussed in this report (tens of thousands rather than millions) but this is heavily dependent on the type of crowd-source funding.

B.6 Investment funds

Investment funds use revenue (from interest, savings or income) from previous projects or investments to fund new projects. There are many examples of investment funds in energy efficiency projects (such as Woking Borough Council's Energy Service Company, Thameswey) where savings as a result of investment in energy efficiency are used to fund other investments in energy saving or renewable energy generation.

