



Report

Mobilising private finance for climate compatible development

A diagnostic tool for mapping incentives and investment

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March 2016

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Key messages

- This paper provides an updated and final methodology to support governments and development partners seeking to understand the role of public support in mobilising private finance for climate-compatible development (CCD).
- The first aim of this methodology is to fill key information gaps about regulatory, economic and information incentives and investment at country and sector level in climate-relevant sectors.
- The second is to enhance understanding of how public support through finance and wider incentives (both domestic and international) is linked to private investment in CCD.
- Thus far, this approach has been applied to look at the energy sector in Uganda, the agriculture sectors in Zambia and Ghana, and the transport sector and water and sanitation sector in Viet Nam.

Acknowledgements

We are grateful for helpful comments provided by peer reviewers Andrew Spezowka of the UN Development Programme, Dambudzo Muzenda of the UN Environment Programme, Matthew Savage of Oxford Consulting Partners, Amin Srivastava of the World Resource Institute,

Jessica Brown of Climate Policy Initiative, and from Emily Darko, Neil Bird, Tom Mitchell, Merylyn Hedger and Anna Locke of Overseas Development Institute.

We welcome inputs to this methodology from climate finance practitioners.

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Abbreviations

BNEF	Bloomberg New Energy Finance	NDCs	Nationally Determined Contributions
BRICS	Brazil, Russia, India, China, South Africa	ODA	Official Development Assistance
CBT	Climate Bonds Taxonomy	ODI	Overseas Development Institute
CCD	Climate-Compatible Development	OECD	Organisation for Economic Co-operation and Development
CDKN	Climate and Development Knowledge Network	OOF	Other Official Flows
CPI	Climate Policy Initiative	PPCR	Pilot Program for Climate Resilience
ERA	Electricity Regulatory Authority (Uganda)	PPP	Public–Private Partnership
FDI	Foreign Direct Investment	REA	Rural Electrification Agency (Uganda)
FSF	Fast Start Finance	REFIT	Renewable Energy Feed-in Tariff
GEEREF	Global Energy Efficiency and Renewable Energy Fund	SREP	Scaling-up Renewable Energy Programme
GEF	Global Environment Facility	TLC	Transparency, Longevity and Certainty
GET FIT	Global Energy Transfer Feed-in Tariffs	UK	United Kingdom
GGBP	Green Growth Best Practice	UN	United Nations
GoU	Government of Uganda	UNCTAD	UN Conference on Trade and Development
ICT	Information and Communication Technology	UNDP	UN Development Programme
IFC	International Finance Corporation	UNFCCC	UN Framework Convention on Climate Change
IMF	International Monetary Fund	US	United States
INDCs	Intended Nationally Determined Contributions	WTO	World Trade Organization
ISIC	International Standard Industrial Classification of All Economic Activities		

Executive summary

This paper provides an updated and final version of a methodology used to map incentives and investment in a given country and sector (Whitley, 2015). This diagnostic tool has been developed with the wider aim of supporting governments and development partners seeking to understand how public support can be used to mobilise private finance for climate-compatible development (CCD).¹

There is consensus within the discourse on climate finance under the UN Framework Convention on Climate Change (UNFCCC), and beyond, that there is a key role for the public sector in mobilising private investment in CCD. Although the evidence base is growing, analysis of options for mobilising private climate finance has primarily remained focused on studying international flows. In contrast, there has been relatively limited analysis of trends in investment and incentives (financial and non-financial) at country level. This is striking particularly in light of findings that i) domestic investment, including domestic private finance, plays by far the most significant role in financing CCD; and ii) the impact of domestic public policies in relation to mobilising private investment in CCD is greater than that of international public finance at the project level (based on initial analysis in the energy sector) (Buchner et al., 2015; Haščič et al., 2015).

There is also consensus that the lack of transparent information is a significant barrier to analysis of climate finance in the context of wider investment (both public and private). A summary of the work of the Organisation for Economic Co-operation and Development (OECD) Research Collaborative on Tracking Private Climate Finance highlighted that there is a current lack of comprehensive data on private climate finance beyond large renewable energy project finance transactions; some of the many data gaps for other low-carbon, climate resilient activities as well as smaller and other types of financial transactions are likely to remain (OECD, 2014). In the case of developing countries, even data on renewable energy investment is lacking; for example, in the Bloomberg New Energy Finance Database, 60% of asset finance transactions do not have an associated transaction value (Jachnik and Raynaud, 2015).

A recent OECD paper highlighted that, to address these gaps in understanding, incentives (including domestic policies) and investment, there is a need for: i) common lists reflecting the full breadth of domestic and international public interventions and instruments currently used to

mobilise private finance; ii) common lists of ‘low-carbon and climate resilient activities’; and iii) more comprehensive data on private flows to those activities (Jachnik, Caruso and Srivastava, 2015). Although these information gaps persist at the international level, there is significant potential for using country- and sector-level approaches to improve understanding of: incentives, climate-relevant activities, and private finance data. All of which can support improvements in global datasets over time.

The current gap in publicly available data on current levels of investment in the key sectors for CCD is one of the most significant barriers to understanding the effectiveness of existing public sector interventions to mobilise private climate finance. Without information on where public sector funds come from and where they have been used to mobilise private climate finance in developing countries, it is virtually impossible to assess their effectiveness, learn lessons or replicate good practice.

We have developed a diagnostic tool that aims to: i) fill key information gaps about incentives and investment at country level in climate-relevant sectors, in order to support governments in their efforts to shift or direct additional private resources to CCD; and ii) to enhance understanding of the links between public incentives and private investment in CCD. We seek to overcome the challenge of determining which activities are climate compatible by reviewing available information on all public and private finance flows in a given sector, and then analysing these findings in the context of the country’s stated climate and green growth objectives (including those for mobilising climate and green finance).

Applying this diagnostic tool involves four steps:

1. Identifying sectors and sub-sectors for review.
2. Completing basic research on the context for private investment, and the country’s climate and green growth plans, as they both apply to the selected sector.
3. Completing three frameworks for the selected country and sector (and sub-sectors) based on the review of relevant international and domestic data sources and information as well as interviews with key stakeholders in government, private sector and civil society.
 - i) Framework 1: Incentives (for private investment in X sector);
 - ii) Framework 2: Sources of capital – public and private (current in X sector and sub-sectors);

1 Climate-compatible development (CCD) safeguards development from climate impacts (climate-resilient development) and reduces emissions or keeps them low without compromising development goals (low-emissions development) (CDKN, 2013).

-
- iii) Framework 3: Scale of investment – public and private (historic in X sector and sub-sectors).
4. Where sufficient information is available to complete all or part of the three frameworks, preliminary analysis is completed on the potential links between public incentives; public and private sources of capital and the resulting investment trends; and the implications for mobilising additional private climate finance.

Thus far, this approach has been applied in the energy sector in Uganda, the agriculture sectors in Zambia and

Ghana, and the transport and water and sanitation sectors in Viet Nam. The full results from these studies can be found in Whitley and Tumushabe (2014), Whitley et al. (2014b), Darko et al. (2015), Canales Trujillo et al. (2015) and Norman et al (2016a). See Whitley and Norman, 2016 (forthcoming) for cross-cutting findings from these five studies. The aim is to refine this methodology and these frameworks through the application of the approach across additional countries and sectors.

1 Introduction

The Paris Agreement adopted at the United Nations Framework Convention on Climate Change (UNFCCC) in 2015 urges developed country Parties to scale up their level of financial support, with a concrete roadmap to achieve the goal of jointly providing \$100 billion annually by 2020 for mitigation and adaptation.

While estimates of the scale of the specific climate financing needs of developing countries vary substantially, there is a growing body of evidence at the global level on the volume of public and private investment that must be mobilised from new sources and shifted from existing sources to support low-carbon development and green growth. Depending on the assumptions and methodologies used, current global estimates are between \$0.7 and \$4 trillion in additional costs, and \$1 trillion in savings² between 2015 and 2050 (see Figures 1 and 2) (GGBP, 2014; Global Commission on the Economy and Climate, 2014). The highest end of these estimates is 40 times higher than donor countries' internationally agreed commitment of \$100 billion annual flows to developing countries under the UNFCCC, and 10 times higher than global climate-finance flows in 2014³ of \$391 billion, of which 62% is estimated to come from the private sector (Buchner et al., 2015). Unfortunately, beyond these global estimates for investment requirements, there is very limited country- or sector-level information on investment and investment gaps – even though this information will be essential for decision-makers seeking to mobilise private climate finance or shift existing investment towards climate-compatible development (CCD) outcomes.

Although recent research by the Climate Policy Initiative (CPI) and others has provided evidence that public policies and public investment can attract private climate finance, only \$34 billion in climate finance in 2013⁴ was identified as flowing from developed to developing countries (10% of total global climate finance identified) (Buchner et al., 2014). There may be other funds that are being used to mobilise private climate finance, but there are no

consistent and comprehensive data on climate-relevant investment, and information is particularly weak at the regional and country level, with the majority of data collection taking place on flows to the energy sector and on public international finance (Figure 3) (Buchner et al., 2015). Beyond large renewable energy projects there is very limited information available on private investment by climate-relevant sectors⁵ and sub-sectors, and very little country-level data beyond those for the Organisation for Economic Co-operation and Development (OECD) countries and the BRICS (Brazil, Russia, India, China, South Africa) (IFC, 2013 and OECD, 2014). In the case of developing countries, even data on renewable energy investment is lacking; for example, in the Bloomberg New Energy Finance (BNEF) database, 60% of asset finance transactions do not have an associated transaction value (Jachnik and Raynaud, 2015). Early work by the ODI suggests issues of commercial confidentiality and regulatory restrictions may make the tracking of private finance even more challenging than tracking public flows (Whitley, 2013b).

This data gap is one of the most significant barriers to understanding the effectiveness of existing public sector interventions to mobilise private climate finance. Without information on where public sector funds come from and where they have been used to mobilise private climate finance in developing countries, it is virtually impossible to assess their effectiveness, learn lessons or replicate good practice (Whitley, 2013a).

In addition to new investment requirements, findings from researchers tracking current climate finance flows demonstrate the following:⁶

- Almost 74% of all climate finance is domestic investment, with private actors having an especially strong domestic investment focus: 92% of their investments remain in the country of origin.⁷ A minority (26%) of climate finance is spent abroad.

2 See Figure 1: Including operating expenses would make a low-carbon transition even more favourable leading to potential savings of \$1 trillion.

3 This includes investment in both developed and developing countries.

4 No updated figure is available for 2014.

5 For the purpose of this research climate-relevant sectors have been defined to include: agriculture, forestry, extractives, manufacturing, energy, water and sanitation, construction, transportation, and information and communication technology (ICT) (see Section 3.1).

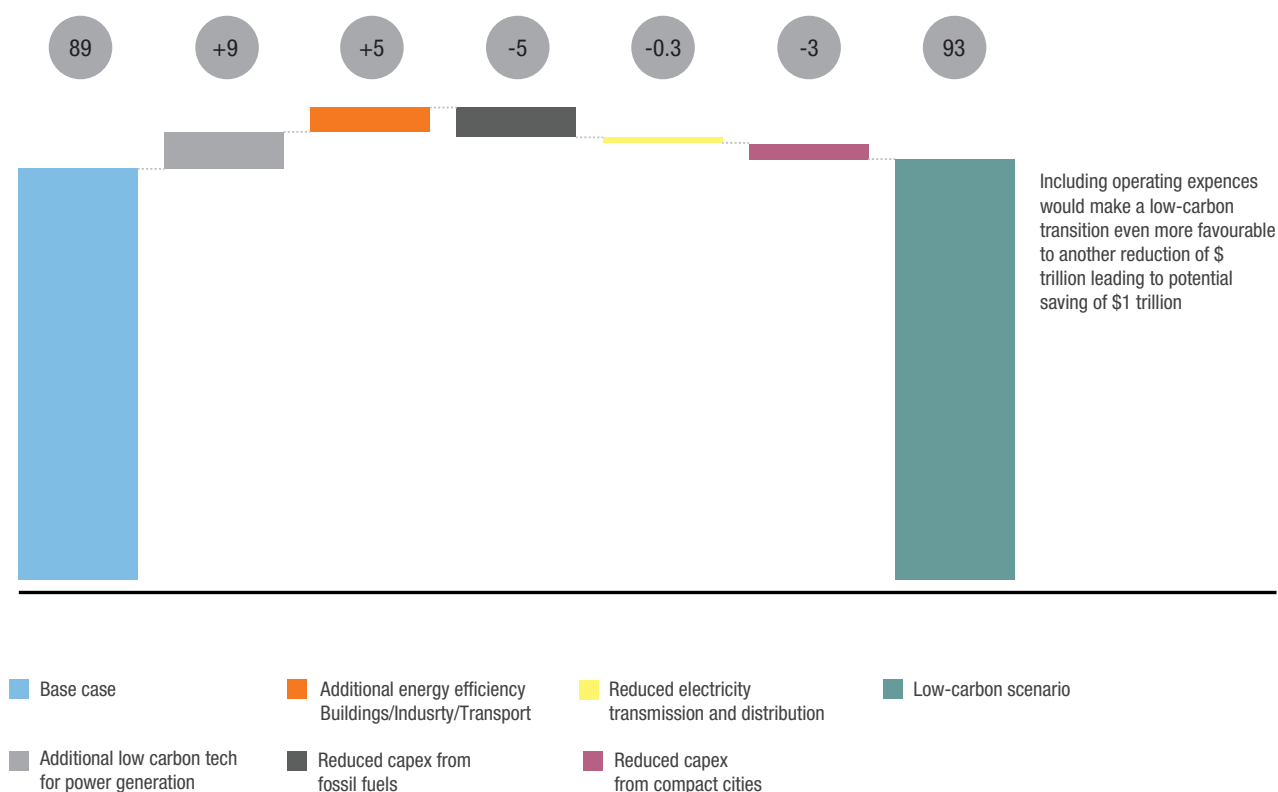
6 See Buchner et al. (2015), Buntaine and Pizer (2014), and Haščič et al. (2015).

7 This information from the Climate Policy Initiative (CPI) is based on a global data review, and it is unclear how this finding would change across different country contexts.

Figure 1: Global investment requirements in a low-carbon scenario (\$ trillion, 2010 dollars)

Infrastructure capital spend is estimated to be around 4% higher in a low-carbon scenario
Global investment requirements; 2015 to 2030, \$ trillion, constant 2010 dollars

Indicative figures only; high range of uncertainty



Source: Global Commission on the Economy and Climate (2014).

- Domestic policies are found to play a greater role in mobilising private finance than international public finance deployed at the project level (based on reviews of renewable energy incentives and investment).
- This is supported by early findings that the ‘leverage’ effect of international public finance is relatively low. A review of the BNEF database of renewable energy investments found that multilateral public finance leveraged private finance at a ratio of 1:1, and bilateral public finance leveraged private finance at a ratio of 1:0.7 (Jachnik and Raynaud, 2015). Forecast leverage ratios for dedicated multilateral climate funds are similar, with \$1 of public funds, aiming to mobilise

\$0.8 of private investment (Whitley et al., 2014a). Parallel analysis of the leverage objectives and impact of domestic public finance has not been identified.

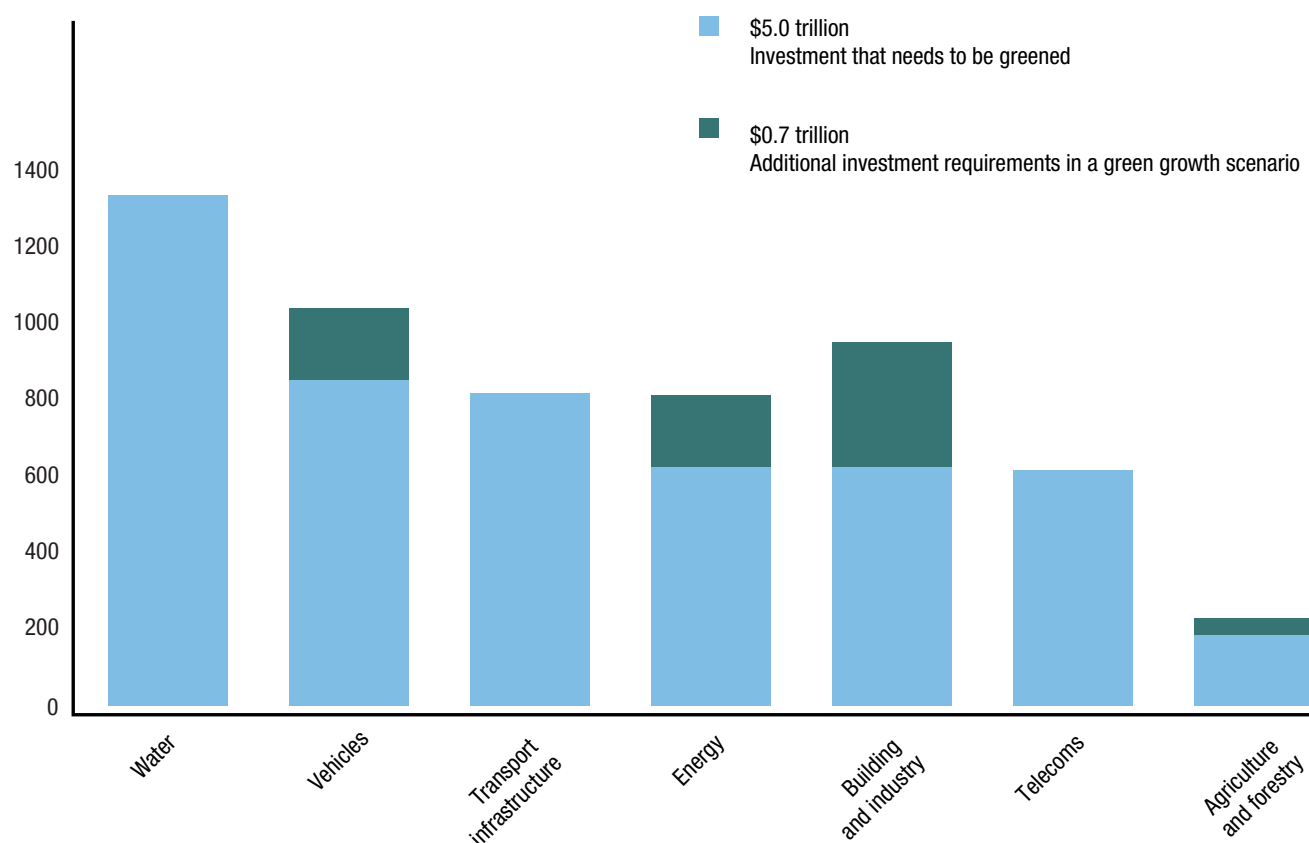
There is also widespread acceptance of the following:⁸

- Significant volumes of private investment will need to be mobilised from new sources and shifted from existing sources to help countries undertake CCD.⁹
- The creation of a stable and attractive regulatory environment through ‘transparency, longevity and certainty’ (TLC) (or long, loud and legal signals) is essential to enable this shift in private investment.

⁸ See Hamilton (2009), High-Level Advisory Group on Climate Change Financing (2010), Kreibichl and Miltner (2013), Mabey (2012) and UNFCCC (2012).

⁹ Climate-compatible development (CCD) safeguards development from climate impacts (climate-resilient development) and reduces or keeps emissions low without compromising development goals (low-emissions development) (CDKN, 2013).

Figure 2: Additional and total investment requirements in a green growth scenario (\$ million, 2010 dollars)



Source: GGBP (2014).

- There is an important role for public finance (domestic and international) to enable greater investment in CCD by the private sector.

In spite of these findings, in the discourse on climate finance, there is relatively limited recognition of the role the domestic public sector can (and does) play in shaping private investment. Support to private actors is often justified only in the cases of market failures or market distortions, or where markets are incomplete (Pack and Saggi, 2006). In addition, there remains a persistent focus on financial interventions by international actors to support private investment at the project level through the use of such as grants, concessional lending, guarantees and equity investments¹⁰ However, in the broader discourse on industrial policy¹¹ or fiscal policy, there is a more general

acceptance that the public sector has a key role to play in establishing and formalising domestic markets, and that a significant portion of private investment globally depends in some way on support from the public sector¹² (Mazzucato, 2013).

This recognition of the critical role of the domestic public sector in driving investment calls for an understanding of incentives as part of the decision-making process around allocating climate finance that aims to mobilise private investment. Such an approach would complement current interventions focused at the project level by linking these activities to the wider reshaping of incentives that drive investment at the sector or country level.

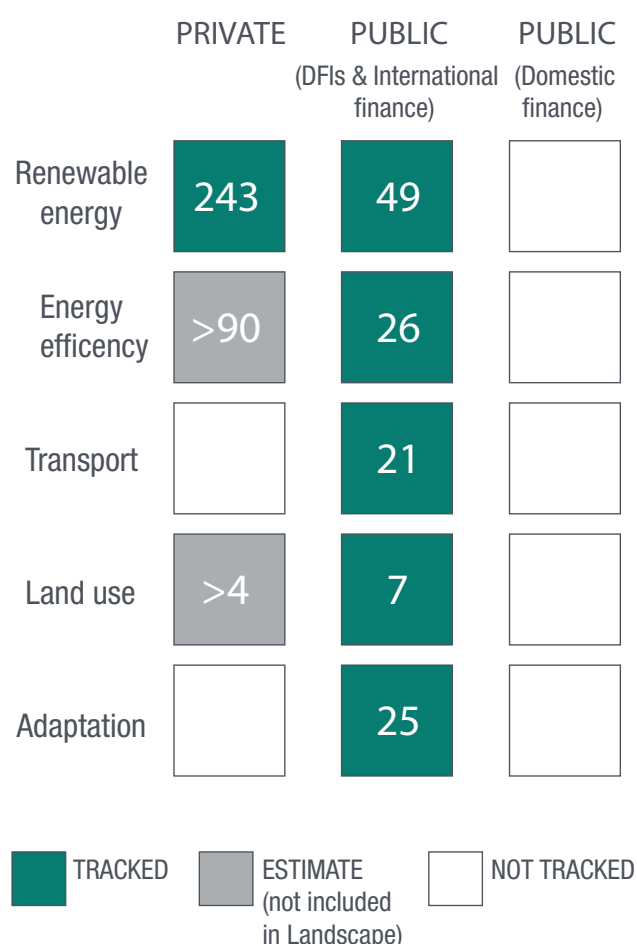
We have developed a methodology that aims to: i) fill key information gaps about incentives and investment at country level in climate-relevant sectors, in order to support

10 See Whitley (2013b) and Whitley et al. (2014a) for databases of specific donor and multilateral fund private climate finance interventions, and Green Climate Fund (2013) for a useful typology of these financial instruments.

11 Definitions of industrial policy (including activities in sectors beyond those typically associated with 'industry'): concerted, focused, conscious efforts on the part of government to encourage and promote a specific industry or sector with an array of policy tools (UNCTAD, 1998); any type of selective intervention or government policy that attempts to alter the structure of production toward sectors that are expected to offer better prospects for economic growth than would occur in the absence of such intervention (Pack and Saggi, 2006).

12 Data from Bloomberg New Energy Finance show that, in 2012, total investment by state investment banks in renewable energy totalled \$80 billion, compared with a mere \$12.5 billion by the private sector (Mazzucato, 2013).

Figure 3: Summary of ‘sector-specific’ climate finance



Source: Buchner et al., 2015

governments in their efforts to shift or direct additional private resources to CCD, and ii) to enhance understanding of the links between public incentives and private investment in CCD. We seek to overcome the challenge of determining which activities are ‘low-carbon and climate resilient’ by reviewing available information on all public and private finance flows in a given sector, and then analysing these findings in the context of the country’s stated climate and green growth objectives (including those for mobilising climate and green finance).

Our research aims to support governments and development partners seeking to understand how public support can be used to mobilise private finance for climate-compatible development by answering the following questions for a given country and sector:

- What are the public policy aspirations regarding private investment, both broadly at the country (economy) level and more narrowly at the sector level?
- What are the country’s climate and green growth objectives at the sector level?
- What are the primary incentives (regulatory, economic and information) in place to support private investment?
- What are the i) current sources of financial capital and ii) historic investment trends, both public and private?
- How can the information on incentives and investment inform those seeking to use climate finance (and, where relevant, wider public support) to mobilise private investment towards CCD?
- What are the remaining data gaps, and how could additional information and data inform domestic and international interventions?

This approach takes a holistic view of financial activity for each climate-relevant sector, given that incentives within a sector or sub-sector play a significant role in shaping the decision of private investors (Buntaine and Pizer, 2014; Haščič et al., 2015). This methodology is an attempt to fill key information gaps about both private and public finance, and the incentives that shape investment in CCD, and to create a framework to identify remaining gaps where data are simply not collected. The primary aim of this work is to support governments in their efforts to shift or direct additional private resources to CCD.

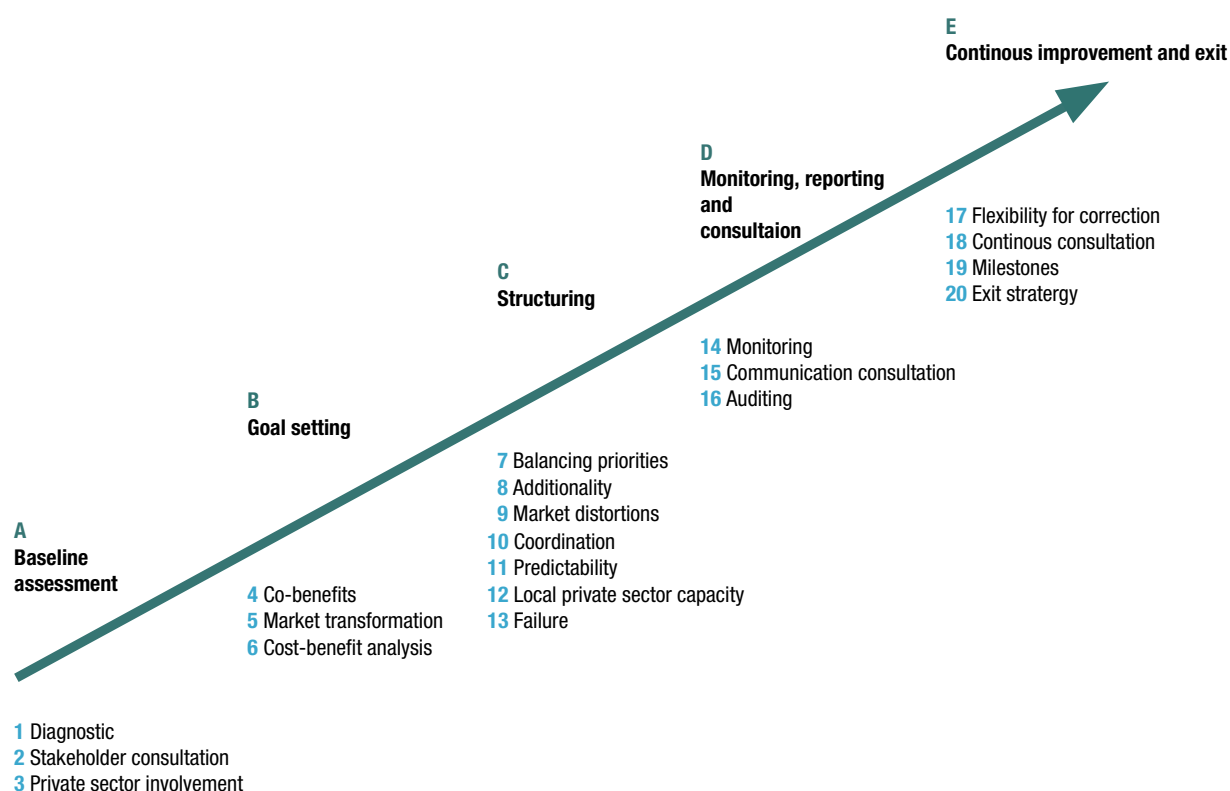
This paper outlines the methodology in detail, including key sources of information. Thus far, this methodology has been applied in the energy sector in Uganda, the agriculture sectors in Zambia and Ghana, and the transport and water and sanitation sectors in Viet Nam. The full results from these studies can be found in Whitley and Tumushabe (2014), Whitley et al. (2014b), Darko et al. (2015), Canales Trujillo et al. (2015), Norman et al. (2016a).

2 Diagnostic tool: methodology

This diagnostic tool¹³ seeks to (1) fill key information gaps about incentives and investment at country level, in climate-relevant sectors, in order to support governments in their efforts to shift or direct additional private resources to CCD, and (2) enhance understanding of the links between public support (both domestic and international, through regulatory, economic and information instruments) and private investment in CCD.

This diagnostic is meant to be applied as the first step in the wider process of designing public interventions to mobilise private climate finance. It is part of a '20 Questions Toolkit' developed by ODI, which is meant to be applied in stages (A through E) and includes specific examples and resources where good practice exists for addressing a given question (see Figure 4) (Whitley and Ellis, 2012).

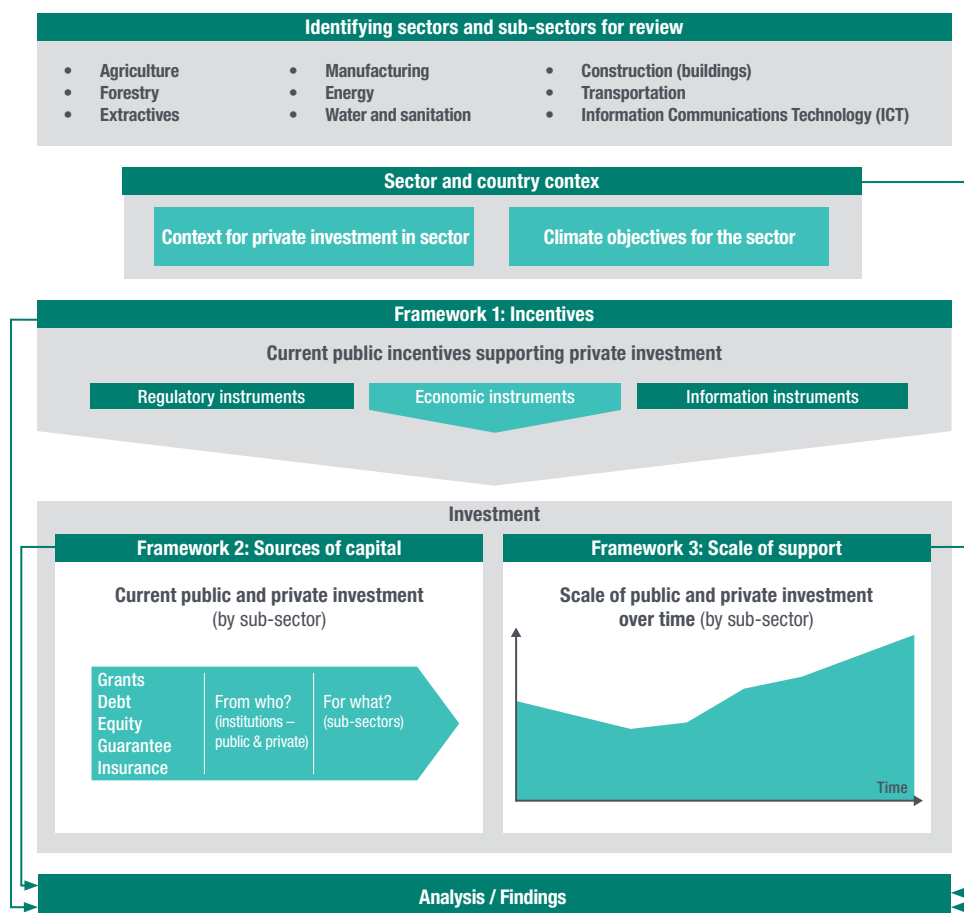
Figure 4: 20 Questions Toolkit for designing interventions to mobilise private climate finance



Source: Whitley and Ellis (2012).

¹³ This revised diagnostic is an updated and final version of a methodology published in 2013 and again in 2015 (Whitley, 2015) and has been amended to: incorporate lessons from applying the approach in four sectors: energy, agriculture, transport and water and sanitation, including specific recommendations on sub-sector divisions and additional sources of information; clarify the links between the three frameworks used in the diagnostic, and their application within a broader process of designing public interventions to mobilise private investment; and update the literature review to include recent research on the role of public finance in mobilising private investment.

Figure 5: Diagnostic tool – mapping incentives and investment at sector and country level



In contrast with most existing research on private climate finance, which has been undertaken using global datasets, this diagnostic is designed to be undertaken at the country level, looking at both investment and incentives in climate-relevant sectors.

Applying this methodology involves four steps (see Figure 5):

1. Identifying sectors and sub-sectors for review.
2. Completing basic research on the wider economic context for private investment in the sector, and the country's climate and green growth plans, as they both apply to the selected sector.
3. Completing three frameworks for the selected country and sector (and sub-sectors) based on the review of relevant international and domestic data sources and information as well as interviews with key stakeholders in government, private sector and civil society.
 - i) Framework 1: Incentives (for private investment in X sector);
 - ii) Framework 2: Sources of capital – public and private (current in X sector and sub-sectors);
 - iii) Framework 3: Scale of investment – public and private (historic in X sector and sub-sectors).
4. Where sufficient information is available to complete all or part of the three frameworks, preliminary analysis is completed on the potential links between public incentives; public and private sources of capital and the

resulting investment trends; and the implications for mobilising additional private climate finance.

The following sections (2.1-2.6) outline each of the four stages, including the three frameworks, in detail. Section 3 provides an overview of potential next steps for applying this methodology in areas including financing of Nationally Determined Contributions (NDCs) under the UNFCCC Paris agreement.

2.1 Step 1: Identifying sectors and sub-sectors for review

In order to understand the role of public policy and incentives for private climate finance, it is first necessary to understand how public policy and incentives shape investment decisions by private actors across entire sectors, and not only for those activities that might support mitigation of or adaptation to climate change. This is because signals at market or sector level may often be stronger than those that have climate specific objectives.

This research is to be undertaken using a sector and sub-sector lens, as this is the approach investors and government departments use most often in categorising their activities and investment and in tracking spend. Given this sector focus, the diagnostic would ideally be

Box 1: Climate-relevant sectors* (see also Appendices 1 and 2)

- Agriculture
- Forestry
- Extractives
- Manufacturing
- Energy
- Water and sanitation
- Construction (buildings)
- Transportation
- Information Communications Technology (ICT)

*Note: *Water and waste under ISIC (see next footnote) is called water and sanitation for the purpose of our analysis, and the construction sector excludes construction of infrastructure – which has been moved into the respective sector for the purpose of our analysis (i.e. construction of a power plant would be under energy as opposed to construction).*

completed by a team with sector-level expertise (ideally in the country being reviewed), in addition to some level of experience in tracking public and/or private finance.

The sector-level analysis of incentives and investment has two important potential outcomes:

- lesson-learning from other sectors on the effectiveness of incentives in mobilising and shifting investment;
- greater understanding of current incentives (i.e. subsidies) that act either as an impediment to private investment in CCD (including subsidies to fossil fuels, to key commodities driving deforestation, etc.) or as an enabler.

To assist this analysis, the typology of climate-relevant sectors in Box 1 was developed using the UN's International Standard Industrial Classification of All Economic Activities (ISIC)¹⁴ Rev. 4, filtered using the categories within the Climate Bonds Taxonomy (CBT) (Climate Bonds Initiative, 2015; UN, 2008). The main contrast with the CBT is that we would propose looking at questions of private investment in adaptation and resilience across all sectors with climate relevance, as opposed to within a separate category or sector of 'adaptation'.

For each sector we have established a set of sub-sector categories for use in this analysis (in particular in Framework 2) to ensure enough data were collected on incentives and to begin to distinguish between 'climate-compatible' and 'climate-incompatible' activities as defined by the country's own plans and strategies (see Appendix 2 for sub-sector breakdowns for the energy, agriculture, water and sanitation and transport sectors).

A climate change lens is applied early on in the analysis, (1) in the selection of the sector to be reviewed in country X – we established this according to which sector received the highest levels of climate finance within a given country,¹⁵ and (2) in the review of the country's own climate and green growth plans as they apply to the given sector (including Nationally Determined Contributions – NDCs).

Information on the country's own climate and green growth objectives for the sector (including objectives for private climate finance where available) are used again at the end of the analysis, once all the data-gathering and interviews have been completed, in order to assess the implications of the findings on investment and incentives for mobilising private climate finance. The middle stage of the research, which involves data-gathering and interviews for the three frameworks, does not involve an explicit discussion of climate change, as the aim is to collect comprehensive information on investment and incentives at the sector level.

2.2 Step 2: Context for private investment, and climate and green growth plans, in the selected sector

2.2.1 Approach

Once the specific sector(s) for review have been identified, a brief overview is completed of the 'climate' for private investment in the given sector and country, including governance and objectives on climate change and green growth in the sector. This broader information is included

¹⁴ ISIC is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be used for the collection and reporting of statistics according to such activities. Wide use has been made of ISIC, both nationally and internationally, in classifying data according to kind of economic activity in the fields of economic and social statistics, such as for statistics on national accounts, demography of enterprises, employment and others (UN, 2008).

¹⁵ Sector receiving highest levels of climate finance can be determined using Climate Funds Update and FSF reviews by ODI and OECD data tracking of climate tagged official development assistance (ODA) (supporting mitigation and adaptation).

to complement the detailed review of the incentives for investment in the sector through the three frameworks and analysis included in Sections 2.3 – 2.6 below.

Information reviewed includes:

- investment climate across the country as a whole, including basic information about economic development and the maturity and development of the finance sector
- the role of the selected sector in wider economic development objectives, along with sub-sector priorities
- objectives for investment in the selected sector (public and private)
- general enabling conditions for private investment in the selected sector
- key policies and institutions in the selected sector
- climate and green growth objectives for the selected sector.

2.2.2 Sources of information

The information to complete this analysis is available through:

- government documents, including national and regional development plans, budget reports, ministerial reports and statements and sector strategies
- climate and green growth strategies and plans
- national-level investment climate and economic reviews completed by international agencies (OECD, World Bank, etc.)
- documentation of incentive reform processes (e.g. International Monetary Fund (IMF) reviews of fossil fuel subsidy and energy sector reforms
- sector-level investment and investment climate reviews (by government, research and academic institutions).

2.3 Step 3 i): Framework 1 – Incentives for private investment

2.3.1 Approach

We use the term ‘incentives’ to describe the policies, subsidies, support, aid, assistance, fiscal policy and fiscal

instruments which shape private investment. The aim of Framework 1 is to understand how the public sector currently uses regulatory, economic and information instruments to shape private investment in a given sector. This review aims to capture both incentives for private investment in climate compatible activities within the sector, and incentives for ‘climate incompatible’ activities i.e. ‘disincentives’ for CCD.

For the purposes of this research, we are using a typology developed in Whitley (2013a) for the incentives framework, building on existing categories of subsidies and the industrial policy tools most commonly used to mobilise private finance. The list of examples within Figure 6 serves as an example and should be expanded and refined through the process of in-country application.

The results from this framework can be used by those aiming to mobilise private investment, to incorporate an understanding of incentives in wider decision-making processes around allocating climate finance. Such an approach would complement current interventions focused at the project level by linking these activities to the wider reshaping of incentives that drive investment at the sector or country level.

2.3.2 Key questions

To complete the framework on incentives for private investment (Figure 6), we have developed the following set of questions to guide the approach and research for a specific country and sector:

Primary question:

- What are the current incentives (regulatory, economic and information) in place to support private investment in Sector X, and what opportunities do they provide for promoting more climate-compatible investment?

Sub-questions:

- Do the existing policies for promoting private investment have implementation instruments, and are the existing regulations being enforced?
- Who are the target beneficiaries (i.e. which potential private investors – see Box 2 – and which sub-sectors)?

Box 2: Typology of private investors

- Households
- Smallholders and small businesses
- Large companies (domestic)
- Large companies (international)
- NGOs, foundations and charities
- Companies producing or selling carbon or ecosystem credits
- Local financial institutions (microfinance and retail finance)
- Financial intermediaries
- Funds and institutional investors

Figure 6: Template for Framework 1 – Incentives for private investment (in Sector X)

<p>Regulatory Instruments</p> <p>Influence behaviour through legality</p> <p>(funded through budget support or grants – see economic instruments)</p>	<ul style="list-style-type: none"> • Standards (for process and products) • Property rights / land rights and land use laws • Legally binding targets • Quotas • Licenses • Planning laws • Accounting systems (mandatory) • Copyright and patent protection (intellectual property rights) • Import / export restrictions • Enforcement
<p>Economic Instruments</p> <p>Influence behaviour through price</p>	<ul style="list-style-type: none"> • Access to resources (at reduced cost or free) • Taxes • Levies • Royalties • Tradeable permits • Budget support • Grants • Lending and guarantees <ul style="list-style-type: none"> ○ Debt – lending ○ Equity – investing ○ Guarantees • Insurance • Public procurement • User fees / charges • Price support or controls • Parallel infrastructure (roads and transmission lines)
<p>Information instruments</p> <p>Influence behaviour through awareness</p> <p>(funded through budget support or grants – see economic instruments)</p>	<ul style="list-style-type: none"> • Policies, plans and strategies • Research and development • Information centres • Statistical services • Awareness campaigns • Training / education • Industry associations • Transparency initiatives • Voluntary performance targets • Certification / labelling (voluntary) • Accounting systems (voluntary)

Degree of government influence

- Are there any specific sub-sectors highlighted within existing incentives?
- Are there any climate change considerations in the existing incentives frameworks?
- Do the current climate policies include incentives for private sector investment?

2.3.3 Sources of information

The information to complete Framework 1 is available through:

- interviews with key stakeholders (public and private actors, international and domestic) including representatives from the ministry of finance, state bank(s), relevant sector ministry(ies), departments, donor agencies, private companies, non-governmental organisations and civil society organisations, as well as researchers, academics and journalists
- reviews of documents from government departments and ministries, and external agencies responsible for implementing the relevant incentive(s) identified through interviews, and (where available) internal or independent audits or reviews of incentives
- government documents, including national and regional development plans, budget reports, ministerial reports and statements and sector strategies

- national-level investment climate and economic reviews completed by international agencies (OECD, World Bank, etc.)
- documentation of incentive reform processes (e.g. IMF reviews of fossil fuel subsidy and energy sector reforms)
- sector-level investment and investment climate reviews (by government, research and academic institutions).

For examples of Framework 1 completed for the energy, agriculture, water and sanitation and transport sectors, see Whitley and Tumushabe (2014), Whitley et al. (2014b), Darko et al. (2015), Canales Trujillo et al. (2015), and Norman et al. (2016a).

2.4 Step 3 ii): Framework 2 – Sources of capital (current) in Sector X

2.4.1 Approach

In addition to understanding incentives and the scale of investments at the country level, the design of interventions to mobilise private investment in CCD requires a clear picture of the sources of capital available. This is highlighted in the approach taken by the International Finance Corporation (IFC) (Figure 3), which seeks to subdivide investment into the categories ‘public’ and ‘private’ along with making distinctions between sources such as ‘dedicated climate funds’ and ‘institutional investors’.

Table 1: Typology of finance instruments (source Norman et al., 2016b forthcoming)

Instrument	Definition
Grants and in-kind contributions	Resources channelled without the expectation that the money will be repaid. Such resources are often used to cover technical assistance and capacity building or feasibility studies. They are also often offered to complement other instruments, including debt (loans).
Debt	Debt investors transfer resources with the expectation that the money will be repaid with interest. This includes corporate loans (in-country as well as cross-border); retail loans, such as credit to small businesses / smallholders; mortgages and micro-finance; balance sheet finance; project loans – non-recourse (in-country as well as cross-border); franchising and smallholder finance; as well as finance linked to goods or services; corporate and project bonds; and impact, climate or green bonds.
Equity	Equity investors own part of the company or assets and therefore depend on the results of the project to secure a financial return on their investments; they do not have any guarantee of repayment or return. In the case of failure of a project, the debt holders involved in the project have priority on any available returns over the equity investors. Includes private equity, venture capital (in-country as well as cross-border), and listed (public) equity and involves investment into a project or asset to leverage debt and achieve better returns
Guarantees and insurance	A guarantor undertakes to fulfil the obligations of a borrower to a lender in the event of non-performance or default of its obligations by the borrower, in exchange for a fee. Guarantees can cover the entire investment or just a portion of it. Risk mitigation instruments such as guarantees focus on reducing key default risks (technology, political etc.) at various points in the financing cycle. Insurance involves the transfer of the risk of a loss, from one entity to another in exchange for money.

Figure 7: Framework 2 – Sources of capital – completed for Uganda's energy sector (2008-2013 and planned)*

		ESTABLISHED				EMERGING		LIMITED	
Sub-sector / sources of capital		Hydro (large)	Hydro (small)	Thermal (heavy fuel oil)	Biomass (thermal)	Solar	Charcoal	Biogas	Geothermal
Grants (including philanthropy and CSR)	Public		International (Norway, GET FIT)	International (Norway)	International (GET FIT)	Domestic (MEMD)	Domestic (MEMD and MWE)	International (DGIS and African Union, KfW, WB, Norway)	International (EU AITF, ICEAID, African Union Commission, BMU and KfW - GRMF)
	Private*		International (UK)			International (US)	International (US - Harvest Fuel Initiative)		
Debt (OTC, market traded, microfinance etc.)	Public	International ^{III}	International ^{IV}	International (WB)	International (WB)				
	Private*	International (UK and South Africa)	International (UK, South Africa, Sri Lanka)	Domestic	Domestic	Domestic			
Equity (listed and unlisted, including balance sheet finance)	Public	Domestic (Energy Fund)	Domestic (REA)						
	Private*	International (Kenya and US)	International (Norway, British Virgin Islands, India)	Domestic	Domestic	International (Netherlands, Australia)	Domestic	Domestic (pilot stage)	
Guarantees (including loan insurance)	Public	International (WB)		International (Norway)		International (USAID)	International (USAID via GVEP)		
	Private*						International (foundations)		

* NGOs and charities included in 'Private'

** Wind power and Insurance not included as no information on this sub-sector and instrument were identified in the research on sources of capital.

^I WB, EIB, EC, ADC and UNDP, GET FIT; ^{II} DANIDA, EU and DGIS, USAID, NDF, GEF, FAO, UNDP, UNCDF and BIO;

^{III} IFC, AfDB, EIB, KfW, FMO and Chinese Ex Im Bank ^{IV} PTA Bank, AfDB, PIDG, FMO, DBSA, DEG, KfW, OeEB, IFC, and Finnfund

*Note: *Where more detail is available on the specific public and private actors (i.e. ministry, institution or budget line for public finance, and institution for private finance) this is included in footnotes to Framework 2, parallel detailed tables, or an Annex to the report.*

Source: Whitley and Tumushabe (2014)

Building on the work of the IFC, we have developed a simplified typology of instruments that have been used to drive private investment in the key sectors for CCD (see Table 1 and Appendices 1 and 2). For Framework 2, we looked to a typology of instruments developed in Green Climate Fund (2013), which already included grants (including for technical assistance and capacity building), concessional lending (debt), equity instruments and guarantees, and to which we added insurance (see Table 1). As outlined in the Green Climate Fund report, each instrument can be applied through a number of modalities (such as credit lines, performance-based payments, public-private partnerships (PPPs) and advanced market commitments). As these are applied in a given country or sector, they are explained in greater detail in the text accompanying the framework. These instruments are then subdivided in terms of the source of capital: public or private, and domestic or international.

Framework 2 has been developed in recognition of the facts that 'climate finance' is a nebulous term (including its relationship with official development assistance (ODA) and other forms of sustainable development support), that the boundaries between 'mitigation activities' and 'adaptation activities' are not clear-cut, and that these are not

distinctions the private sector uses when considering making investments. The line between private and public finance is also highly nuanced (e.g. private sector money being used to capitalise national development banks or to finance projects indirectly through public sector bond issuance). While these categories are not always clear, we have made a conservative judgement for each source of capital included, as can be seen in the framework as it has been applied to Uganda's energy sector (see Figure 8). Building on lessons from exercises in tracking private climate finance (Illman et al., 2014; Whitley, 2013b), references are included for each project and company in the completed framework, so the underlying information is transparent.

2.4.2 Key questions

To complete the framework on sources of capital (Figure 7), we have developed the following set of questions to guide the approach and research for a specific country and sector:

Primary question:

- What are the current sources of capital both public and private in Sector X?

Sub-questions:

- What are the major investments in the sector and what are their sources of funding? (public or private, domestic or international), and how are they financed? (what type of instruments – see Table 1)
- In which sub-sectors is there more private investment and why?
- What are the sub-sectors and private investors (see Box 2) that are not receiving private investment and why?
- Are there public finance interventions identified in Framework 2 that should also be included (at a higher level) under the economic instruments section of Framework 1? (i.e. grants, debt, equity, insurance)?

2.4.3 Sources of information

The information to complete Framework 2 is primarily available in:

- local media (newspapers and websites)
- corporate documents (annual reports), company websites and press releases
- industry, trade and professional publications
- project and programme documentation, websites and press releases of international financial institutions, bilateral and donor agencies.

While such granular information, by both sub-sector and instrument (source of capital), may be collected at present by national governments and international agencies, it is often not publicly available through these sources.

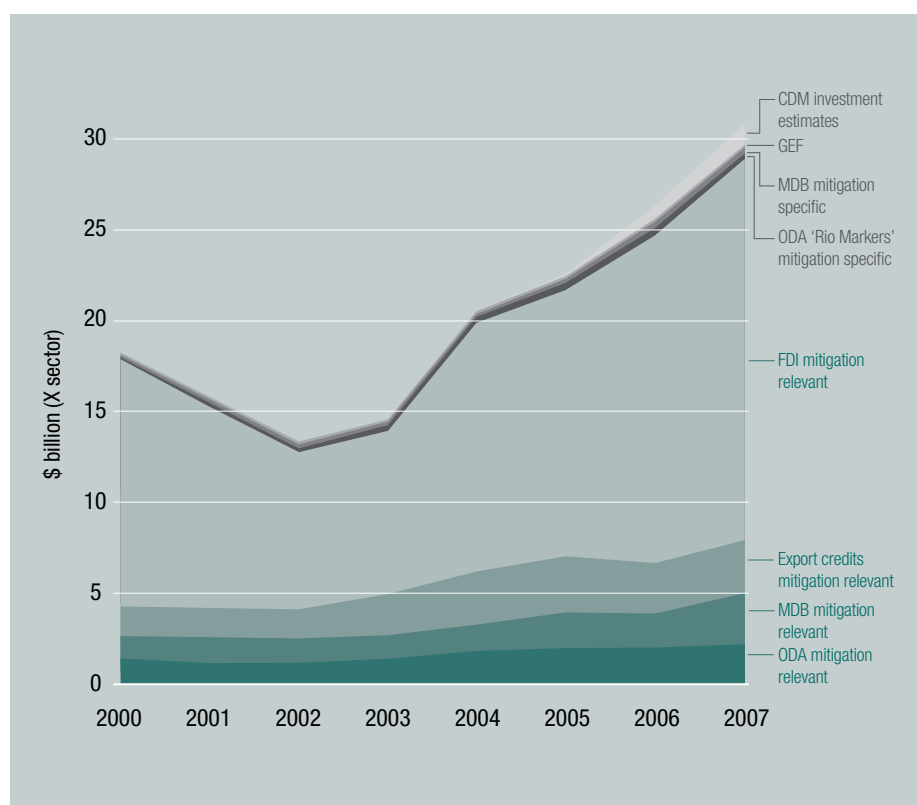
For examples of Framework 2 completed for the energy, agriculture, water and sanitation and transport sectors, see Whitley and Tumushabe (2014), Whitley et al. (2014b), Darko et al. (2015), Canales Trujillo et al. (2015), and Norman et al. (2016a).

2.5 Step 3 iii): Framework 3 – scale of support (historic) in Sector X

2.5.1 Approach

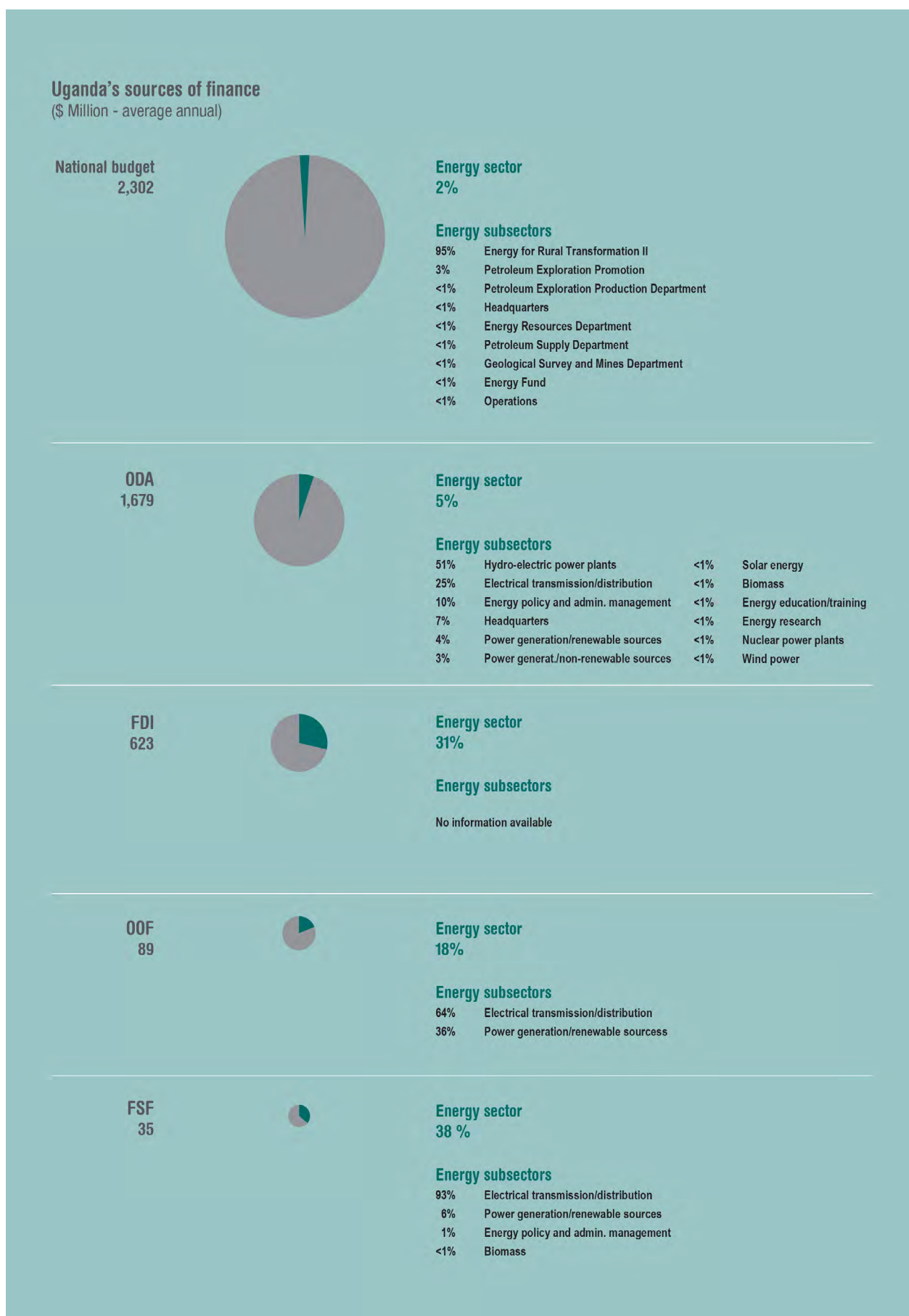
The aim of Framework 3 scale of support analysis is to track shifts in investment over time at the sub-sector level and, if possible, also by source (international, domestic, public and private). In developing Framework 3, we referenced analysis completed in 2009 by the OECD, which tracked climate-specific (climate-positive) and climate-relevant investment at the global level over time (see Figure 8). We anticipated some of the information required could be found within the different international datasets referenced by the OECD in Figure 8, and could be used to complement national-level data.

Figure 8: Estimated mitigation relevant investment flows



Source: Corfee-Morlot et al. (OECD, 2009).

Figure 9: Framework 3 – Scale of support (historic) – completed for Uganda's energy sector (annual average where information available 2005-2013)



Although this approach to data collection will be critical for future research on the effectiveness of governments in mobilising private climate finance (see Section 3) – it has not been possible to complete Framework 3 as envisaged in Figure 8 for any of the countries and sectors reviewed. This is because of significant gaps in international and national datasets, in terms of both year and sub-sector coverage. In many cases, it was not possible to identify levels of private investment in the sector beyond foreign direct investment (FDI), as none of the national or international datasets covered domestic investment. In many cases, it was also not possible to find sub-sector information for FDI.

Where comparable datasets over time are not available, in order to highlight the trends observed based on the available information, average annual investment (or support provided) can be estimated across multiple years. This enables a comparison of sector- (and sub-sector-) level investment with investment to the country as a whole (see Figure 9). As each data provider may use different sub-sector categories, and these can be shown in order to demonstrate the opportunities both for additional investment data collection and transparency, but also for harmonisation across datasets.

2.5.2 Key questions

To complete the framework on scale of support (historic) (Figure 9), we have developed the following set of questions to guide the approach and research for a specific country and sector:

Primary question:

- What are the historic levels of investment, both public and private?
- Sub-questions:
 - What are the sub-sector divisions in the international datasets for the given country? How do these differ from the sub-sector breakdown for the same sector under the ISIC code, and from the sub-sector breakdown used in Framework 2?
 - Have there been any changes in levels of support from different sources over time?
 - Can these changes in levels of investment be linked to any of the current or historic incentives identified in Framework 1?

2.5.3 Sources of information

This analysis is to be completed at sector level using comparable data across different years (where possible) from domestic and international data sources. It can include the sources referenced in the template OECD graphic (Figure 8), such as the UN Conference on Trade and Development (UNCTAD) for FDI¹⁶ data and OECD data on ODA and other official flows (OOF).¹⁷

Other potential sources of information on investment at sector and sub-sector level may include:

- domestic agencies for statistics, investment and the central bank
- domestic and international industry associations
- sector and sub-sector-level investment datasets (where these have been compiled for a particular country, sector or sub-sector)
- PPPs captured through the World Bank World Development Indicators
- transparency initiatives, such as the Extractive Industries Transparency Initiative, the Transparency and Accountability Initiative, the Open Government Initiative and Publish What You Pay/Fund
- climate finance analysis (including Climate Funds Update and Fast Start Finance (FSF) reviews by ODI) and OECD tracking of climate tagged ODA (supporting mitigation and adaptation)
- information from the UNFCCC Clean Development Mechanism database and registries of voluntary carbon standards including the Verified Carbon Standard and the Gold Standard.

For examples of Framework 3 completed for the energy, agriculture, water and sanitation and transport sectors, see Whitley and Tumushabe (2014), Whitley et al. (2014b), Darko et al. (2015), Canales Trujillo et al. (2015), and Norman et al. (2016a).

2.6 Step 4: Analysis

Where information is available to complete all or part of the three frameworks, it is possible to combine findings across each framework, and from the context analysis in Step 2 to complete an initial high-level analysis of the possible opportunities to mobilise private climate finance in the given sector and country. Box 3 includes the key findings for such opportunities in Uganda's energy sector. This information can also be used to support the design of specific interventions to mobilise private climate finance at sector- and sub-sector-level using the guidance in Figure 4.

¹⁶ Foreign direct investment is defined as investment from one country into another (normally by companies rather than governments) that involves establishing operations or acquiring tangible assets, including stakes in other businesses (Financial Times, 2016).

¹⁷ Other official flows, include refinancing loans, that are considered to be for development purposes, but which have too low a grant element to qualify as ODA (OECD, 2016).

Box 3: Key findings from application of the diagnostic in Uganda's energy sector

Current context – results from diagnostic

- The historic focus of the government of Uganda and its development partners on grid extension, the development of large hydro projects and back-up thermal power has taken place in the absence of parallel instruments oriented towards private financing of technologies for cooking, and off-grid or mini-grid solutions that would have an impact on the greatest (and poorest) proportion of the Ugandan population. Government resources, such as the Energy Fund and the Petroleum Fund, could be applied to energy sector investment more broadly.
- Focusing on smaller-scale projects will not only fill a gap left by Government of Uganda and development partners but also address the investment gap identified by a number of small-scale project developers that has resulted from the sharp decline in carbon prices in recent years. Such a focus would also support areas where the private sector is less inclined to invest because of the common barriers of high transactions costs in proportion to overall deal size.

Examples of mobilised private finance – including for renewable electricity

- Government of Uganda has attracted private investment in electricity generation assets through unbundling and privatisation of elements of the electricity sector, establishment of a transparent and effective Electricity Regulatory Authority (ERA), Renewable Energy Feed-in Tariffs (REFITs) (topped up through the Global Energy Transfer Feed-in Tariff (GET FiT) programme) and template Power Purchase Agreements and Investment Agreements. There are opportunities to replicate these approaches in other countries (with similar objectives) with donor support through the innovative use of grants to top up REFITs.

Potential incentives – recommendations

- Government of Uganda and its development partners need to design financial instruments, in participation with local financial institutions, that suit the current environment, as most local companies are start-ups without significant cash flows. The majority of current support instruments can be accessed only by foreign entities (as shown in the small solar and small hydro sub-sectors). To change this requires recognition that different private actors and sources of capital are important for different sub-sectors and scales of investment, and that government and donor support must take into account the structure of the local capital markets.
- Information on energy sector investment can also be scaled up and harmonised through support to the current holders of these data, which include not only government ministries but also often the press and non-profit organisations. This would include support for the Rural Electrification Agency (REA) to track investment in off-grid projects and formalisation of the biomass cooking sector.

3 Next steps

3.1 Mobilising public and private climate finance (financing NDCs)

The recent Paris Agreement in December 2015 and individual country mitigation and adaptation commitments set out in Intended Nationally Determined Contributions (I)NDCs detail how each Party to the UNFCCC plans to contribute to averting dangerous climate change and demonstrate progress from its current position. The (I)NDC commitments make links to policies and plans and detail key priorities for reducing emissions and adapting to climate change.

Estimating costs and financial needs has been varied in (I)NDCs submitted to date (Hedger and Nakhoda, 2015) and it is clear that more information and data are needed for countries to be able to implement and finance their proposed climate mitigation and adaptation actions so as to meet overall emission reduction commitments by 2030. For example, Box 4 highlights the scale of the challenge for Ghana in meeting the financing needs to implement its agriculture and forest NDC commitments.

The information collected by applying our methodology for mapping incentives and investment at country and sector level (Whitley et al., 2016) can inform five important considerations for countries as they seek to finalise and finance their NDCs (from both public and private sources).

Examples of supporting data that can be tracked at country and sector level on public and private climate finance flows (using Frameworks 2 and 3):

1. The average annual levels of climate finance flowing to the countries for a specific sector and already supporting key climate actions set out in a given country's NDC.
2. The average annual level of other finance flowing to the sector which is not necessarily supporting climate compatible goals (including domestic public government spend, FDI, wider international ODA) and which could be shifted towards supporting climate compatible development in the sector. There are opportunities to further research and consider the best ways to 'mainstream' climate within these existing flows and so reduce the scale of new finance needed between 2020 and 2030 to fund the country's NDC.
3. The current average annual finance gap (based on available information set out in the country NDCs where costs are listed) between finance already flowing and the costs of delivering climate mitigation and adaptation actions in the sector by 2030. Examples of potential actions to shift and mobilise public and private climate finance (using Frameworks 1 and 2).

Box 4: Ghana's climate change commitments and financial needs

Consistent with other countries in sub-Saharan Africa, the most significant sources of agriculture finance in Ghana are FDI (averaging \$124 million annually) and international public finance mainly through ODA (averaging around \$117 million annually). While ODA has historically provided high levels of investment in agriculture in Ghana, the annual contributions have fallen in recent years, almost halving since a peak of \$220 million in 2011.

As a result, Ghana has an objective to both ramp up the national budget for agriculture and – as part of its (I)NDC – seek to increase climate compatible investment in Ghana. The government of Ghana has committed to allocate and spend at least 10% of the national budget on agriculture. The government has also outlined that Ghana will need to mobilise \$23 billion in international and domestic support for the mitigation and adaptation pledges included in the country's (I)NDC under the UNFCCC between 2020 and 2030.

At least \$3.2 billion or an average of \$320 million annually is expected to be spent on climate resilient agriculture, with forestry financial needs estimated at \$6.3 billion by 2030 or \$630 million per year between 2020 and 2030 as part of the INDC commitment. While the proportion expected to be financed by the private sector is not specified, 14.2% of finance overall is expected to come from the domestic private sector and 16.8% from international private capital investment.

If Ghana is to meet the financial investment requirements of its NDC, the country can either seek to mobilise at least \$950 million annually in new climate compatible investment from public and private sources or also look to mainstream climate within the existing finance flowing to agriculture that have been identified in this study (through FDI, ODA, national budget and climate finance, which already averages \$405 million annually).

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4. The current barriers (regulatory and fiscal) that need to be addressed in order to deliver the proposed climate mitigation and adaptation actions.
 5. The opportunities to redirect existing budget sources, fiscal policy tools, and financial instruments to support a country's NDC planned actions and outcomes.

3.2 Tracking public and private climate finance

Over the medium term, the absence of publicly available information on historic levels of investment has significant implications for tracking climate finance effectiveness, and not only as it pertains to mobilising further private capital. If it is not possible to track support and investment at sub-sector level, it is not possible to make a causal link between the support provided and any shifts or increases in climate-compatible activities and investment. It would be useful to look into the following questions on data availability for private climate finance assessments.

- To what extent is investment data for climate-relevant sectors transparent, comparable and publicly available?
- What is the cost (time and financial) of accessing data?
- Who are the data-holders in a given country/sector – and what are the drivers behind and barriers to making information open and transparent?

This work could build on existing open data and data transparency initiatives. One possibility could be to look at countries that have already accepted and adopted open data protocols, including the US (data.gov), the UK (data.gov.uk and openai.org), and Kenya (opendata.go.ke). In addition, there could be an opportunity to influence the next version of the UN's ISIC, which is widely used both nationally and internationally for compiling economic and social statistics, including the investment data necessary for this diagnostic.

Each UN ISIC Section is subdivided into divisions, groups and classes. In many cases, the divisions, groups and classes provided under UN ISIC (and country level investment tracking systems) are not granular enough for us to use in tracking and informing climate finance. For example, the most granular class within the group, 3150: 'Electric power generation, transmission and distribution', includes 'Operation of generation facilities that produce electric energy, including thermal, nuclear, hydroelectric, gas turbine, diesel and renewable'. This would need to be split into multiple classes to allow for tracking of public and private support shifting from high-carbon to low-carbon sources of energy.

Future work could include seeking out opportunities for international institutions and country governments to provide more granular data that better reflect the finance data that are necessary at both the national and the international level for tracking progress towards objectives on climate change, green growth and wider development goals.

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Appendix 1: Climate-relevant sectors*

Included ISIC sectors:

1. Agriculture forestry and fishing
2. (Extractives) Mining and quarrying
3. Manufacturing
4. (Energy) Electricity, gas, steam and air conditioning supply
5. (Water and Waste) Water supply; sewerage, waste management and remediation activities
6. Construction
7. (Transport) Transportation and storage
8. Information and communication technology

Excluded ISIC sectors:

1. Wholesale and retail trade; repair of motor vehicles and motorcycles
2. Accommodation and food service activities
3. Financial and insurance activities
4. Real estate activities
5. Professional, scientific and technical activities
6. Administrative and support service activities
7. Public administration and defence; compulsory social security
8. Education
9. Q Human health and social work activities
10. R Arts, entertainment and recreation
11. S Other service activities
12. T Activities of households as employers
13. U Activities of extraterritorial organisations and bodies

Note: * Preliminary list based on Climate Bonds Initiative (2015) and UN (2008).

Appendix 2: Climate-relevant sub-sectors

Each ISIC section (or ‘sector’ for the purpose of this research) is subdivided into divisions, groups and classes (see Appendix 1). In the case of each ISIC sector reviewed thus far (energy, agriculture, water and waste and transport), the divisions, groups and classes were not granular enough for us to use in informing the mobilisation of climate finance. As a result, we have established a set of sub-sector categories for use in this analysis (in particular in Framework 2) to ensure enough data were collected on incentives and investment to begin to distinguish between ‘climate-compatible’ and ‘climate-incompatible’ activities.

An opportunity for future research could be to understand if and how ISIC guidance might become more granular to support climate finance tracking. For example, Energy Class (sub-sector) 3150, which currently includes operation of generation facilities that produce electric energy, including thermal, nuclear, hydroelectric, gas turbine, diesel and renewable, could be broken down into multiple classes.

Energy sector (developed in Uganda country study), divided by energy source

- Hydro power (large)
- Hydro power (small)
- Thermal power
- Biomass
- Solar
- Charcoal
- Biogas

Source: Whitley and Tumushabe (2014).

Table 2: Agriculture sector (developed in Zambia desk study and Ghana country study), divided by agricultural commodity and scale

Zambia	Ghana
Smallholder farmers (primarily)	Smallholder farmers (primarily)
- Maize	- Cashew
- Cassava	- Maize
- Groundnuts/peanuts	- Cassava
	- Shea
	- Also: garden vegetables, yam, cocoyam, groundnut and sweet potato
n/a	Smallholder farmers (primarily) – with significant public sector support
	- Cocoa
Mixed farm scales	Mixed farm scales
- Livestock	- Rubber
	- Rice
	- Oil palm
	- Fruits
	- Livestock
Commercial agribusiness using smallholder out-grower schemes	n/a
- Tobacco	
- Horticulture/floriculture	
- Cotton	
Commercial agribusiness	Commercial agribusiness
- Coffee	- Cotton
- Wheat	- Flowers
- Soybeans	- Tobacco
	- Coffee
	- Sugarcane
	- Plantain

Source: Whitley et al. (2014b) and Norman et al. (2016a).

Water and sanitation sector (developed in Viet Nam country study - Wastewater treatment (household and industrial))

- Water treatment (household and industrial)
- Wastewater collection (drainage and flood control)
- Urban water supply and sanitation (household and industrial)
- Rural water supply and sanitation
- Solid waste
- Irrigation), divided (in part) between urban and rural supply

Source: Canales Trujillo et al. (2015).

Transport sector (developed in Viet Nam country study), divided into land, air, water and storage and infrastructure and operations

Land (infrastructure and operations)

- Roads and bridges
- Bus and taxi stations
- Railways
- Railway stations
- Pipelines (gas, oil, water)
- Cars, coaches, trucks, bikes and motorbikes
- Trains and urban metro

Air (infrastructure and operations)

- Airports
- Airplanes, helicopters and seaplanes
- Satellites

Water (infrastructure and operations)

- Seaports
- Inland ports and waterways
- Passenger and commercial boats and ships

Storage (infrastructure and operations)

- Warehouses
- Silos
- Cargo facilities

Source: Darko et al. (2015).



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This material has been funded by UK aid from the UK Government, however the views expressed do not necessarily reflect the UK Government's official policies.

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