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Master's Programme in Innovative Sustainable Energy Engineering (Energy Systems)

Unlocking clean energy investments through financial de-risking instruments

An analysis of the barriers hindering the practical implementation of financial de-risking instruments for mobilising private capital towards clean energy projects in emerging markets and developing economies and an assessment of the changes required to overcome them.

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Abstract

This Master's thesis investigates how the barriers that prevent the practical implementation of financial de-risking instruments for clean energy projects in emerging markets and developing economies (EMDEs)[1] can be overcome. Based on expert interviews, five barriers that hinder the implementation of financial de-risking instruments for clean energy projects in EMDEs have been identified. To overcome these barriers, four required changes are presented: the standardisation of instruments and processes, enhanced donor education, stronger orchestration and alignment of stakeholders, and the improvement of the project pipeline. This thesis discusses that while the limited utilisation of financial de-risking instruments may not represent the primary bottleneck for mobilising private capital towards clean energy projects in EMDEs and scaling the application of these instruments is not a primary focus amongst experts, the changes identified through this research remain relevant. They address broader, systemic barriers faced by investors, facilitate private capital mobilisation, and promote the wider adoption of clean energy technologies.

Keywords financial de-risking instruments - clean energy - mobilising private capital - energy projects - development - emerging markets and developing economies (EMDEs)

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Foreword and acknowledgements

Creating and designing your Master's thesis from scratch in a field that is related to but not directly covered by your study programme has been an incredibly intense and, most of all, rewarding journey (disclaimer: as is every thesis, I hope). Especially when deciding to conduct expert interviews in a field where you hope to continue your career, really makes you want to bring your A-game. If you are willing to invest your time, energy, nerves, excitement, and dedication, I can highly recommend this type of Master's thesis as it will be totally worth it.

My best tip for someone that will also do an interview-based thesis in the future: make sure you have a big space with empty walls at your disposal without a time restriction. The photo below shows the current state of my basement, which is of course not as much of a chaos as it looks: different colours of post-its and markers indicate different characteristics of interviewees. One of my roommates, who walked into the basement before I had the chance to send an update on my project, wrote in our group chat: "*Is it a genius or a psychopath working down here?*" - I like to believe it is the first of course. :)

The Thesis that you have here in front of you, and you are hopefully going to read, would not have been possible without the support of many people who I would like to thank. First of all, I would like to thank my supervisors from Aalto, Iivo Vehviläinen, and KTH, Maryna Henrysson. Thank you both for your trust in me, opening your professional networks to connect me with experts in this field. Iivo, thank you for your clear feedback that has helped me build confidence. Maryna, thank you for your honesty and directness, especially while I was shaping my research - sharpening my thinking to its fullest potential.

Another special thanks goes to all the interviewees for your time, engagement and willingness to contribute. I hope this is not the last time we will be in contact.

My outreach would not have been this successful without the help of everyone who has reposted my LinkedIn post, forwarded contacts and introduced me to experts. I will personally get in touch with you to thank you. Furthermore, the sessions organised by and one-on-one meetings with these experts have been incredibly helpful: thank you to all the KTH library staff. Thank you to my proofreaders Matti and Ties. The next big thank you is for the ISEE crew, especially Anna, Clara, Paul, Soham and Mattia for.. Just being you, being here and sharing this journey.

The final and biggest, best thank you goes to my family: my not-so-little brother Thomas, my mom Sandrine and especially my dad Wouter. Thank you for being better than any ChatGPT or AI tool and always being there. Always there to share my excitement with when I got a response from an expert, to brainstorm with me on challenges that I encountered and to support me when I needed an energy boost; even though this often happened by just listening to my stories and simply wishing me "good luck".

If you have any questions, thoughts, or remarks after reading this thesis you would like to discuss or share, please do not hesitate to reach out (mail: florine.crul@posteo.net).

Excited for what is to come,

Florine Roëlle Crul
Hägersten, Stockholm, 30-05-2025

Abbreviations

CIF	Climate Investment Fund
CTCN	Climate Technology Centre and Network
DFI	Development Finance Institution
GCF	Green Climate Fund
GEF	Global Environment Facility
IEA	International Energy Agency
IFC	International Finance Corporation
IPCC	International Panel on Climate Change
IRENA	International Renewable Energy Agency
MDB	Multilateral Development Bank
TA	Thematic Analysis
OECD	Organisation for Economic Co-operation and Development
UNEP(-CCC)	United Nations Environmental Programme (-Copenhagen Climate Centre)
UNFCCC	United Nations Framework Convention on Climate Change

Glossary

Advanced economies - All countries that are part of the OECD, next to Bulgaria, Croatia, Cyprus, Malta, and Romania (IEA, n.d.).

Asset - Physical infrastructure such as solar farms, wind turbines, transmission lines, and energy storage facilities for energy systems (IRENA, 2024).

Bilateral institutions - Organizations funded by one government and provide financial support or technical assistance to another country (Violetti et al., 2023).

Bond - Financial tools that allow organisations to borrow funds from investors, promising scheduled interest payments and repayment of the original investment after a set period.

Capital structure - The combination of different types of funding (debt and equity) that is used to finance a project or entity.

Catalytic capital - Funds that are deployed with the main objective to mobilise private capital (Convergence, 2024).

Clean energy - Energy that is produced in a way that aligns with the goals of a net-zero emissions energy system (IEA, n.d.).

Commercial capital - Funds with the main objective to make and maximize profit, can be private or public in origin (Convergence, 2024).

Concessional capital - Capital provided on more favorable conditions than offered in the market, such as lower interest rates or longer repayment periods (OECD, 2024).

Contingent instruments - Instruments through which financial support is provided, only when a predefined trigger is met.

Cost of capital - The costs that have to be paid to obtain external funding for financing a project or entity.

Debt - Capital provided by an external lender that needs to be repaid, usually with interest. Umbrella term that includes loans, bonds and lines of credit amongst others.

Default - State of an entity where it cannot fulfill a financial obligation, for example to repay a loan.

Derivatives - Financial contracts where two or more parties agree today on the future price of an asset or item.

Equity - Capital provided to a project or entity in exchange for ownership rights or shares (Amin et al., 2014).

Emerging Markets and Developing Economies (EMDEs) - All countries outside the advanced economies grouping (IEA, n.d.).

Grant - Funding provided for which no repayment is required (African Development Bank et al., 2021).

Guarantee - A commitment by a guarantor to fulfill a borrower's obligation in case the borrower fails to do so (Amin et al., 2014).

Insurance - Financial compensation provided to cover losses after a specific, predefined event.

Interest - The cost of borrowing money, typically expressed as a percentage of the principal amount, paid by the borrower to the lender.

Leverage rate - The amount of commercial capital mobilised through concessional capital (Convergence, 2024).

Line of Credit - A flexible loan arrangement where funds are made available by a lender and can be withdrawn when required (Habbel et al., 2021).

Loan - The transfer of capital to a borrower for which repayment is required, usually with interest (African Development Bank et al., 2021).

Maturity - The date on which the final payment for a debt obligation needs to be made.

Mezzanine instruments - Financial structure where the mezzanine or first-loss capital is consumed first in the case of loss. Therefore, it protects other, more senior investments (Habbel et al., 2021).

Multilateral institutions - Organizations funded by multiple governments that pool resources together to reach shared goals (Violetti et al., 2023).

National capital - Funding provided by the local government to support local programs or entities (Violetti et al., 2023), also called domestic capital.

Net-zero - When emissions are compensated by the removals (UNEP, 2024).

Perceived risk - The uncertainty investors feel and experience when making an investment decision, based on subjective judgment.

Policy-based finance - Funding provided to support government policy reforms or institutional changes, often linked to achieving specific policy goals (African Development Bank et al., 2021).

Private capital - The use of personal or corporate funds from individuals, private companies, or non-governmentally owned entities - such as pensions, savings, or revenue. The main objective is to achieve financial returns.

Public capital - The use of funds that originate from government institutions. Often managed by public agencies or development organisations. The main objective is to promote social, economic, or infrastructural development rather than maximizing financial returns (Violetti et al., 2023).

Real risk - Quantifiable risk, risk that can be proven to be present.

Renewable energy - Natural energy sources that are replenished by a higher rate than they are consumed, such as bio-, wind, geothermal, hydro, and solar energy (United Nations, n.d.).

Results-based finance - Funding provided to facilitate the delivery of a specified set of results (Hussain, 2013). The capital is not necessarily paid at once, but can be paid in parts where the next part follows once certain results are accomplished.

Soft currency - Currencies that are prone to fluctuations (Chen, 2022).

Syndication - The activity where multiple investors or lenders join together to fund a single project or entity (Habbel et al., 2024).

Sustainable energy - Energy obtained from sources that can fulfil our current energy needs without negatively affecting future generations (Johns Hopkins University, 2025).

Technical Assistance (TA) - The transfer of knowledge, services, engineering, and skills through targeted support for, for example, supporting project preparation and implementation (World Bank, 1996).

Zero emissions - A state where no greenhouse gases are emitted into the atmosphere, achieved through renewable energy sources or carbon capture (IEA, n.d.)

1 Introduction

The year 2023 marked the hottest on record, until it was surpassed by 2024 (IEA, 2025). This ongoing rise in global temperatures contributes to more frequent and severe climate-related disasters, threatens ecosystems, and poses serious risks to all organisms' health and livelihoods. The scientific consensus is clear: human activities are the primary driver of global warming, mainly through greenhouse gas emissions (IPCC, 2023). Carbon dioxide alone accounts for 74% of the total greenhouse gas emissions (Ge et al., 2024). While carbon emissions in advanced economies declined in 2024, overall global carbon emissions continued to rise, driven by increased emissions from emerging markets and developing economies (EMDEs) (IEA, 2025).

The energy sector is the most significant contributor, responsible for over 75% of global greenhouse gas emissions (Ge et al., 2024). In EMDEs, emissions related to energy consumption rose by 1.5% over 2024 (IEA, 2025). This increase in energy demand is primarily driven by the population and economic growth experienced by these countries. Currently, nearly two-thirds of the global population lives in EMDEs, and future population growth is expected to be concentrated in these regions. Simultaneously, most of the world's population that currently lacks access to energy or clean cooking facilities are also found in EMDEs. As a result, EMDEs are expected to account for the largest share of future global energy demand growth (IEA, 2021). Given these trends, transitioning to a net-zero energy system, where greenhouse gas emissions are balanced by removals (UNEP,2024), is essential to mitigate global emissions and limit further planet heating.

Clean energy technologies are energy technologies that are compatible with a net-zero emissions pathway. Clean energy includes renewable energy sources, nuclear power, and fossil fuels equipped with carbon capture, utilisation and storage, as well as supporting technologies such as battery storage and electricity grids (IEA, n.d.). Renewable energy is energy derived from natural sources that replenish faster than consumed (United Nations, n.d.). Clean energy often falls, but not by definition, under sustainable energy. Sustainable energy goes beyond just environmental impact and considers social and economic impact (Johns Hopkins University, 2025).

Figure 1.1 provides an overview of global clean energy investments per region. This figure shows that, even though EMDEs (excluding China) represent nearly two-thirds of the world's population, they account for only 15% of global clean energy investments. These investments are mainly made into energy assets. Assets are the physical infrastructure, such as solar farms, wind turbines, transmission lines, and energy storage facilities, of which clean energy systems consist. These assets are often financed through project financing structures (IRENA, 2024). In project financing structures, funding is secured, and initial investments will be earned back based on the projected revenues generated by the project (Hussain, 2013).

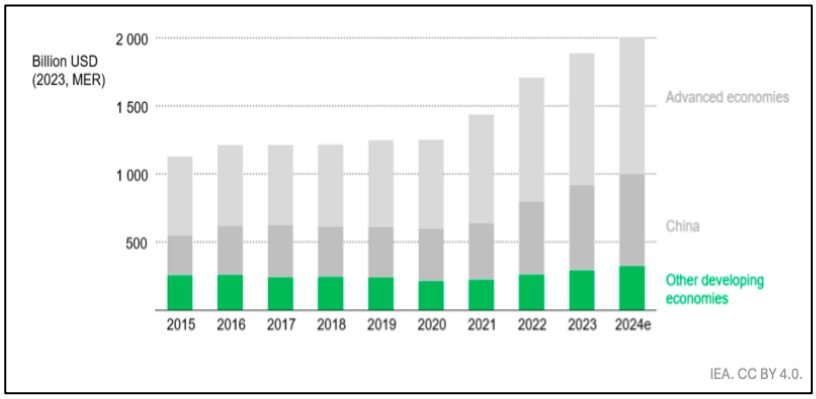

Figure 1.1 - Global clean energy investment by region (IEA, 2024)

The financing of clean energy projects in EMDEs typically involves two primary sources of capital: public and private. Public finance originates from, or is channelled through, government institutions and development agencies, primarily promoting social and economic welfare rather than maximizing financial returns (Violetti et al, 2023). It often accepts higher risks and longer investment horizons to support early-stage or high-impact projects. In contrast, private capital providers, such as private banks, pension funds, and institutional investors, aim to earn profits that match what the overall market offers, while also considering the level of risk involved. This is called market-level, risk-adjusted returns. Therefore, they invest in projects with proven technologies and lower perceived risks.

1.1 Problem statement

Nearly two-thirds of the global required investments to reach a net-zero pathway need to be done in EMDEs (Lopez Claros, 2021). According to the UNEP Emission Gap Report (2024) and the UNEP-CCC Climate Technology Progress Report (2024), investments in renewable energy technologies in EMDEs remain low despite the technology maturity. They must increase at least six times to align with a net-zero pathway and mobilise the estimated 9.1 trillion USD required by 2035.

According to Park & Browne (2025), public funding cannot cover the investments necessary to cover this financing requirement. Therefore, providing private capital is essential to finance the energy transition in EMDEs (IEA & IFC, 2023). The scarcely available public funds can and need to be deployed more efficiently and catalytically to de-risk investments and leverage capital, meaning that every dollar of public funding helps to attract private investments (OECD, 2022; IRENA, 2025). Private capital providers, however, are often reluctant to invest in these markets or projects as they involve higher risks without offering higher financial benefits compared to safer or more well-known alternatives.

To mobilise the private capital that is required for and increase the investments towards clean energy deployment, financial de-risking instruments, such as performance-based grants, green bonds, sustainability-linked loans, first loss capital or equity instruments, can be used and help to overcome these high perceived risks (Habbel et al, 2021). Each of these financial instruments comes with its value proposition, opportunities and potential risk for funders. International development and

financial institutions agree that investment support through financial de-risking instruments is crucial to build confidence amongst private financiers, which will result in the mobilisation of their capital to upscale the deployment of clean energy technologies in EMDEs (UNEP-CCC & CTCN, 2024; Convergence Blended Finance, 2024; IRENA, 2025; OECD, 2023).

This thesis is motivated by the observation that despite the importance of these financial instruments in academic and policy literature, detailed insights into their practical application and effectiveness remain limited. The small share of private capital flowing towards climate action mobilised through these instruments suggests that some instruments are underutilised and effective implementation is lacking (OECD, 2023).

1.2 Aim, research question and objectives

This thesis investigates the difference between the financial de-risking instruments proposed in the literature to mobilise private capital for clean energy projects in EMDEs and the degree of their adoption. By analysing this gap through a literature review and expert interviews, the research aims to identify the barriers and drivers influencing the adoption of specific financial instruments and to examine how these barriers can be overcome so these instruments can help more effectively mobilise private capital. This leads to the research question:

How can the barriers preventing the practical implementation of financial de-risking instruments for clean energy projects in EMDEs be overcome?

To answer this question, the following research objectives have been identified:

1. To examine the discrepancy between theoretically proposed de-risking instruments and the degree of their real-world adoption

2. To identify the barriers and obstacles that prevent the application of these financial instruments in practice.

3. To propose necessary changes or interventions to overcome these barriers and generate insights to provide practical guidance for capital mobilisers.

By examining the factors contributing to the gap between theory and practice, this thesis will highlight general changes that, if addressed, could support a greater application of financial de-risking instruments, ultimately contributing to mobilising capital and accelerating the deployment of clean energy in EMDEs.

1.3 Outline of thesis

Chapter 2 consists of the relevant background on the topic. The chapter includes the identification and selection of the financial de-risking instruments, as well as an assessment of the clean energy investment landscape, including associated risks and investment barriers. Furthermore, this chapter touches upon the role and objectives of the stakeholders involved in clean energy development in EMDEs. Chapter three describes the methodology used for this research based on the interviews. The next chapter, chapter four, presents the interview results and the data analysis. The current use of instruments by the interviewees, key barriers for their implementation,

required changes to overcome these barriers and current trends are identified. Additionally, this chapter compares the results from the thematic analysis done by the researcher with the results from the AI tool-supported analysis. Chapter five discusses the results presented in chapter four, puts them in context and enriches them with literature. The final chapter, chapter six, summarises the main findings which answer the research question and concludes with recommendations for future research.

2 Background

This background section primarily draws on grey literature reports and publications from international organisations and independent institutions, such as the International Energy Agency (IEA), the International Finance Corporation (IFC), the United Nations Environmental Program (UNEP), and the Organisation for Economic Co-operation and Development (OECD). Given the relatively recent and practice-oriented nature of clean energy investment and financial de-risking instruments in EMDEs, the available and most up-to-date information is produced by policy institutions, development finance organisations, and specialised research associations rather than through academic journals.

This chapter aims to provide essential context for the analysis that follows. It begins by outlining the selected financial de-risking instruments, highlighting their respective advantages and limitations. Section 2.2 presents an overview of clean energy projects, detailing their typical financing structures, associated risks, and major investment barriers. Finally, Section 2.3 introduces the key stakeholders involved in this landscape and describes their roles and characteristics.

2.1 Financial de-risking instruments

Various financial instruments can be used to de-risk investments, increase returns for private investors and contribute clean energy development (Amin et al, 2014). Section 2.1.1 outlines the rationale for the classification of financial de-risking instruments adopted in this thesis. Section 2.1.2 reviews the mechanisms through which these instruments mitigate risks and discusses their respective advantages and disadvantages, briefly summarizing their current state of deployment and/or their importance for clean energy projects.

The purpose of Section 2.1.2 is to understand the strengths and weaknesses of each instrument, rather than to determine which instrument is best. The best (mix of) instrument(s) depends on, amongst others, the project, its size, the market, the host government, the technology, its geographical location, and the risks associated with these factors (OECD, 2024; UNFCCC Standing Committee on Finance, 2024; Violetti et al., 2023). Determining the optimal financial structure for a project requires a very complex evaluation of multiple variables (IRENA, 2024; Lopez-Claros, 2021).

Financial de-risking instruments do not always directly address or eliminate the underlying barriers that create real or perceived risk; policy de-risking instruments do (Amin et al., 2014). Instead, financial de-risking instruments shift or mitigate risks among stakeholders, transferring them towards entities that are better capable or more willing to bear the risk. Therefore, these instruments are sometimes named risk mitigation or risk-sharing instruments rather than de-risking instruments. For example, IRENA (2024) uses the terms de-risking and risk mitigation interchangeably. Given that this research aims to increase the private sector participation by reducing the risk faced by private financiers, these instruments are referred to as de-risking instruments in this thesis. On another important note, the classification includes umbrella terms that cover various underlying instruments. Some instruments, such as loans or grants, do not de-risk by definition. However, specific types or structures of these instruments do have de-risking characteristics. The instruments will be explained in detail in Section 2.1.2, and this discussion on the classification and term ‘financial de-risking instruments’ continues in Section 5.2.

2.1.1 Classification of financial de-risking instruments

An extensive literature review and quantitative analysis have been conducted to establish the classification of financial de-risking instruments used in this thesis. This analysis does not incorporate the quantity of instruments mentioned within a specific source, but only if the instruments are mentioned. Instruments referred to as one of the typologies mentioned below, combined with one of the finance classifications mentioned in this section, have been included in the count to determine the most discussed and well-known financial de-risking instruments.

The instruments are referred to as:

- de-risking instruments (Amin et al, 2014; Green Climate Fund, 2022; IRENA, 2024; Micale et al, 2013)
- instruments (that can be) used to mobilise private capital (Convergence Blended Finance, 2024; Cull et al, 2024; El Aynaoui & Canuto, 2022; Habbel et al, 2023; IEA & IFC, 2023; IFC, n.d.-a; Jamarillo et al, 2023; OECD, 2021; OECD, 2022; OECD, 2024; Prasad et al, 2022; UNFCCC Standing Committee on Finance, 2024; Wei & Lin, 2022)
- instruments through which finance flows (African Development Bank et al, 2021; Violetti et al, 2023)
- mix of flows and de-risking instruments (Bobinaite and Tarvydas, 2014; Hussain, 2013; UNFCCC authors, 2024)

The instruments in the literature identified as tools for mobilising private capital possess de-risking characteristics because the risk-return relation is one of the most critical factors for a private investor that influences their investment decision. This will be elaborated in Section 2.3. In this analysis, instruments through which finance flows are only included if referenced in other sources as mechanisms that can either reduce or mitigate risk.

The instruments are described in relation to:

- climate finance (African Development Bank et al, 2021; Green Climate Fund, 2022; Habbel et al, 2023; Jamarillo et al, 2023; Micali et al, 2013; OECD, 2021; OECD, 2024; Prasad et al, 2022; UNFCCC authors, 2024; UNFCCC Standing Committee on Finance, 2024; Violetti et al, 2023)
- development finance (IFC, n.d.-a)
- financing clean energy in EMDEs (Bobinaite and Tarvydas, 2014; Convergence Blended Finance, 2024; El Aynaoui & Canuto, 2022; Hussain, 2013; IEA & IFC, 2023; IRENA, 2024; OECD, 2022)
- green finance (Amin et al, 2014)
- sustainable finance (Cull et al, 2024; Wei & Lin, 2022)

Appendix A contains a brief overview of these different types of finance. Despite their different objectives and definitions, all these types of finance can support the development of clean energy projects in EMDEs.

Figure 2.1 shows the results of the qualitative analysis of the presence of de-risking instruments in these twenty-two sources. The instruments mentioned at least four

times, visible with a green bar in Figure 2.1, have been included in the final classification of financial de-risking instruments. Nevertheless, there are a few exemptions. The final classification does not include blended finance, co-financing, policy-based finance, public-private partnerships, and result-based finance. Although they are sometimes considered instruments, they can come in various forms such as loans, grants, bonds and/or equity. Therefore, these forms of financing are represented under the included instruments and not separately included. Furthermore, debt is not included, as this is an umbrella term for various instruments where a sum of money needs to be repaid.

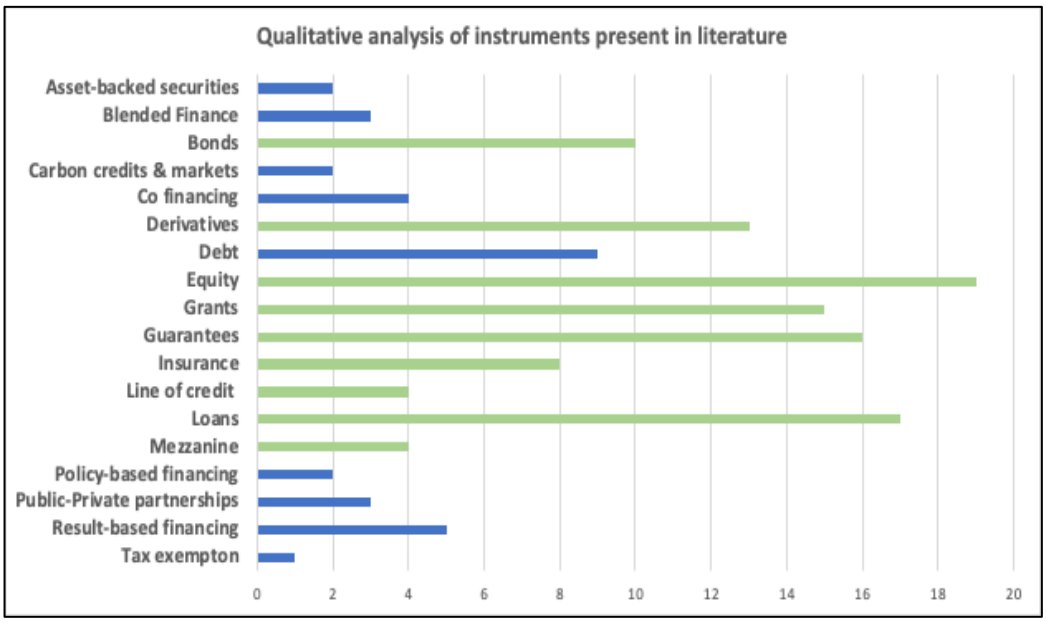

Figure 2.2 - Qualitative literature analysis of financial de-risking instruments that can be used for financing clean energy projects.

This results in the following classification of de-risking instruments: bonds, derivatives, equity, grants, guarantees, insurance, lines of credit, loans, and mezzanine capital. Lines of credit can be classified as a type of loan, and mezzanine capital is a way of structuring equity or debt. However, given their significant presence and explicit mention in the literature, these instruments have been separately included in this thesis' classification.

2.1.2 Functions and limitations of de-risking instruments

Each of the following sections is structured in three paragraphs. The first paragraph introduces the financial de-risking instrument, outlining its mechanism and the types of this instrument that can be used to de-risk clean energy investments. The second paragraph briefly summarises the instrument's de-risking function and examines the advantages and disadvantages encountered during its implementation and/or development. The third paragraph discusses the current state of deployment and/or highlights ongoing challenges that come with using the instrument.

Bonds

A bond is a fixed-income instrument commonly used to raise capital for growth or development. The entity that issues the bond is called the issuer, and the investor who buys the bond is often called the debtholder or creditor. The debtholder provides capital to the issuer when they buy the bond and is paid a predefined and agreed-upon interest rate over the lifetime of the bond by the issuer. On maturity, the issuer pays back the initial investment to the debtholder. A bond is a tradable asset, meaning the debtholder can sell the bond to other investors (UNFCCC Standing Committee on Finance, 2024). There are different types of bonds, as seen in Figure 2.2. The classification of bonds is determined by the objective that the issuer wants to achieve with the capital raised through the bond issuance. This classification gives the investor more transparency on what will happen with the provided capital (IRENA, 2024). These classifications relate to the different types of finance, which are briefly touched upon in Appendix A. According to the IEA and IFC (2023), the green, social, sustainable and sustainability-linked (GSSS) bonds can potentially mobilise private capital for climate financing into EMDEs.

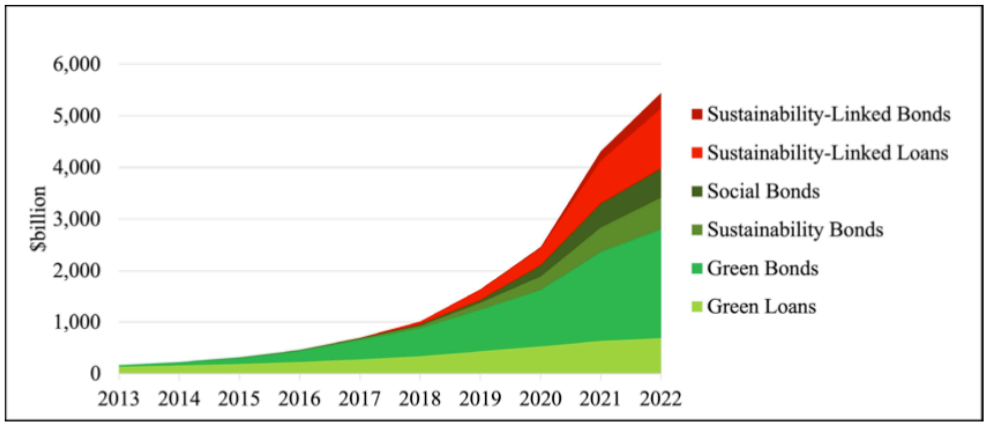

Figure 2.3 - Cumulative sustainable debt issuances by contract type (Cull et al., 2024)

Bonds de-risk and mobilise private capital by improving transparency, making it easier to assess risks, providing long-term stable financing that matches project cash flows, and pooling multiple projects together as a bond is not issued for one project. The main advantages of bonds are that they are relatively straightforward to design, have a longer lifetime than some loans, and are easily legally enforced (Habbel et al., 2021). Furthermore, bonds can lower financing costs in comparison to bank financing as these assets are freely tradeable amongst investors and are therefore priced based on how the market assesses the associated risks (Prasad et al., 2022). Finally, certain bonds can come with a so-called 'greenium' or green premium. This "greenium" benefits the bond issuer because a lower premium or interest rate is required from the debtholder if certain environmental, climate or green goals are achieved (Hussain, 2013). On the downside, bonds are not suited to every location, as more mature markets are required to adequately analyse and price the risks associated with this instrument.

IRENA (2024) reports that green bonds have become increasingly popular among investors seeking environmentally friendly projects. This trend is also clearly visible in Figure 2.2. In 2022, roughly 136 billion USD of GSSS bonds were issued by EMDEs (IEA & IFC, 2023). The division of these issuances is not equally distributed over EMDEs: China accounts for more than half of these issuances, and Africa is considered underrepresented in the global bond market (IEA & IFC, 2023). The overreliance on concessional capital and the underdevelopment of local capital markets in Africa are possible explanations (Wambui, 2022). Even though the market for these types of bonds is rapidly expanding and attracting investments globally, it is still small compared to the overall bond market (IRENA, 2024). Limited awareness amongst investors, high transaction costs and regulatory uncertainty are market barriers limiting this instrument's expansion (IRENA 2024; Convergence Blended Finance, 2024). Further market will be established by developing industry guidelines, harmonised classifications, and independent third-party evaluation (IEA & IFC, 2023; Prasad et al, 2022).

Derivatives

Derivatives are financial contracts between two or more parties where an item will be sold in the future against a price that is determined today (Fernando, 2025). This agreement can mitigate risk from one party to another, which is called hedging. Forward contracts and swaps are two examples of derivatives. These instruments can, for example, be used to transfer the risk of exchange rate fluctuations, also referred to as currency risk (OECD, 2022). Forward contracts, also called forwards, are contracts where two parties agree today on the future exchange rate used to repay a debt obligation. Setting a fixed exchange rate removes the risk that the currency's value might fluctuate. Next to forwards, swaps are used to exchange one type of cash flow for another. Currency swaps allow exchanging a loan payment in one currency for an equivalent in another currency (Convergence Blended Finance, 2024). Next to currency swaps, debt swaps can be used to raise capital in EMDEs. Through debt swaps, debt can be acquired at a financial discount to fulfil prespecified objectives with a positive social, economic, or environmental outcome rather than a monetary value. These debt swaps are used for the restoration of nature (debt-for-nature swaps), protection of biodiversity (debt-for-biodiversity swaps) or climate change-related investments (debt-for-climate swaps) (Violetti et al., 2023).

By setting the price of a future transaction today, future financing costs are known, and derivatives de-risk debt obligations with an extended timeframe, which is usually true with clean energy projects. Derivatives are well-known and established instruments used in financial markets. Furthermore, this instrument is very effective in mitigating the risk of international financing including multiple currencies. However, these instruments can be expensive (OECD, 2022), and debt swaps are complex to set up and execute (Violetti et al, 2023).

Currency risk is a significant barrier for international investors in EMDEs (El Aynaoui and Canuto, 2022). To mitigate this risk, financial markets are required for the deployment of derivatives. Currency markets are relatively underdeveloped in multiple EMDEs. Several programs by international organisations try to mitigate currency risks and support local lending by deploying derivatives. These efforts, however, are not yet enough to mobilise private investments significantly with this instrument, according to the IEA (2021). More resources to develop affordable

derivatives and promote local lending are required to enhance the global deployment of derivatives.

Equity

When an investor gets a share of ownership of the entity in return for their investment, this partial ownership is called equity. This share of ownership entitles the investor to an equivalent share of the revenue and value of the corporation that would remain if all the assets were sold and all debts were repaid (Habbel et al, 2021). There are several mechanisms and structures for how equity can be used to de-risk investments for private investors. First, concessional equity, which is more affordable because it offers lower return expectations, can strengthen the entity's financial position (IEA & IFC, 2023). A stronger financial position lowers the risk that an organisation cannot pay their debt obligations, or, in other words, defaults. Consequently, lower costs in the form of interest will be imposed by lenders and/or lower returns are expected by other investors, resulting in cheaper options to obtain additional funding (OECD, 2022). Second, according to the OECD (2022), direct investments by Multilateral Development Banks (MDBs) or Development Finance Institutions (DFIs) can decrease risk and boost investor confidence. These organisations often provide concessional capital. However, when they invest on market terms, they can set an example for private investors without concessional characteristics. Next to the ability to set an example, MDBs and DFIs are well-known for their due diligence capacity and experience in managing unexpected events. Therefore, their investments boost co-investments by the private sector because they show that the risk of the project is worth taking, and private investors can benefit from these organisations' capabilities. Third, pooling projects through structured investment instruments, such as special purpose vehicles, overcomes the investment barrier that individual clean energy projects are considered too small for private investors. As mentioned before, private investors do not have the capacity or skills to analyse every project adequately and cost-effectively. The bundling of small projects by organisations, such as specialised funds, removes these costs for private investors and diversifies the risks (Prasad et al., 2022).

Through concessional investments and direct investments by development institutions, next to the bundling of projects, equity structures help lower the risks and barriers that private investors face. Equity instruments are considered flexible; they can obtain potential returns over time and support innovation of new technologies without burdening the companies with debt repayment obligations (Green Climate Fund, 2022; UNFCCC authors, 2024; Amin et al, 2014). However, these instruments have complex structures and limitations in their ability to mobilise private investments (UNFCCC authors, 2024; Hussain, 2013). The acceptance of lower returns with concessional equity makes it harder for private equity providers to compete with providers of concessional capital. Private investors have return expectations set by internal mandates and external legislations that must be complied with. Furthermore, these types of investments done by public institutions directly replace possible private financing, as investment opportunities are limited.

One of the biggest challenges to overcome during the development of an appropriate investment structure for clean energy projects that includes private capital is that private investors show a preference for assets that are easy to sell, in other words,

liquid, and tradeable (IRENA, 2024). These are characteristics that clean energy projects often lack.

Grants

Grants are transfers of money, goods, or services for which no repayment is required (African Development Bank et al., 2021). Grants are donations from various actors: most commonly from governments, philanthropies, climate funds or development banks. Grants are most commonly used to finance technical assistance, support the development of financial products such as bonds, and finance early-stage development for newer and riskier technologies (OECD, 2022). Technical assistance is the transfer of knowledge, services, engineering, and skills through targeted support for, for example, supporting project preparation and implementation (World Bank, 1996).

Grants lower the risks faced by the private sector when they are used to cover project preparation costs, develop new technologies to a more mature stage, and adequately map the risks related to a specific project. The main advantages of grants are that they are relatively simple to implement and require no ongoing monitoring (Hussain, 2013). Furthermore, this instrument can be easily used in combination with other instruments, and, given that no continuing tracking is required, this instrument comes with low administrative costs (Amin et al., 2014). On the downside, grants are not sustainable since no returns of capital can be used to finance other projects. Besides, as incentives for delivery often lack since there is no monitoring or repayment requirement, there is a high risk that the objectives with which the grant is issued will not be reached (Hussain, 2013; Amin et al., 2014).

One way of ensuring that the project objectives will be reached is by using performance-based grants. Performance-based grants have recently been increasingly used to mobilise private capital and impact investments supporting the Social Development Goals (Habbel et al., 2021). With performance-based grants, the funds are only paid when pre-defined outcomes are achieved. This happens in steps, so the next amount of capital is often unlocked once specific objectives are met.

Guarantees

A guarantee is a financial instrument where the guarantor will pay part or the whole value of a loan, equity or other instrument if the lender fails to pay back the capital and defaults (Habbel et al, 2021). Guarantees can transfer risk, incentivise investments and ensure a specific element of a program (Green Climate Fund, 2022). Furthermore, as guarantees improve the financial stability and ability to repay debt, a guarantee serves as a credit enhancement mechanism that results in lower costs for borrowing capital. Additionally, from an international organisation's perspective, providing a guarantee for a loan rather than giving a loan allows local financiers to provide loans in local currencies at lower rates. This activity removes the currency risks of international lending and borrowing (Green Climate Fund, 2022). Next to so-called foreign exchange guarantees, guarantees can also cover risks related to project delays or revenue uncertainty (OECD, 2022).

Guarantees transfer the risk from a clean energy project to an entity willing to carry the risk, resulting in lower project risks that private investors face. The main advantage of guarantees is that they do not necessarily result in an outflow of capital

and thus optimise the use of public funds (Habbel et al.,2021; Arezki, 2022). The absence of a required large upfront payment makes obtaining political approval easier. Furthermore, as guarantees target a specific risk or market distortion, relatively small commitments of funds can mobilise a significant amount of private capital (Hussain, 2013). Complex structures and high transaction costs are the main challenges that hinder the broader implementation of guarantees (Frisari & Micale, 2015; Hussain, 2013).

Efforts to scale up guarantees have been unsuccessful (Cull et al., 2024). In addition to the barriers mentioned in the previous paragraph, the absence of investable projects limits the use of guarantees. Despite their challenges, guarantees are considered a top priority to scale up climate investments (Green Climate Fund, 2022; Arezki, 2022; OECD, 2021).

Insurance

In contrast to a guarantee, insurance compensates the insured after the occurrence of a loss. A guarantee, however, is used to prevent this loss in the first place. Insurances act to share and spread the consequences of a particular risk. Donors can participate in insurance individually or through multi-country risk pools (UNFCCC Standing Committee on Finance, 2024). Through risk pools, multiple countries can share and diversify the risks present in the region, resulting in lower premiums that need to be paid in exchange for the coverage of these risks. There are different types of insurance: insurance that depends on proven losses, index-based insurance, and parametric insurance. Index-based and parametric insurances kick in when a predefined trigger is met, the index or parameter, after which a predefined payment will be transferred. Parametric insurances, where both the pay-out and the trigger are predefined, are a type of index-based insurance. Index-based insurances are insurances that rely on an external index. For the development of sustainable energy projects, insurances are often used for lost income due to lower-than-expected output because of a lack of solar/wind (Hussain, 2013), to cover any shortfall in projected energy savings compared to actual project performance (OECD, 2022) and against political risks (OECD, 2022). Political risk insurance covers a wide range of risks and is especially important for clean energy projects, as their success often depends on the actions of local governments. Next to de-risking investments to attract private capital, insurances allow DFIs or other donors to fund a project and transfer the risk to the private sector. This effectively mobilises capital for renewable energy projects where this otherwise would not have been possible (IEA & IFC, 2023).

Insurances transfer the risk to the insurer, which instantly results in a lower risk faced by the financiers of the projects (UNFCCC authors, 2024). Advantages of insurance are that they are cost-effective, straightforward, and quick in the processing and pay-out of monetary compensation for the insured. This last advantage is especially relevant for index-based insurances. Insurance can also help reach micro, small, and medium-sized companies that lack access to project finance (UNFCCC Standing Committee on Finance, 2024). Disadvantages of insurances and barriers to its deployment are that insurances can go accompanied with high premium costs, an extensive database of historic data is required to adequately assess the risk, which often lacks, and high up-front development costs are needed for these type of insurance schemes (UNFCCC authors, 2024; Hussain, 2013).

Insurance markets are essential instruments to help attract more private capital. In Africa, these markets are still severely underdeveloped (Arezki, 2022). According to the Green Climate Fund (2022), which wants to respond to a growing demand for climate insurance, this lack of insurance market development is also present in other developing economies, next to Africa. A lack of enabling policy environments and regulatory incentives limits innovation and market growth. To overcome these barriers and allow the deployment of insurances, the Green Climate Fund is trying to improve their forecasting capabilities and availability of reliable data, build supportive knowledge and regulation platforms, improve risk pricing, and reduce the costs wherever possible.

Lines of Credit

A line of credit is a loan with a flexible upper limit (Habbel et al., 2021). The capital is made available and ready to be borrowed. However, the borrower does not necessarily have to borrow the full amount and can withdraw the funds required when needed. The instrument is useful to ensure that financial resources will be rapidly available to respond to climate-related events without resulting in additional costs for the borrower (UNFCCC authors, 2024). This type of contingent instrument, an instrument that only kicks in under certain circumstances, decreases the risk of default as additional capital is readily available.

Having additional capital available at any time improves the financial stability and directly lowers the risk of project default. The significant advantage of this instrument is that it provides a certainty of borrowing capacity without costs. The costs are only incurred when the capital is borrowed from the lender (UNFCCC authors, 2024). Furthermore, its flexibility ensures that capital withdrawal perfectly aligns with project and/or policy objectives. However, this instrument comes with upfront preparation costs and costs to maintain the agreement (UNFCCC authors, 2024). Finding a balance between the costs and the certainty of additional capital is a trade-off that needs to be carefully examined.

This type of instrument is mainly used for adaptation rather than mitigation projects (Micale et al., 2013). Mitigation projects aim to reduce greenhouse gas emissions, and adaptation projects improve resilience against the impacts of climate change. Clean energy projects are labelled as mitigation (African Development Bank et al., 2021)

Loans

Loans are transfers of capital for which repayment is required (African Development Bank et al., 2021). Repayment can happen at once or in periodic payments. In return for the provision of capital, the lender, the individual or institution that lends out the capital to the borrower, gets periodic payments, a percentage of the total loan. These periodic payments are called interest (Barone, 2023). Loans can have collateral. A collateral is an asset the lender can take over if the borrower cannot repay the loan in cash (Violetti et al., 2023). Different types of loans come with specific terms. Lines of credit, concessional and syndicated loans are most used and hold de-risking characteristics. Lines of credit are mentioned as a separate instrument because of their prominent presence in existing literature; please refer to the previous section. Concessional loans are loans that have terms which are more favourable than market terms. For example, with lower interest rates or a more extended

repayment period, in other words, the maturity of the loans (Violetti et al., 2023). Syndicated loans are loans where a group of lenders provide funds to one borrower (Habbel et al., 2021). The main objective is to diversify the risk over multiple lenders. Syndications involving MDBs or DFIs are particularly successful in mobilising private capital as private investors want to take advantage of their technical expertise, knowledge and monitoring capacity (Cull et al., 2014).

Loans de-risk investments in various ways: providing concessional loans to a project attracts private investors because these instruments increase the financial stability of a project, and syndicated loans spread the risk over multiple investors. Loans are well-known, straightforward and widely applied instruments. They can reduce project financing costs and improve the risk-return ratio for other investors and lenders (Amin et al., 2014; UNFCCC authors, 2024). Besides the advantages, loans are also considered inflexible and create a repayment obligation that introduces the risk of default by the borrower (UNFCCC authors 2024; OECD, 2022).

Loans from any bank are critical to make clean energy projects viable (IRENA, 2024). Loans play a vital role during the higher-risk construction phase. During this phase, loans must be tailored to a project's specific need for cash in the case of delays and higher costs than expected to prevent default. IRENA (2024) highlights the need for syndicated loans issued by experienced banks that understand project risks, such as development banks, to involve less experienced private capital providers. Social benefits of investments and climate action are not yet reflected in the terms and conditions of conventional loan contracts. Together with that there is little data available on the credit history of EMDEs, private lenders' capital is only lent to EMDEs with very high interest rates (Prasad et al., 2022).

Mezzanine instruments

Mezzanine instruments are also referred to as first-loss, junior or senior capital. In the case of a project or entity default, this mezzanine capital is consumed first before the more senior capital is touched. Therefore, it can lower the risk for private investors or lenders by taking up this first loss and consequently catalyse the participation of co-investors who otherwise would not have participated in the deal (Habbel et al., 2021). Mezzanine instruments are implemented as equity, grants that can be converted to debt or equity depending on the project's capital structure, guarantees that take a predefined loss and debt structures such as loans. Junior equity can increase the returns for more senior investors, whereas junior debt can reduce the costs and extend the lifetime of senior debt (Hussain, 2013).

By taking the financial first-loss that occurs, mezzanine instruments protect the more senior capital provided, creating a buffer for risks and events that negatively influence the project's cash flow. The main advantage of this instrument is that, through this financial structuring, it can result in high leverage levels, which shows high mobilisation of commercial capital through concessional capital, as it significantly and directly lowers the risk for other investors (Hussain, 2013). Furthermore, as mentioned before, it increases the returns and reduces the costs of additional sources of capital. These flexible instruments are generally custom designed for each project. Therefore, they are quite complex to implement, resulting in high transaction costs. Furthermore, risks are often transferred to public entities, which might not be able to control and handle these risks (Hussain, 2013).

New or less widely adopted energy technologies, especially in EMDEs, are often considered too risky by private investors. A lack of operational data in local markets and unfamiliarity with the technologies result in the absence of private investors for these types of projects. Market confidence and a track record of renewable energy projects can be established through mezzanine structuring, encouraging private investors to participate (OECD, 2022).

2.2 Clean energy projects in EMDEs

Section 2.2.1 reviews the types of clean energy projects and capital structures commonly used in EMDEs, summarising key characteristics highlighted in the literature. Section 2.2.2 explores the risks frequently associated with investing in clean energy projects in this context. The risks mentioned in this section are examples and do not cover all possible risks. Finally, Section 2.2.3 analyses the main barriers that hinder investment flows into clean energy projects in EMDEs.

2.2.1 Types of projects and capital structures

Energy projects

Energy projects, which are categorised as infrastructure projects, consist of two phases: the construction and the operation phase (El Aynaoui & Canuto, 2022). Most of the capital is needed during the construction phase, as most of the costs are incurred up front when there is no revenue. This phase is considered the riskiest phase, resulting in very high demands for return rates. The project's cash flow is negative during this phase: more capital is spent than earned. The security that the initial investment will be returned needs to come from the future projected revenues of the project (Hussain, 2013). Compared to energy from fossil fuel sources, the revenue stream of clean energy sources is relatively stable as it does not rely on fluctuating and volatile prices of fossil fuels (IRENA, 2024). Offtake agreements with reliable off-takers can strengthen investors' confidence in participating in the project from an early stage. After the construction phase is completed and the operation phase starts, the risks from the development and construction phase disappear, and only operational risks remain. During this phase, the costs are very low, and revenue is earned, so the cash flow shifts to positive and increases. The project might be worth investing in even for conservative investors at this stage.

Investments in clean energy projects typically last between twenty and thirty years (IRENA, 2024). That is the time often needed to earn back the initial investments made during construction. For project finance, all the initial investments made during this phase need to be earned back from the expected revenue streams in the future. This revenue is a projection and remains uncertain, where a small variation can have a big influence given the relatively long lifetime of the project.

Project finance has emerged as a relatively recent trend in comparison to the traditional model of corporate finance, which historically was more present in energy development. Under corporate finance, capital is invested in the firms responsible for the project development. These firms typically manage multiple projects, so they have a portfolio of projects. In contrast, project finance builds on the idea that the financing of a project should be based on the project’s characteristics and cash flow potential, rather than the creditworthiness of the owning firm. Given infrastructure projects’ generally stable cash flows, project finance structures often support higher debt levels (El Aynaoui & Canuto, 2022).

Capital structure

The technology and project maturity stage influences the project's capital structure. The capital structure refers to the financial sources that finance a project or entity. Generally, this is a combination of equity and debt. For clean energy projects, the capital structure often relies on a greater share of debt finance (IEA, 2021). This is also visible in Figure 2.3, where the green bars that indicate debt account for more than half of the financing of renewable energy development. The presence of debt financing increases over the years because lenders are getting more comfortable with clean energy models and their high upfront costs, but relatively stable and predictable revenues.

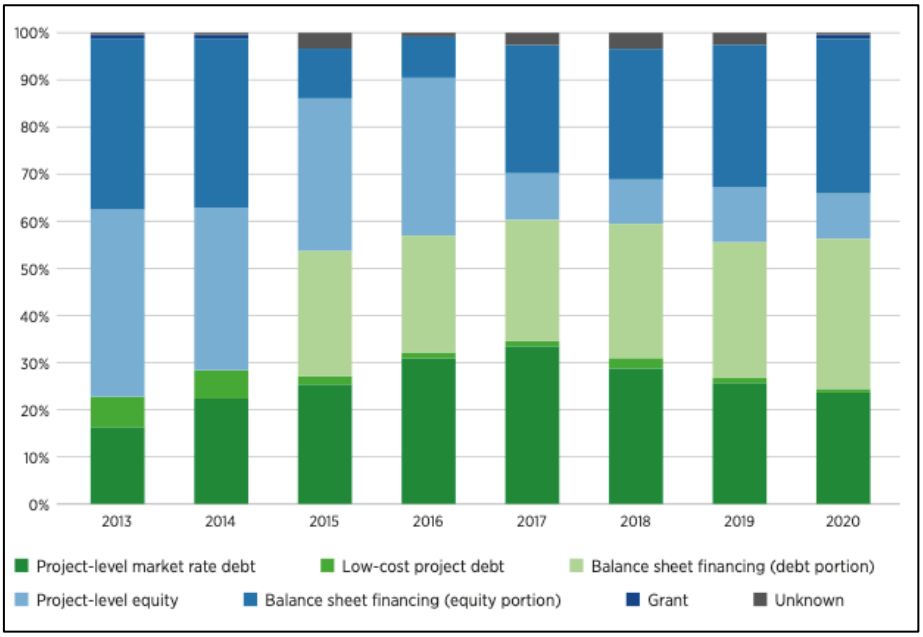

Figure 2.4 - Investments in renewable energy per financing source (IRENA, 2024)

Clean energy projects in EMDEs have a greater equity share in their capital structure than in advanced economies (OECD, 2022). According to the IEA (2021), this is because of relatively high risks in these markets, resulting in higher capital costs, a lack of projects that meet bank criteria, and underdeveloped local banking systems.

Cost of capital

The cost of capital is the minimum return that capital providers demand in return for their capital (UNEP-CCC & CTCN, 2024). This is the interest rate charged for debt, expected return on equity or the weighted average cost of capital (WACC) when there is a mix of debt and equity. The cost of capital is determined by the risk associated with the investments. Higher returns are required for projects that have higher associated risks. The risks related to a project and influencing investors' decisions can be real or perceived. Real risks are quantifiable, actually present. Perceived risks are risks experienced by investors but are not necessarily present. Perceived risks are substantiated by subjective judgement.

The cost of capital is a benchmark for the price of external capital that can be invested in the project through equity or provided through debt. According to a survey amongst investor firms and leading financiers by the IEA (2024), the cost of capital for clean energy projects in EMDEs is twice as high as in advanced economies. High real and perceived risks cause these extensive high capital costs and make these clean energy projects unnecessarily expensive. As a result, financing costs can be a relatively high share of the total costs for clean energy projects in EMDEs (IEA & IFC, 2023).

2.2.2 Types of risk

This section overviews common risks encountered when developing and financing clean energy projects in EMDEs. These are just examples and do not cover all possible risks.

High real or perceived risks often prevent clean energy projects from obtaining the required financing, especially in EMDEs (IRENA, 2024). Risks related to a project are the most critical factor determining the success of finding project investors and influencing the returns that these investors demand (Frisari et al., 2013). The UNEP-CCC and CTCN (2024) identify five types of risk that determine the costs of capital: risks associated with country-, energy sector-, financial sector-, technology- and project-level.

Country-level risks

The main country-level risks that influence the cost of capital are political and currency risks (IEA, 2024). Political, or sovereign, risks arise from the possibility that income is lost due to changes in law or regulations, war or civil conflicts (IEA, 2024). Furthermore, risks associated with the countries' general investment conditions, such as political stability, breach of contracts or permits and settling disputes, influence the perception of this risk (IEA & IFC, 2023). Governments in some contexts have limited institutional capacity or authority to enforce property rights and uphold contractual agreements. Public institutions may also be subject to influence from non-state actors or affected by high levels of corruption, which can increase the risk of political or legal changes that could impact project outcomes. Political instability is not just a risk in EMDEs, as shown by the recent example of the Trump administration cancelling, at the beginning of 2025, the permits of a wind farm that was financially closed and ready for construction, after a development trajectory that started already in 2017 (Dalban, 2025). These risks can be mitigated through political risk insurance or guarantees.

Currency risk, as briefly touched upon in Section 2.1.2 on derivatives, originates from sudden and unexpected changes in foreign exchange rates. This risk is perceived when a loan or investment is in a hard currency and the project's revenues are obtained in a local soft currency. Hard currencies are globally dominant, stable currencies, whereas soft currencies are the opposite and prone to fluctuations (Chen, 2022). Currency exchange fluctuations result in variable repayment amounts and significantly influence the cash flow of projects (IRENA, 2024). Large-scale energy projects are susceptible to currency risks because of the required upfront costs and long repayment periods. According to El Aynaoui and Canuto (2022), currency risk significantly influences international investors' decisions in EMDEs.

Derivatives, guarantees, certain types of loans and mezzanine instruments can be used to mitigate these risks.

Energy sector-level risks

Energy sector-level risks are shaped by the structure of the electricity market and the design of clean energy support policies. These energy-related policies and market frameworks play an important role in determining the predictability and stability of revenues. Whether the market is state-regulated or operates on a liberalised, competitive basis affects the investment climate, each model offering advantages and challenges for investors. Especially for clean energy projects, the presence of power-purchase agreements, when an off-taker signs a contract to buy a prespecified amount of energy against a prespecified price, increases the confidence of investors that they will get their promised returns and thus lowers the risk that is perceived (UNEP-CCC & CTCN, 2024).

Financial sector-level risks

The cost of capital is influenced by the maturity of the financial sector, its experience in financing clean energy projects, and the availability of concessional finance, all are captured under the financial sector driver (UNEP-CCC & CTCN, 2024). Financial sector risk materialises when there is limited or no experience in financing such projects, leading to suboptimal capital structures and unnecessarily high financing costs.

Furthermore, clean energy projects have relatively low financial returns. To increase the return on their investments, investors sometimes borrow money at a lower rate than the project's return and use that capital to invest in the project instead of their own. This is called leverage. The heavy reliance on debt financing results in a leverage risk (Prasad et al., 2022). When interest rates rise, the cost of financing increases, but the returns on the investment do not change.

Technology-level risks

The maturity of the technology affects both the real and perceived risk. Newer technologies often lack a proven track record, heightening perceived risk (OECD, 2022). Furthermore, the constant declining prices of technology costs create a risk that if you invest today, the opportunity will be better tomorrow. Capital providers postponing investments because they are waiting for lower prices is a general trend for new technologies and not specific to clean energy projects (Eden & Ronen, 1993). Additionally, limited availability of data and information on the project development, execution, and performance of emerging technologies further increases uncertainty (IEA & IFC, 2023). Without transparent or publicly accessible information, projects are more vulnerable to underperformance and suboptimal design. Finally, an operational risk arises from the uncertainty that a project's actual performance may fall short of initial design expectations, leading to lower-than-anticipated revenues (IEA, 2021).

Project-level risks

As outlined in Section 2.2.1, the construction and development phase is typically the riskiest stage of energy projects. The possibility of cost overruns, construction delays and unforeseen setbacks, combined with already high project development costs, significantly affects the overall project risk and increases the cost of capital (Prasad

et al., 2022). Furthermore, the project's financial structure, particularly the absence or presence of de-risking mechanisms such as guarantees or mezzanine structures, plays an important role in developing investment risks (UNEP-CCC & CTCN, 2024).

2.2.3 Investment barriers

As do all types of investors, private capital providers have unique motivations, objectives, and rationales behind their investment decisions. The selection of project type, geographical area, or technology to invest in depends on their ability to carry risk and return expectations, which differ per type of funder. These differences will be highlighted in the next section. This section focuses on barriers that make it unattractive to invest in and hinder investments towards clean energy projects in EMDEs.

First and foremost, as mentioned in Section 2.2.2, the cost of capital for clean energy projects in EMDEs is higher than in advanced economies (IEA, 2024). This makes these projects unattractive for investors unless the returns are higher than in advanced economies or other costs are compensated and are significantly lower than in advanced economies (IEA & IFC, 2023). This is often the case with costs for labour and land.

Second, a lack of data makes it hard to adequately estimate and assess the risk and consequently the cost of capital (IEA & IFC, 2023). Inadequate coverage and knowledge about the risk are often a reason why project developers cannot find and convince investors to finance their clean energy systems (El Aynaoui and Canuto, 2022). This lack of data makes evaluating projects and obtaining transparent financial reporting challenging (Prasad et al., 2022). The evaluation of projects is especially important for investors, for whom it is essential to showcase the impact their investment has made on, for example, social, economic and climate aspects to stakeholders.

Another frequently mentioned barrier is the complexity of the setup of projects (El Aynaoui and Canuto, 2022). Contractual structures, regulatory environments, safety requirements, and capital structures differ for each project. This lack of heterogeneity tends to scare away private investors and comes with high and uncertain development costs. Clean energy projects in EMDEs are often located in areas that are socially and/or environmentally unstable, distant from where the energy is consumed and, as mentioned before, there is no sufficient data available for the design of the project, for example the site-specific wind data for the development of a wind park (Hussain, 2013). As a result, an expensive development process is required to identify opportunities. These costs are only worth making for large-scale investments, whereas in EMDEs, small-scale off-grid energy solutions are often needed. The IEA (2021) and Prasad et al (2022) mention a shortage of large-scale clean energy investment opportunities with adequate risk and return characteristics limits the mobilisation of private capital. This complaint about a lack of pipeline for investable projects is also highlighted by El Aynaoui & Canuto (2022).

Finally, as touched upon in Section 2.2.1, long-term financing is required to finance clean energy projects. This long-term financing is invested in energy technologies, which are physical assets. Therefore, it is not easily possible to get the investment back unless another investor takes over. In combination with high up-front costs,

this illiquidity of capital is often a barrier for investors (Prasad et al., 2022; IEA & IFC, 2023).

2.3 Financier landscape and market roles

Two main types of financiers are financing clean energy projects in EMDEs: the public and private sectors. Private sector financiers include private investors, households, and philanthropies. Public entities involved in the financing of these projects are mainly governments, development finance institutions (DFIs), and public funds. Their different mandates, risk appetite and return expectations influence the type of projects an investor invests in and the financial instruments utilised (UNFCCC Standing Committee on Finance, 2024).

The public sector tends to be more important in financing clean energy projects in EMDEs than in advanced economies (IEA, 2024). As shown in the right graph of Figure 2.4, roughly half of the clean energy projects in EMDEs are financed from public sources. This is a significant difference from advanced economies, where only 20% of clean energy development is funded by public sources of capital (IEA & IFC, 2023).

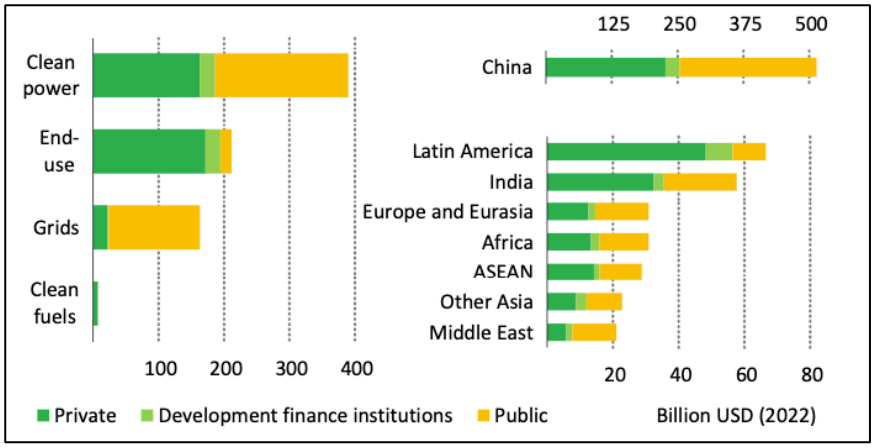

Figure 2.5 - Clean energy financed in EMDEs by public and private sources in 2022 (IEA & IFC, 2023)

The private sector is more likely to dominate investments in commercially viable technologies. In contrast, the public sector can make the most significant difference in areas that require a lot of upfront capital or have higher associated risks (UNEP-CCC & CTCN, 2024). In this context, the left graph in Figure 2.4 suggests that grid development and clean power deployment are not yet commercially viable and heavily rely on public financing. Another contributing factor to the public sector's dominant role in grid development is that the societal value generated by grid infrastructure exceeds the direct commercial returns private firms can obtain by developing these projects.

To minimize costs, a risk needs to be managed by the stakeholder with the best knowledge about or most significant influence on specific aspects of the project. Therefore, the public sector is most suited to manage the country-level risks as these aspects are within its influence. The private sector can best manage the technology-level risks. Energy sector, financial sector level and project level risks can best be shared between the public and private sector financiers (Frisari et al., 2013).

Understanding investors' specific investment criteria and risk appetite is crucial for mobilising their capital for a project. When these characteristics and preferences are included in the project design from the start, this will significantly increase the attractiveness of the project proposal for targeted stakeholders (Violetti et al., 2023). This chapter examines each stakeholder's key characteristics, preferences, and abilities.

2.3.1 Private sector financiers

Private capital is sometimes mistakenly confused with commercial capital or commercial investors. Commercial capital is market-priced capital focused on generating profit, in contrast to concessional capital with below-market rate prices and aims to facilitate social, economic, or environmental development. Commercial capital is another characteristic and can include capital from private, public, and philanthropic sources (Convergence Blended Finance, 2024). Commercial investors, banks, or other financial institutions seek returns for their investments, which can be private or public in origin. DFIs are an example of a public commercial provider of capital (Violetti et al., 2023).

Private investors

Private investors are an umbrella term for privately-owned companies, commercial banks and institutional investors. Institutional investors invest, amongst others, for pension funds, insurance companies or private investment funds (IEA & IFC, 2023). Private investors invest in equity or debt, mostly in listed financial products or securities (Violetti et al., 2023). Single energy projects are only exceptionally listed in public financial markets. Furthermore, single energy projects are often too small for private investors, as explained in Section 2.1.2 on equity. Besides, private investors rarely have the experience to invest directly in clean energy projects. These limitations result in a market where private investors do not often provide project-level direct funding. Throughout 2015-2020, private institutional investors have funded less than 1% of energy investments through direct project financing in EMDEs (IEA, 2021).

The main objective of private investors is often to maximize and create stable profits for their clients. Therefore, these investors expect market-rate, risk-adjusted returns. That means the investor expects a higher return for projects with a high real and/or perceived risk. Additionally, these institutions must comply with domestic and international regulations limiting their ability to take risks (IEA & IFC, 2023). This makes investing in EMDEs less attractive, as the risks are often higher and the returns do not necessarily compensate. The de-risking instruments discussed in Section 2.1 can help to increase this risk-return relationship (OECD, 2021).

Domestic investors and local capital providers are better placed to absorb country-related and energy—or financial sector-related risks, as they are more experienced with the environment. International investors with more experience with specific clean energy technology are better equipped and generally willing to take on more technology or project risk (IEA, 2021).

Households

Households are increasingly important for clean energy transitions, but are not always highlighted (IEA, 2024). Without the involvement of the public, increasing the energy efficiency of end-users, deploying rooftop solar panels, and installing energy-efficient technologies such as heat pumps will not be possible. The involvement of households in the deployment of clean energy depends highly on the area's economic development. In more advanced economies, energy savings obtained by deploying clean energy technologies can be a viable business case. Meanwhile, for less developed economies, the strong fluctuations of fossil fuel prices that influence household financing might motivate structural changes in the energy system (IEA & IFC, 2023).

Household participation in clean energy development remains low (IEA, 2024). China is the exception, given the rise in popularity of EVs. The IEA and IFC (2023) highlight that households must play the vital role required to catalyse clean energy development in EMDEs.

Philanthropies

Philanthropies provide private financing, but unlike the other stakeholders mentioned in this section, they aim at achieving public, environmental or social benefits rather than risk-adjusted returns (Hayes, 2024). Often, philanthropies do not require a return at all, and their capital is deployed through grants. Philanthropies can, just as DFIs, mobilise private capital when they use their funds through de-risking instruments such as grants, mezzanine instruments, concessional equity or guarantees (IEA & IFC, 2023). Philanthropic capital can especially impact the development of less mature technologies with too high risks to attract private capital. Convergence Blended Finance (2024) noticed an increase in philanthropic funds that target and mobilise investments for clean energy projects, amongst other climate objectives.

Criticisms highlight that many philanthropic donations benefit elite institutions such as universities rather than directly aiding people experiencing poverty. Furthermore, because philanthropists benefit from tax relief, they use taxpayer money to fund their chosen causes, potentially misaligning public priorities and policies (Vallely, 2020).

2.3.2 Public sector financiers

Providers of public capital can be multinational, bilateral, or national. Multinational providers are entities that are funded by multiple donor countries. Each multilateral institution has its governance, geographical focus, mandates, and objectives. Institutions funded by one government that provide capital to others are referred to as bilateral. The local government offers national or domestic capital (Violetti et al., 2023).

Providers of public capital can use their capital to mobilise private sector investments through blended finance structures, where these two types of capital are combined. Deleidi et al. (2020) have shown that public co-investments and direct public participation in the financing and development of clean energy projects can effectively mobilise private sector investments. Metrics to measure the mobilisation effect of public capital are still underdeveloped, making it challenging to examine the effectiveness of different strategies (UNEP-CCC & CTCN, 2024).

Governments

According to Amin et al. (2014) and IRENA (2024), governments have three primary roles in supporting the mobilisation of private capital. First, the policies and regulations should create an enabling environment for long-term investments. Supportive and stable policies are crucial to decrease financing and capital costs and create bankable clean energy projects. Second, public funds should be used effectively and simultaneously secure additional private capital funding through blended finance practices. Third, governments can and should use de-risking instruments to help lower the risk faced and increase the returns for private investors.

Governments can mobilise private sector investments and catalyse the deployment of clean energy technologies through legal and regulatory stability, effective use of public funds, and mixing public and private capital.

Development Finance Institutions (DFIs)

It is important to distinguish between the two types of DFIs: bilateral and multilateral DFIs. Bilateral DFIs are funded by one government, such as the Dutch FMO, Denmark's IFU and the Japan International Cooperation Agency. Multilateral DFIs are financed through multiple governments. Examples are the African Development Bank (AfDB), International Finance Corporation (IFC), Asian Development Bank (ADB) and the World Bank Group (IEA, 2024). The previously mentioned AfDB, ADB and World Bank Group are also called Multilateral Development Banks (MDBs).

DFIs are public financial intermediaries. That means they deploy the capital their government(s) provide as efficiently and effectively as possible (Prasad et al., 2022). Their main purpose is, and objective should be to catalyse private sector investments and lead the private sector to investable projects (El Aynaoui and Canuto, 2022). To do so, DFIs work with various de-risking instruments, including all the instruments mentioned in Section 2.1. Next to financial de-risking, DFIs invest directly into projects and provide technical, project, financial structuring and policy assistance to support the development of bankable clean energy projects (IEA, 2024). Furthermore, their expertise in selecting, developing and monitoring projects motivates the private sector to co-invest alongside (Prasad et al., 2022).

DFIs are often banks, also known as development banks. To maintain their status and rating as a bank, they must comply with the same rules and requirements as commercial banks. This can lead to challenges in the amount of risk that DFIs can take and compromise their role as providers of capital where it is most needed (IEA, 2021).

Public Funds

Multilateral and bilateral funds provide essential capital in blended finance structures for energy deals (Convergence Blended Finance, 2024). One or multiple governments finance these funds to achieve commonly agreed objectives, such as to increase biodiversity, to improve energy access or other social or climate-related goals. The Green Climate Fund (GCF), Global Environment Facility (GEF) and Climate Investment Fund (CIF) are examples of multilateral climate funds. The GCF got 9.9 billion USD pledged in 2020 by their donors, and the GEF got 4.1 billion USD pledged by 30 donors for 2019-2020 (Violetti et al., 2022). While these pledges show significant commitments, they fall far short of the estimated 9.1 trillion USD required to achieve a net-zero pathway in EMDEs, particularly considering that these funds do not only focus on energy.

Grants and loans, mainly concessional, are the dominant instruments used by these funds. In 2022, the Green Climate Fund (2022) stated that global trends show that guarantees and equity have the greatest potential of mobilising capital, far beyond any other instrument. These instruments improve an EMDE's access to international financial markets at lower costs and with longer maturities. Therefore, the Green Climate Fund has shifted their portfolio towards these high-impact instruments.

3 Methodology

This chapter begins by outlining the research design, including the type of research, its purpose, and the reasoning approach adopted in this thesis. Section 3.2 details the data collection process, covering the interview design, recruitment strategy, and a description of the sample group, the interviewees. Section 3.3 explains the methods used for analysing the interview data, after which Section 3.4 concludes the chapter by addressing the study's limitations.

3.1 Research design

A qualitative research approach is deemed most suitable for addressing the research question and achieving the objectives of this thesis, given its capacity to generate in-depth insights into the complex real-life phenomena of energy finance. Qualitative research is well-suited for exploring complex, nuanced, and context-dependent objectives where the goal is to gain deep insights rather than to quantify variables. Questions asked in qualitative research are not easily put into numbers as they focus on questions such as “why” and “how”, rather than “how many” (Cleland, 2017). Since this research aims to identify the barriers and obstacles that prevent the practical implementation of financial de-risking instruments, a qualitative study allows for uncovering the experiences, perceptions, and underlying factors of experts working with these instruments. The qualitative approach provides the opportunity to delve deeper into the diverse experiences with these instruments and obtain further insights into the reasons behind their application, which is a limitation of quantitative methods.

Based on an extensive literature review, Casula et al. (2020) identify three basic research purposes: explanation, description and exploration. This research is exploratory as it tries to uncover the barriers and limitations that are not predefined. No hypothesis has been tested (Casula et al., 2020). As mentioned before, this research addresses a “how” question, instead of the “what” question, which is answered with descriptive research that does not focus on the cause or the “why” question, which is the focus of explanatory research.

The type of reasoning applied in this research is inductive. Inductive reasoning is appropriate when the goal is to generate new insights or build theory based on observed data rather than to test existing theories or hypotheses (Casula et al., 2020). In inductive research, patterns, themes, and categories emerge from the data through a careful analysis process. The analysis remains open and exploratory, allowing for creativity and a deeper analysis of the main barriers and obstacles that hinder the practical implementation of financial de-risking instruments. This process ensures that the conclusions are substantiated by the real experiences practitioners encounter, thus enhancing the relevance of the research outcomes. Accordingly, this work has started with the collection of data through in-depth interviews with industry experts, from which patterns and insights were gradually developed.

3.2 Data gathering

3.2.1 Interview methodology

Given the study’s qualitative, inductive and exploratory orientation, semi-structured interviews were selected as the primary data collection method in addition to a literature review. An interview aims to uncover the knowledge the interviewee

possesses. It allows the participants to explain their experiences and insights in their own words. The type of knowledge that is sought in this research is technical knowledge and practical process experience. Technical knowledge consists of operating and applying aspects related to a specific field. Expert knowledge can provide more systemic, thought-through, and accurate insights than what can be found in the literature. Semi-structured interviews are often used in this kind of research, as they strike a balance between providing structure through a topic guide and allowing flexibility to explore emerging themes in greater depth. This format enables researchers to guide the conversation while also following up on insights as they arise (Bogner et al., 2018).

Therefore, semi-structured interviews have been identified as most appropriate for this thesis. A detailed interview protocol has been established to guide the interviews. This protocol was used as a guideline and to help the interviewer. The interview protocol can be found in Appendix B. The semi-structured interviews lasted a minimum of 30 minutes and a maximum of 60 minutes. The expert's current perceptions and future perspectives on applying financial de-risking instruments were discussed during these interviews. All participants were informed about the study's purpose, procedures, and rights. Informed consent information was shared with each participant, and verbal or written consent was obtained.

3.2.2 Recruitment of Participants

The literature on the required number of interviewees differs; a standard answer is "it depends" (Baker & Edwards, 2021). Ragin suggests that twenty interviews for a Master's thesis are sufficient, and Adler and Adler advise graduate students to sample between 12 and 60 participants (in Baker & Edwards, 2021). Nevertheless, the main goal is to reach saturation of participants. Saturation is reached once the data or responses start to be repetitive.

For this research, interviews have been conducted with a representative set of participants across the investment community of clean energy investors and capital mobilisers for EMDEs. The sample criteria did not define an already existing group. The requirements described individuals with a similar position, experience or knowledge but not part of one specific organisation or institution. Kristensen and Ravn (2015) highlight that despite the increased flexibility for researchers, this also comes with challenges for recruiting informants. Two main recruitment strategies have been applied: the involvement of a mediator and snowball sampling.

A mediator is a person who uses their formal or informal position and relationships to facilitate contact between the researcher and potential interviewees. I have contacted the interviewees through the network of my thesis supervisors and my network. Once these first contacts were established and interviews were conducted, the interviewees were asked to help the researcher connect with more interviewees. In literature, this is referred to as snowball sampling (Kristensen and Ravn, 2015).

In addition to these two strategies, other relevant organisations with no prior personal connection have been contacted directly through email or telephone. This strategy has been less successful than involving a mediator and snowball sampling: out of twenty-one organisations contacted, only five responded, resulting in a single completed interview.

3.2.3 Sample group

In total, 21 interviews have been conducted with 23 experts working at 21 different institutions. Interviews with two experts simultaneously are labelled under one acronym, making no distinction between who said what during these interviews. The interviews took place in March, April and May 2025. The sample group includes professionals currently working for or who have worked for, amongst others, bilateral and multilateral development finance institutions, multilateral climate funds, consultants, governmental development bodies and local banks. Appendix C contains a table with an overview of the participants. Almost all the interviewees agreed that the interview was recorded and cited in this report. Some interviewees did not permit the enclosures of personal information and are therefore unidentifiable in the table.

3.3 Data Analysis

For the analysis of the collected data, a thematic analysis is identified as the most suited and appropriate methodology for this research. Thematic analysis is used to identify patterns and themes within datasets (Maguire and Delahunt, 2017). It is not bound to a specific field, theory or perspective, making it a flexible method. Thematic analysis is well-suited for qualitative, exploratory research as it enables the identification and analysis of patterns and themes based on the obtained data. In line with the inductive approach of this study, themes were not predetermined but emerged organically from the analysis of the interview transcripts and participants' responses. Conducting a thematic analysis is more than simply summarizing the data, the researcher needs to understand, interpret and make sense of the data that comes, in this research, from the interviews (Maguire and Delahunt, 2017).

There are multiple ways to approach and execute a thematic analysis (Maguire and Delahunt, 2017). The six-phase framework provided by Braun and Clarke (2006) has been used for the data analysis in this research. The first step is to become familiar with the data. This has been done by relistening to the recording and polishing the transcripts. The initial transcript of the interview consisted of a single block of text without differentiation between speakers. The recording was manually reviewed to verify the accuracy of the automatic transcription and to attribute statements to the correct speakers. During step two, the transcript was coded. Here, open coding was applied. The codes were not predefined, and all relevant information, main takeaways, examples of projects or other organisations, enumerations, and other important details were marked with a specific colour in the transcripts. Step three consists of the identification of themes. Themes are patterns that capture something significant and repetitive in the data (Maguire and Delahunt, 2017). This was also done manually. The codes from step two, the marked text from the transcripts, were written down on post-its and added to the corresponding poster. There was one poster for each question/part of the interview: the current application of instruments, barriers for their implementation, required changes and current trends/future outlooks. After all the interviews had been re-examined and their main pieces of information had been written down on a post-it and added to the wall, recurrent codes were grouped into broader themes that matched the focus of the poster.

Step four, a review of the themes, has been done in the final three expert interviews. Next, in step five, the final themes were defined. The last step, step six, included writing down the results. These results can be found in Chapter 4. To increase the credibility and substantiate the research findings, direct quotes from the interviews are included in the results section (Gioia et al., 2021). Some of the interviews have been conducted in Dutch. The researcher, a native Dutch speaker, translated these quotes into English before they were included in this thesis.

Afterwards, the outcome of this manual thematic analysis was compared to that of a thematic analysis conducted by the AI tool NotebookLM. NotebookLM is not designed to perform a thematic analysis. This AI tool generates responses solely based on the document uploaded by the user, relying only on the information provided (*Google NotebookLM*, n.d.). Specialised AI tools were mostly subscription-based and still involved manual coding or user-guided input for an analysis. NotebookLM has been used to analyse the raw data and the transcripts of the interviews and to generate initial insights. The raw data was anonymised to ensure that all interviewees and their organisations remained unidentifiable. These results are compared to those obtained from the manual thematic analysis done by the researcher in Section 4.5 and further discussed in Section 5.2.

3.4 Limitations

Several limitations of the chosen method must be acknowledged and influence the credibility of this thesis. First, as with most qualitative studies, the results and conclusion might have differed with a different sample group for the same research question. This research relies on a small group of experts, whose experiences and perspectives may not fully capture the diversity of opinions in the field. Each interviewee influenced the conclusion. Therefore, different interviewees who emphasize different aspects of the barriers and limitations to implementing de-risking instruments, could have resulted in a different conclusion. Important to note here is that quotes from multiple interviews substantiate every key theme. This indicates that some form of saturation is present in the data, as several interviewees have repeated themes. Another inherent risk of interviews is the potential for bias in interviewees' responses, or incentives that may influence what they choose to share.

Furthermore, as seen in Appendix C, five interviewees operate in or work with projects in Africa. Their views might not be representatives to applying these instruments in other EMDEs. This touches upon another limitation: the chosen geographical scope, EMDEs, might be too broad a statement, as environmental, economic, social and political characteristics vary widely between EMDEs. This geographical scope has still been chosen because this research focuses on the application of de-risking instruments by donors, investors, and capital mobilisers, independent of the geographical area in which they are located or invest.

Additionally, despite the researcher's intention not to impose ideas on the interviewees, it might have happened that conclusions from the first interviews shaped the conversation of the following. To mitigate this risk, the researcher followed the same interview script throughout all the interviews, except for the last interviews, where the identified themes were reviewed and refined.

Finally, despite being a systematic approach, thematic analysis involves the researcher's interpretation. Others might establish different codes and themes from the same data and interpret them differently (Gioia et al., 2013). Various interpretations can be overcome by inviting different researchers to analyse the same data. Since only one researcher worked on this project, Notebook LM's AI tool has been used as a second opinion.

The researcher has been aware of most of these limitations since the start of the data-gathering period, so they have been actively minimised during the process. Consequently, this research offers a thorough and reflective exploration of the key barriers that hinder the implementation of financial de-risking instruments and the required changes to overcome these barriers, providing a strong basis for future research and practical improvements.

4 Results

This chapter presents the findings derived from the interviews and thematic analysis. Section 4.1 outlines the current use of financial de-risking instruments and captures the interviewees' experiences with and perspectives on them. Sections 4.2 and 4.3 present the thematic analysis results, which consist of the key barriers that prevent the implementation of financial de-risking instruments and the necessary changes to overcome these barriers. Section 4.4 explores emerging trends associated with these instruments, while Section 4.5 concludes the chapter by comparing the findings from the thematic analysis with the outcomes of the AI analysis by NotebookLM.

4.1 Current application

All the interviewees apply and recognise the financial de-risking instruments included in this thesis' classification. This classification is supported and also criticised by the interviewees, which is discussed in detail in Section 5.1. Despite the barriers to their implementation, which will be highlighted in the next section, some interviewees state that the usage of these instruments is "*business as usual*" (Int1) and they are "*pretty standard and traditional instruments"* (Int18).

The level of development of the country and local markets influences the instruments that can be applied, according to interviewees Int5, Int8 and Int9. As one interviewee noted:

> "*Depending on the level of development, you can be sophisticated on the use of the instrument. And that's why you can have a hierarchy. And the more you are sophisticated, the more you use all these instruments, which are all being used in Europe.*" (Int5)

Determining which instruments are applied depends on the need and type of project, which varies widely. Multiple interviewees highlight that instrument combinations are also used (Int1, Int8, Int13, Int16). Furthermore, the instruments are constantly changing and being developed (Int11). This results in a wide range of financial de-risking instruments, as described by Int9:

> *"Development finance is very tailor-made per situation. And that is why they have so many products. Depending on the situation, one instrument is better than the other."* (Int9)

Private or semi-private institutions have mostly issued and offered these instruments. Public institutions still have much to learn about taking and carrying risks (Int2, Int3, Int11). Despite that Int5 would have wanted to see a faster uptake, the implementation of these instruments has increased over the years. The following paragraphs include the interviewees' views on the current application of the financial de-risking instruments included in this thesis.

Bonds

Bonds have been present in financial markets for a long time. Since bonds are not issued for one single project but rather for an organisation or fund that combines projects, the impact reporting is important for investors (Int7). Despite the acknowledgement that climate-related bonds are gaining more attention and are an

important instrument (Int1, Int5, Int14), interviewees are also critical of the role bonds play in de-risking and mobilising private capital. Int6 and Int12 highlight that the only thing that has changed over the past period is the labelling of the bonds (green, social, sustainable…), but that the capital mobilised through this instrument has not significantly changed. Furthermore, Int9 and Int19 question a bond's capacity to de-risk investments. Section 5.1 discusses further whether the included instruments are justified to be selected as "de-risking instruments".

Derivatives

Derivatives are mainly offered by commercial banks or private finance institutions. Multilateral and bilateral DFIs use derivatives, especially currency swaps, but they mostly use external providers and do not offer them themselves (Int1, Int9). Governments use different types of debt swaps to mobilise more capital (Int7). Int5 points out that the most common swaps are debt-for-nature and debt-for-adaptation swaps, but debt-for-energy swaps have not been used despite their potential.

Equity

Equity is the core of all these instruments, as pointed out by Int12: *"everything is linked to somebody willing to put up equity as a starting point"*. It is an instrument with which the public sector can take some relevant risk that improves the risk-return profile for private investors (Int6). De-risking smaller-scale projects, through, for example, co-investments or special purpose vehicles, is and has been difficult:

> "*We've known the challenge* [trying to raise equity or co-investment for smaller-scale developing activities] *forever, but it does not really mean that the fundamentals are on the side of the smaller projects. They are not.*" (Int12)

This issue has been confirmed by Int4, which mainly works with and focuses on small-scale energy projects. Int4 mentions that the long lead time, relatively high costs, and legal requirements are the main obstacles to setting up special equity structures that can de-risk small-scale energy projects.

Grants

Grants are the most controversial instruments, and experts have widely varying opinions. On one hand, the importance and necessity of grants for basic research, development of the project and securing the cash flow during the construction and first operation phase, therefore lowering risk for investors, is emphasized by Int3, Int6 and Int15. Oppositely, Int12 and Int17 state that financial structures that include grants should be avoided as these structures are, by definition, unsustainable. Instead, grants should be considered as a form of equity, referred to as equity grant (Int12) or investment grant (Int4):

> *"So disregarded as a grant, used as a seed capital instead somehow. Something that generates a cash flow that you can sustain your activity with."* (Int12)

Guarantees

Guarantees were the most frequently discussed instrument, and many different interviewees mentioned them. Guarantees are becoming more popular and considered more necessary to improve the level of leverage from public capital, especially

now that development aid budgets are decreasing (Int6, Int11, Int14). The following quote captures this trend:

> *"People are coming kind of in the direction that these are actually a really efficient or effective instrument to mobilise private investment."* (Int6)

Nevertheless, guarantees remain overlooked and are far too little used, according to Int12. Int11 explains that they are not as often used as possible because of their complexity. This is confirmed by Int4, who has tried to set up a guarantee scheme with their organisation but has not succeeded, partly because of the complexity. Guarantee schemes need to be completely sealed off to prevent misuse of funds. Additionally, the current set-up of guarantee schemes results in higher costs than necessary, as the design is often not optimal and does not accurately reflect the risk associated (Int6). Especially for small-scale projects, these costs are a major barrier (Int16).

Insurance

Insurance has not been used a lot for energy projects (Int5). However, insurances are gaining more attention, especially due to the recent and fast-growing development that insurances can help mobilise larger investments (Int1, Int7). Private insurance providers mainly issue these insurances. When governments are involved, it is often a public private partnership. Regarding energy projects, insurance companies are particularly interested and have a business in covering construction risks (Int12). Reinsurance has not yet been highlighted in this report, but it is important to include, according to Int16, as guarantees offered by development institutions are often reinsured in private markets.

Lines of credit

Lines of credit are not used as much for energy projects, in Int1's experience. Nevertheless, this instrument is commonly used and pretty standard for general climate-related development aid according to Int6 and Int7. An issue with the provision of capital through lines of credit is that when capital for a line of credit with a specific development purpose is parked at a local bank in an EMDE, this capital is too often not used and sits at the bank. The unfamiliarity with this type of capital by local bankers and the fact that sometimes these lines of credit with development objectives are offered on the same terms as the bank offers other types of capital are possible explanations for the failed implementation experienced by Int4 and Int12.

Loans

Loans, especially concessional loans, are the main instrument used by the public sector and development banks (Int5, Int6). That is where the bulk of funding for Sub-Saharan Africa is coming from. The maturity, in other words, the lifetime, of the loan is an important factor that influences the de-risking of the cash flows according to Int9. Loans, especially when local banks in EMDEs provide them in EMDEs, are costly and often small-scale projects are too small for many loan providers (Int2). Furthermore, there is another challenge with loans for the development of projects or companies, captured in the following quote:

> "*Loans are nice, but you are actually taking more money out of the company than what you put in. Because of course interest has to be paid.*

So can you do that? Can you give them both credit history and also make sure the company becomes more resilient and builds up reserves." (Int4)

Mezzanine structures

Mezzanine structures are becoming mainstream as they are deployed more often because they appeal to equity investors (Int7, Int13). Despite the complexity of the instrument underlined by Int6, Int5 has seen a lot of successful projects with this structuring. One interviewee emphasized mezzanine structures, saying:

> "*One of the learnings is that the funds that are best positioned are actually the ones that can provide mezzanine instruments. That depending on the situation where the company is, they can either convert it to debt or convert it to equity."* (Int8)

4.2 Barriers to the implementation of instruments

Drawing on the analysis of the first eighteen interviews, five principal barriers to the implementation of financial de-risking instruments for clean energy projects in EMDEs have been identified: complexity of the instruments (1), limited expertise (2), risk aversion amongst stakeholders (3), high associated costs (4) and insufficient pipeline of viable projects (5). This section will elaborate on these barriers, providing insights from the interviews and context to substantiate their selection.

Complexity of instruments

Half of the interviewees identify the complexity of these financial de-risking instruments as a significant barrier to their implementation. Their technical and accounting complexity mainly causes this complexity. In addition, the legal and operational requirements associated with contingent instruments also contribute to the complexity (Int6, Int11). Despite being used for several years, these instruments and the concept of blended finance are still considered a fairly new approach by some market participants and financiers (Int7, Int14). There are only a few examples of how these instruments could and should be structured (Int11). Furthermore, as noted in the previous section, these instruments' structural and contractual variations, often tailored to individual projects, further add to this complexity. This diversity, combined with a lack of common structures and examples, leads to structures that are challenging to manage and present to investors. As one interviewee remarked, *"anything complex is costly, it takes time, and it's not, in many cases, it's not replicable"* (Int21).

From an accounting perspective, clear outcomes regarding using funds are often preferred: either recognizing the money as a grant (fully lost) or as a loan (fully recoverable). Int6 notes that "*many public sector entities have preferred to rather be sure whether the money is lost or 100% gets back",* adding that "*from an accounting matter, it's* [financial de-risking instruments] *not something most government entities like to deal with"*. This preference shows the institutional discomfort with the contingent and uncertain nature of many de-risking instruments.

Moreover, this complexity also discourages private sector participation. Interviewees Int13, In14 and Int19 experience that these instruments' complex structure often tends to scare away private investors. As Int14 describes:

> *"They can look at this super complex blended finance impact fund that gives them 7% interest rates, and then they go, 'I might as well just invest in a US government bond that gives me a guaranteed equivalent return. Why read this 300-page document about how this guarantee will work?"* (Int14)

Limited expertise

While banks and institutional investors are generally aware of the variety of instruments available, several interviewees mention that development organisations often lack this financial expertise:

> *"It* [the usage and design of financial structures that include de-risking instruments] *requires a financier who has a lot of knowledge about what they are investing in, and there are simply not that many of them."* (Int11)

Across the interviews, various stakeholders were identified as lacking the knowledge or capacity to implement these instruments effectively. Public donors and local institutions based in EMDEs, so recipients, are most frequently mentioned and will be discussed in the following paragraphs.

With extensive experience working with such institutions, Int5's remark reflects an external observation and an internal recognition of the limitations of public donors:

> *"Most of the donors or the* [bilateral or national] *development agencies are ill-equipped to advise on sophisticated project finance for energy development projects"* (Int5)

This internal recognition is further supported by Int4, who states: "*We do not have the people who understand this* [design of instruments] *very well",* which shows an awareness within governments of the lack of their capacity. According to Int2, most ministries of foreign affairs have limited experience with de-risking instruments such as guarantees or insurances, as the responsibility for risk mitigation and the carrying of risks has historically been delegated to national or international DFIs.

A broad diversity of de-risking instruments is needed to mobilise investments in EMDEs. The knowledge to effectively utilise these instruments is often lacking locally. Neither the local governments nor the local banking sector can adequately cover this knowledge gap, according to Int6. This observation is confirmed by Int3 and Int10, who specifically highlight the lack of financial knowledge among local project developers. Local development projects in EMDEs are and have been mostly funded through grants. Introducing loans or other types of recurrent capital fundamentally changes a project's financial and accounting structure. This creates capacity challenges as local project developers are unfamiliar with these financial structures. In addition, there is a confusion surrounding the term 'green finance' and other types of finance: it is frequently assumed that this type of financing will come with concessional interest rates if there are interest rates at all, which is not always the case.

Risk aversion amongst stakeholders

Financial de-risking instruments aim to reduce the risks for private investors by either providing additional capital from donors or transferring the risk to other

stakeholders. This raises the questions posed by Int2 and Int9: *"Who is willing and best capable to carry the risk?"* and *"Do the people who have the capital want to take and do they understand the risk?*". Across interviews, a broader issue is identified: a general lack of understanding of the risks involved in clean energy projects in EMDEs, not only among private institutions but also among public donors. This causes a mismatch between the perceived and real risk (Int7, Int13, Int14). Int18 remarks:

> *"Because nobody knows the risk and nobody has tested it, the default option is either not to do it or to do it in a way that is very expensive"* (Int18)

In theory, public institutions, mainly governments and DFIs, are well-positioned to mobilise private capital by absorbing or mitigating some of these risks. Governments and DFIs, however, have been too conservative with these de-risking instruments and are not fulfilling their role as de-riskers, at least not as well as some interviewees would like to see. The following paragraphs will discuss the role governments and DFIs fulfil in greater depth.

Governments operate with taxpayers' money and thus need to comply with high standards of accountability and transparency. Int4, Int7 and Int8, all operating under a governmental mandate, confirm that demonstrating taxpayer money's effective use and impact is a fundamental requirement. Public institutions must be able to verify and communicate that their financial interventions align with defined development objectives. Historically, governments have not liked and have never wanted to take risks, primarily due to concerns of the potential loss of public capital (Int2, Int6). Using de-risking instruments introduces uncertainty that is often difficult to explain and justify to the public. As noted earlier, governments tend to prefer financial instruments that offer certainty regarding outcomes. Int6 elaborates on this concern by stating that *"some of the bad stories in parentheses out there are often involving equity and guarantees",* suggesting that past negative experiences with more uncertain financial instruments further reinforce governmental risk aversion.

A similar issue, a lower-than-expected level of risk taking, applies to DFIs. Although DFIs are public entities, their capital allocation rules and requirements are very similar to those of private institutions. Several interviewees mentioned this constraint in their interviews, highlighting the ongoing debate about whether DFIs have been too conservative in risk-taking (Int7, Int8, Int12, Int13, Int14). While their mandates include a developmental mission, DFIs are also expected to generate financial returns, leading some interviewees to argue that they have become increasingly profit-oriented (Int12, Int15) and are thus falling short on their development objectives. Public capital providers should not need de-risking by developmental institutions; this de-risking should instead be aimed at involving private capital providers (Int14). Int13 explains that DFIs have, over time, been required to become more self-sufficient as governmental budget allocations for development aid decreased, and therefore they had to focus more on financial performance as well:

> "*They* [DFIs] *are less risk tolerant than you might think. They can act quite well just like a purely commercial entity because they have to financially take care of themselves"* (Int13)

This commercial orientation is reinforced by the fact that DFIs are subject to banking regulations similar to private institutions and aim to maintain a comparable status within the financial system. Capturing the essence of this challenge, Int19 states:

> "*The DFIs are actually providing something which the banking system is not set up to provide, and that has to do with the risk weights under the Basel three rules." ... "If you look at the risk weights under the Basel three, they are quite punitive for this kind of financing"* (Int19)

The Basel three rules are minimal capital requirements that banks must meet to enhance the banking sector's resilience and safeguard against financial instability (Gratton, 2025). The core challenge for DFIs lies in balancing developmental impact and financial performance. When asked whether DFIs are public entities operating with a private mandate, Int21 responds:

> "*I think this view, and sometimes we ourselves have said this wrong, is less that the DFI can absorb more risk than somebody else. I think what they can do is they can take lower returns"* (Int21)

This statement shows an important distinction: while DFIs may not have a greater capacity to absorb risk under standard regulations, they are, at least in principle, positioned to accept lower returns in pursuit of developmental goals.

When public institutions, who are expected to take some of the investment risk, are not willing to do so, financial de-risking instruments are unlikely to be deployed.

High associated costs

The design and set-up of financial structures that include de-risking instruments is often associated with high costs. Six interviewees identified costs as a key barrier to the broader adoption of these instruments. The complexity of the instruments mainly drives these costs, making the design and set-up of a de-risking structure a time-consuming and resource-intensive process (Int19). In addition, organisations that issue de-risking instruments require projects or entities to comply with environmental, social, or other performance standards. As noted by Int16, whose organisation provides guarantees, meeting these standards can generate significant additional costs. Beyond these transaction-related costs, some de-risking instruments also carry high periodic premium costs.

This cost barrier is even more prevalent with smaller projects. Int3 and Int4, who work primarily with small-scale energy initiatives, mention that local companies and projects often lack the scale necessary to cover the development costs of these mechanisms.

Insufficient pipeline of viable projects

According to Int1, who works for a bilateral DFI, financial de-risking instruments are not scalable because there are not enough projects in which to invest. More than half of the interviewees acknowledge this concern, identifying the lack of a robust

project pipeline as a critical bottleneck to channelling investments towards clean energy projects in EMDEs. As a result, this shortfall contributes to the underutilization of financial de-risking instruments. Nearly all interviewees who mentioned this constraint also offer an important nuance: the core issue is not the quantity of projects but rather the limited number of projects considered suitable or bankable from an investor's perspective. This nuance is clearly articulated during one of the interviews:

> "*Finding that pipeline of projects, it is a bottleneck. It doesn't mean that there aren't projects out there. I know there is for a fact.*" … "*We need to put them together into a diversified portfolio that is communicated in a palatable way.*" … "*Package them in a way that becomes palatable for investors.*" (Int14)

This reflects a broader misalignment between project developers and capital providers, a gap that both interviewees Int12 and Int21 state explicitly: "*what a bank calls a good project is far from what a development professional calls a good project*" and "*what a project developer might perceive as a bankable project may be nowhere near that from a capital provider's perspective*".

The lack of investable projects in EMDEs comes from several underlying factors, given throughout the interviews. First, project preparation is expensive, resource-intensive and does not generate immediate or guaranteed revenue (Int5, Int7, Int20). This discourages early-stage investments and limits the project generation given that development resources are limited. Second, many development organisations lack the internal capacity and technical expertise to originate and structure deals, further constraining the pipeline of viable projects. An additional reason mentioned by interviewees is the uncertainty of demand. Energy demand is key for an energy project's security and long-term viability. Investments in energy infrastructure require a reasonably secure demand outlook to ensure future revenue streams. Without this certainty, projects remain unattractive to private investors. As Int15 explains:

> "*So you need sort of a demand growth as well. And the state normally had this insight and also invested in this, even if they didn't always make a profit in the short run. The natural evolvement of projects was that you need a demand growth before you invest, whereas the private sector doesn't have that role really, or they haven't had that role.*" (Int15)

This observation highlights that governments can actively generate a pipeline of investable projects by identifying and orchestrating demand. In contrast, the private sector tends to follow this demand. If the demand is not secured, investors will be reluctant to invest.

The creation of demand is tied to the underlying market design. The market design and its prominent players can actively hinder or support the development of clean energy projects and the attraction of investors. For example, when there is only one off-taker, as in Int10's electricity market, it is essential to ensure that the electricity generated by a project can be sold. This reliance on a single buyer increases the risk profile of a project. In addition, governmental policies and mandates play an important role in creating investable projects. A barrier that can arise here is the lack

of acceptance of foreign capital in domestic markets. Int2 and Int15 note that some governments do not allow foreign investors because they do not want to sell their domestic infrastructure. Finally, the relatively short term that politicians are in office hinders the development of projects. Int16 points out that politicians mainly focus on and determine their priorities based on what is considered urgent or beneficial during their term. Things are only *"important when I am in office",* whereas energy projects have a lifetime of at least fifteen to twenty years from their development.

4.3 Required changes

During the interviews, participants were asked to reflect on the changes they believe are necessary to overcome the barriers that currently hinder the implementation of de-risking instruments. While these reflections were being asked for in a general manner and not tied to specific barriers, the changes identified by interviewees collectively address all the barriers to implementing financial de-risking instruments. Based on the responses, five key areas of change emerged as essential for increasing the deployment and effective use of financial de-risking instruments in EMDEs: standardisation of instruments and processes (1), enhanced donor education (2), stronger orchestration and alignment of stakeholders (3), more strategic targeting of scale (4) and improvement of the project pipeline (5).

Standardisation of instruments and processes

Stakeholders across the climate finance landscape are actively and continuously exploring ways to simplify the application and promotion of financial de-risking instruments to mainstream their use. Int13, who works for a fund that has multiple de-risking instruments incorporated in their fund, notes: "*We are of course constantly looking at how we can make our model, yes, less complex.".* This reflects a broader ongoing effort to reduce complexity, where there is no one-size-fits-all solution. More benchmarks and examples of the deployment of instruments will make things easier and help to overcome this challenge (Int11). One of the key proposals to reduce complexity is the standardisation of project structures that incorporate de-risking instruments:

> *"We need to do better work in harmonising with each other, so we don't create this complexity. So more standardisation, more harmonization between each other and how de-risking works". … "There's been a lot of piloting done in the last ten years, and the next stage is very much trying to narrow down what works and what doesn't work. So by that I mean standardisation. So trying to standardise more what actually works with bringing in private capital and what doesn't work."* (Int14)

However, reaching standardisation is complicated because of donors' diverse preferences and mandates. Int20 highlights that the complexity of the instruments originates from (varying) return expectations of stakeholders:

> "*If everybody were just providing grants, that would be an easy way to standardise things, but that would not be so palatable with the taxpayers of that country." … "I think they* [financial de-risking instruments] *are not standardised so far because in my experience, different donors or contributors have different risk tolerances and also different expectations*

in terms of recovery of their capital. I am not sure they can be easily standardised, because the authorizing environment in each of these countries differs from country to country." (Int20)

Similarly, Int21 points out that because project-specific risks and stakeholder expectations vary widely, the focus of standardising the underlying financial project structures and project development should instead be focused on, over the standardisation of these financial instruments.

These reflections suggest that while complete standardisation of financial de-risking instruments may be difficult, progress can still be made by harmonizing processes and documentation that guide their integration.

Enhanced donor education

Five interviewees (Int2, Int6, Int10, Int12, Int20) mention the need for enhanced donor entities' education. Education is needed for the public sector on the diversity of instruments available for the energy sector, on carrying risks, and on how to efficiently structure projects financially. With education, the instruments will be better understood and easier to implement. A better understanding of the instruments would facilitate their implementation and improve public actors' ability to justify and communicate their use, both to the public and to internal stakeholders. Int6 notes that when governments cannot explain why a guarantee or equity investment might be preferable to a traditional grant, it becomes difficult to find political and institutional support. In addition to addressing the knowledge about specific instruments, education can help overcome the perceived risks related to climate finance in EMDEs, which are often too high (Int2) and support the development of good projects from a development and financial point of view (Int12).

Beyond public sector actors, Int20 underlines the broader need for education on blended finance structures. The complexity and growing relevance of these instruments call for an earlier integration in education:

> *"Given how important this has become, maybe it is time for the education system and the university system in various countries to actually come up with courses on blended finance, which may be a little bit more focused on the trade-offs between creating impact and achieving return of capital as opposed to conventional finance and economics."* (Int20)

This suggests that addressing the educational gap requires technical training for current donors and a long-term investment in developing a new generation of finance professionals who can navigate the complexities of climate and development finance. Int20, who works for the IFC and has extensive experience with these instruments, has offered to contribute practical examples and case studies—should someone be willing to design such a course.

Stronger orchestration and alignment of stakeholders

A diverse field of stakeholders shapes the clean energy investment landscape in EMDEs, each fulfilling specific roles related to policymaking, project development, financing and risk mitigation. However, as highlighted across interviews, these roles do not have clear boundaries. Instead, stakeholder mandates sometimes overlap,

creating unclear responsibilities and confusing expectations. At the same time, some critical elements, such as early-stage project preparation and development, as well as long-term risk absorption, are not adequately covered, resulting in institutional gaps. This fragmented landscape needs stronger orchestration and alignment of stakeholders. Int7, Int14 and Int19 all emphasize that no single stakeholder can do this alone. Instead, collaboration, in which all stakeholders must step up and participate, is essential to mobilise private capital towards clean energy projects in EMDEs effectively.

Organisations have different strengths and capacities that determine the role and the risks that these organisations can take. For example, Int21 mentions that the commercial sector is better at financial engineering than DFIs, and the DFIs are better at structuring the projects. Int20 adds to this discussion:

> *"The private sector is very good at analysing and assuming performance risk of a project and also in certain situations assuming technology risk or new business model risk. The private sector cannot deal with regulatory uncertainty.*" (Int20)

The views highlight the need for the involvement of different actors in the development of projects to cover and effectively manage the various types of risks. Int20 elaborates:

> "*I think it's a myth, if governments think that they can pass on all the risk in a PPP* [public-private partnership] *project to a private sector developer."* (Int20)

Governments should be involved and carry some of the project risks to ensure that they minimize the potential negative impact of regulatory and political risks on the project. Int18 highlights the necessity of developing a wider ecosystem, where financial institutions, developers, and legal firms are needed as well, in addition to the provider and recipient of capital. Every actor has something to contribute.

Stakeholders involved, however, have not always fulfilled the core roles for which they were established. Roles that are essential for the creation of a complete and functional market. Int5 suggests that organisations should critically look at their activities and whether they are fulfilling the fundamentals of what they are about. "*The syndrome of thinking that you are needed"* is what Int5 calls the phenomenon that, especially bilateral DFIs, are taking on other roles than for which they were founded. To have a well-functioning, complete and effective investment landscape, we should go back to the fundamentals of what institutions are about and distribute the carrying of risks accordingly.

Interviewees stated that DFIs should focus on project development, only invest in the early stages or immature technologies, and leave the actual financing to the private sector as soon as possible. However, the development roles of DFIs do not always fit the requirements they have to live up to from the banking sector, as mentioned before, under the barrier of Risk aversion amongst stakeholders. The role of a DFI is described as follows during one of the interviews:

> "*We should be talking about private capital mobilisation because that's sort of the essence of the development finance institutions. They*

> *should always be building the market and sort of paving the way for the private sector and leaving the private sector to finance the projects as soon as possible, and maybe that hasn't been happening enough."* (Int7)

Interviewees Int5, Int6, Int9, and Int21, who have extensive experience working for and with DFIs, confirm that DFIs should be catalytic and mobilise private investors through the legal, regulatory, and financial development of projects.

Just as private investors, DFIs also have investment targets and return expectations. Int8 points out that "*investors like DFI and other commercial investors, they have their risk return expectations for a reason and they cannot be not complying with those."* As a result, these expectations can lead to suboptimal financing structures, from a mobilisation point of view, as DFIs keep projects for themselves rather than crowding in private investments (Int11). According to Int6, the fact that these organisations are so conservative reflects what their stakeholders want, so governments set up the rules within which these organisations have to operate and therefore could also change these expectations. Int6, Int7 and Int14 urge governments and DFIs to take more risks and significantly contribute to the broader challenge of clean energy development beyond individual achievements.

Traditionally, organisations have been doing their own thing. Stakeholders are working towards different objectives and have very different expectations of what their investments should achieve (Int14, Int18). This makes it difficult to agree on the transition that needs to take place (Int15). According to Int12:

> "*There is a very bad connection between the development world, the wanna do goodies, and the finance world. Even the development finance world. You know the old story about the conflict between those two groups of people: the banks saying 'There are no good projects, we have plenty of finance' and the developing people saying 'There is no finance, there's plenty of projects'."* (Int12)

When good investment opportunities are developed, private investors will find their way, because, as Int19 explains:

> "*I have this belief that you don't really need to mobilise anything. The financial sector is specialised in finding opportunities. This is what they do for a living. This is what they are paid for."* (Int19)

This is supported by Int21, who mentions that strong business cases, that build upon suitable policy frameworks and cost-reflective pricing, will make markets move themselves. The challenge is in bringing together all the stakeholders and, in Int18's words, "*getting into a situation where everybody's comfortable with the other's objective and a deal is struck"*. The need for more collaboration and better alignment amongst stakeholders is emphasized by Int8, Int15, Int16 and Int17.

A stronger orchestration and alignment of stakeholders will also result in a more complete market, where all relevant stakeholders are included. The inclusion of every stakeholder has not always been successful. Int8 mentions that "*there is a lot of local capital in Africa that is not being currently mobilised"*. The fact that a very low percentage of local capital goes towards climate finance activities in EMDEs was also brought up by Int14. This is a significant untapped source of financing for clean

energy projects in EMDEs that could be utilised with better collaboration between stakeholders.

According to Int19, "*the most consequential actor that could influence and impact finance flows by creating the opportunity is the local government*". This view is supported by other experts:

> "*It's not that other stakeholders could not do it, but I think optimally, it's really a government who wants a project to say, "hey, I want this project for my community or for my stakeholders. These are the people that are talking to me. I don't know exactly how they work, but I think we should all get into a room and try and see if we can help each other.*" (Int20)

Stronger orchestration and alignment of stakeholders will benefit the speed and scale at which projects are delivered, especially when working towards the same developmental goals. Interviewees also note that collaboration is needed in a balanced way, as there also has to be competition to ensure that capital is well spent (Int11, Int17). Competition is also required in a balanced way, as MDBs and DFIs are not supposed to compete in a way that prevents the private sector from participating (Int7).

A more orchestrated approach would ensure that each actor brings their specific skills, be it risk capital, policy influence, technical assistance, or local presence, and that these contributions and efforts are complementary rather than fragmented. This systemic alignment is essential to overcome the barriers that prevent de-risking instrument implementation and enable a reliable pipeline of investable clean energy projects in EMDEs.

More strategic targeting of scale

Next to better risk absorption and more security for investors, scale is important as it can result in cost savings through economies of scale, and it brings the scattered landscape of stakeholders together so governance, transparency, or other issues can be jointly tackled. One interviewee remarks:

> *"I think that the way forward is really on targeting scale". …* "*When you have big facilities, you can have bigger portfolios. So you can also absorb risks much better.*" (Int8)

Pooled financing opportunities, which combine multiple small projects into investable portfolios, have not been offered that much (Int7). This is a missed opportunity, especially since most private investors seek minimum ticket sizes in the tens of millions and generally do not want to engage in fragmented, small-scale deals. Finding the best way to scale projects remains difficult and a challenge (Int21).

Improvement of the project pipeline

Interviewees widely see a stronger and more consistent pipeline of bankable projects as essential for scaling the use of financial de-risking instruments. They identified several actions that could enhance this project pipeline: local capacity building, increased funding, and a shift to a demand-driven approach.

Engagement with local project developers, particularly small and medium enterprises (SMEs), is considered an important starting point. Local businesses often lack

the technical and financial expertise to design projects that meet investor standards. According to Int2, international organisations often expect that the business understanding is present with local entrepreneurs, but this is rarely the case. Therefore, SMEs will benefit from entrepreneurial training and courses. Int16 notes that more direct support and handholding could be beneficial:

> "*We are not managing the project, but maybe we can be more thoughtful and engaged in terms of the knowledge sharing"* (Int16)

While such support is essential, few organisations have an on-the-ground presence and experience to provide this. Int14 highlights that the UN can play an important role in facilitating investment opportunities in EMDEs, as they already have local offices and deep networks in these markets. However, Int12, who works for the UN, mentions that they have been proposing to facilitate the design of projects that meet development objectives and private capital expectations. Still, their efforts have not received the required response from the community to continue.

The second identified action urges to increase funding for project preparation. Project preparation: conducting feasibility studies, addressing technical and political risks and structuring the financial model is resource-intensive and underfunded. Multiple interviewees emphasize that more preparation funding is required to improve the pipeline of investable projects (Int5, Int8, Int18, Int20):

> *"You need to prepare a list of a portfolio of projects. So that the private sector, when they come to finance it, they have some projects where feasibility study is done, where bankability is done, where construction risks, operational risks, supply risks of their repayment risk, political risk, currency risks are all looked at somehow." … "The question is you have to fund it. Somebody has to pay. And most of the countries don't want to put that money. And most of the banks who will finance this project are not going to put for $1 billion project, 10% for project preparation."* (Int5)

Private financiers are often unwilling to invest in companies still in the early stages of growth (Int8). In addition to project preparation, concessional capital is needed for the growth of these companies so they can become commercial.

Third, several interviewees argue that the project development should evolve from push-driven, where projects seek out finance after being conceptualised, to pull-driven, where projects are developed based on clearly identified energy demand and investor interest (Int12, Int15, Int17, Int19). Int12 mentions that a demand-oriented approach is more likely to yield investable outcomes. In practice, this shift requires more structured planning from the start of a project and an understanding of local market demand. An important question that always needs to be asked when establishing the local market demand is: "*Who pushes whom? Do people really need, want and/or can pay for this energy source?"* (Int3). The local demand is not simply equal to the number of people without access to electricity, and a more elaborate analysis is required to determine the energy demand (Int19).

Furthermore, in a pull-driven market, companies must compete against similar companies. In the design of Int17's programs, they make sure that big international companies do not compete against local SMEs to stimulate the development of

different types of companies and to create a dynamic and diverse market. Governments can play a critical role by creating an enabling environment. Six interviewees cite the need for greater regulatory certainty and legislative stability to encourage long-term investments in EMDEs.

4.4 Current trends

When asked about current trends and future outlook regarding financial de-risking instruments, interviewees are positive about the progress being made. Int6 mentions that governments are starting to change, that they understand the instruments better and are taking more risks. Int19 highlights that the barriers related to these instruments are being overcome, and organisations are working on streamlining processes. Furthermore, there is a lot of progress on collaborations. Three interviewees mention the M300 program by the World Bank as an example (Int8, Int17, Int19). This program was set up by two MDBs joining forces to provide and rapidly increase access to energy in Africa. Int15 points out that we should not forget that things can change.

A less positive trend is that official development assistance (ODA), governmental budgets for development aid, have been and will continue to decrease:

> "*For the medium term, say the next five years, I think that development aid will decrease and that stricter requirements will be imposed, and that you can therefore go less low in transactions and take less risk.*" (Int4)

Given that resources will be more constrained, stakeholders will be more aware and see the necessity of collaborating, in Int16's view. In addition, the increased pressure on the available resources also increases the requirement for "*mutually beneficial partnerships*". In this case, the donor will get a financial return or other benefits from the investment, or can clearly show the impact made with their capital. In other words, the capital will be less ideology-free, less that it would only benefit the aid recipient (Int7). This will increase the demand for accurate impact measurement, which has not been as established as wished for or demanded by investors (Int14). When an investor is financing 1% of the World Bank Group, it is very difficult to report and showcase to your taxpayers what you are achieving with the capital (Int7). This focus on, or, as Int19 describes it, people's obsession with action and attribution of development to their contribution, also acknowledged by Int4, does not always go well with certain de-risking instruments:

> *"Using a guarantee instrument is not as glamorous and doesn't really get you the kind of recognition that you've done something." … "I think there's even a paper on that. They're showing that underwriting a guarantee will not get you as much recognition as doing a senior lending to a project."* (Int19)

Nevertheless, given that organisations want to use their capital more efficiently and effectively now that replenishments are decreasing, most interviewees agree that financial de-risking instruments will become more important.

4.5 Comparison to AI analysis

Given that a thematic analysis involves researcher interpretation, incorporating an AI tool to analyse the same dataset enhances the reliability of theme identification

and helps mitigate potential researcher bias. The results from the AI analysis done by NotebookLM include the identification of nine barriers that cause the underutilization of financial de-risking instruments for clean energy projects in EMDEs. Corresponding to these barriers, nine changes have been identified on how to overcome each. The full results from the AI analysis are included in Appendix D. Figure 4.1 shows how the identified areas by NotebookLM are covered by and relate to the identified barriers and required changes from Sections 4.2 and 4.3. To avoid confusion, barriers and changes identified by AI are referred to as AI barriers and AI changes, including their corresponding number. In contrast, the barriers and changes identified in Sections 4.2 and 4.3 through the thematic analysis (TA) are referred to as TA barriers and TA changes.

AI Barrier 1 - Lack of Bankable and Ready Projects corresponds to the TA barrier 'Insufficient pipeline of viable projects'. The changes identified under AI change 1, which include funding project preparation facilities, developing a portfolio of projects and building local capacity, overlap with the changes described under TA change 'Improvement of the project pipeline'. AI barriers 2 - Risk Perception vs. Reality & Investor Behaviour, 4 - Knowledge and Capacity Gaps, 5 - Regulatory and Policy Environment, 8 - Coordination and Collaboration and 9 - Capital Availability and Cost each overlap with and are covered by the TA barriers defined in Section 4.2. The TA changes identified in Section 4.3 also include their corresponding AI changes.

The TA barriers are all addressed by one or multiple TA changes. This is shown in Figure 4.1, where each TA barrier, the dark blue rectangles, matches with one of the nine AI barriers, the lighter blue circles. The AI changes, shown with the purple circles in Figure 4.1, are identified for specific AI barriers during the AI analysis. This complete analysis can be found in Appendix D. All TA barriers match one of the barriers identified by AI and consequently have a corresponding change that helps to overcome this barrier.

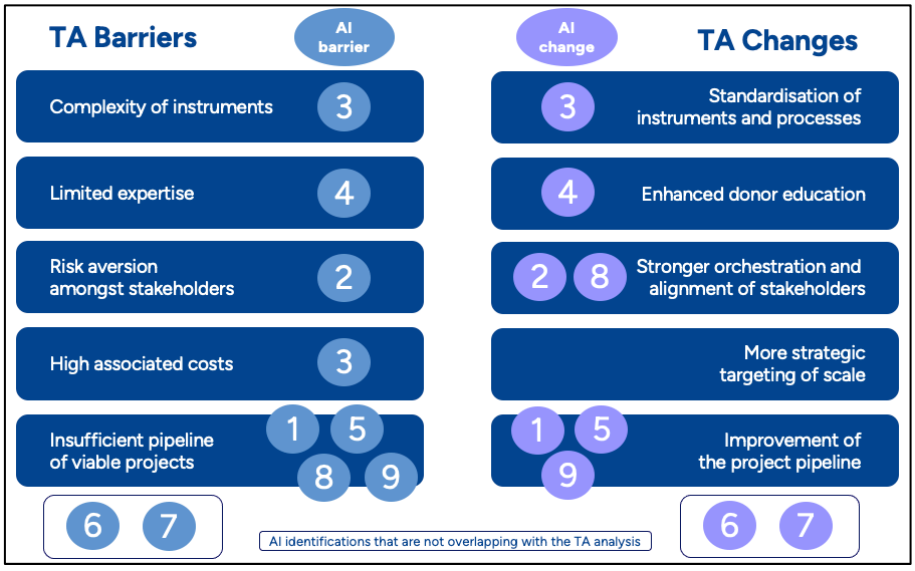

Figure 4.6 Comparison of barriers and changes identified by the researcher through thematic analysis (TA) and NotebookLM (AI)

The TA change that stands out is ‘More strategic targeting of scale’, as this change is not identified as a focus point in the AI analysis. Furthermore, a few identifications from NotebookLM stand out: 6 and 7. AI Identification 6 - Instrument Effectiveness and Appropriateness is not directly addressed under one of the five TA barriers or changes. This is also the case for 7 - Incentives and Recognition. Section 5.2 further discusses this difference and narrows down the changes to focus on.

5 Discussion

This chapter discusses the results presented in Chapter 4, comparing and enriching them with insights from the literature reviewed in Chapter 2 to fulfil the research objectives. Section 5.1 revisits the classification of financial de-risking instruments as established in Section 2.1.1, incorporating feedback obtained during the interviews. Section 5.2 continues the comparison of the thematic analysis (TA) and AI-supported findings that started in Section 4.5, and refines the initially identified changes to four key priorities. Section 5.3 explores the role of financial de-risking instruments within the broader context of mobilising private finance for clean energy projects in EMDEs. Finally, Section 5.4 reflects on the relevance of the proposed changes to overcome the barriers that prevent the implementation of financial de-risking instruments in light of the conclusion of Section 5.3 that these instruments may not be the primary bottleneck, assessing whether they should remain a focus of stakeholders.

5.1 The classification of financial de-risking instruments

The classification of financial de-risking instruments established during the literature review was shared and discussed with the participants at the start of the interviews to develop a common understanding of the term. Most interviewees who were explicitly asked if this list resonates with their knowledge of de-risking instruments recognise and acknowledge this classification, with one interviewee describing it as "*quite exhaustive*" (Int20). Another interviewee (Int18) acknowledged the classification but suggested grouping the instruments into debt, equity, grants, and unfunded risk protections.

Nevertheless, some participants raised critical reflections regarding the precision of the classification. One interviewee questioned whether the list accurately covers the essence of de-risking instruments, describing their essence as follows:

> *"If we take kind of an abstract view of what an instrument would be, it would be something that one of the investors or someone who puts anything into a project would get either reduced probability of an adverse event affecting the project economics or reduced consequences should such an event happen anyway."* (Int19)

According to this perspective, certain instruments, such as bonds, do not belong in this classification. Whether other instruments belong under this classification depends on the identity and objective of the capital provider.

In line with this critique, another interviewee emphasized the importance of distinguishing between structural financing approaches and instruments that directly mitigate or transfer risk:

> *"You kind of got a mix of what are sort of structural approaches or capital raising approaches for clean energy and what are direct de-risking, where somebody is taking the risk from somebody else or helping to manage that risk."* (Int21)

Both interviewees highlight that while several instruments may have de-risking properties, it is context-dependent whether they classify as de-risking instruments.

All interviewees universally recognise derivatives, guarantees, and insurance as de-risking instruments. Equity, grants, lines of credit, loans and mezzanine structures are not, by definition, classified by all interviewees as de-risking instruments. However, these instruments have de-risking characteristics, depending on who injects the capital and under what terms. Consequently, it is essential to specify the capital provider and the conditions under which the capital is deployed to assess these financial tools' de-risking function accurately.

Bonds, however, are "*just a way to raise money*" (Int21) and that despite that "*it's true that it may matter who's buying it, and then it may have some effects because of that* [de-risking]. *But you shouldn't consider this a de-risking instrum*ent" (Int19). As discussed in Section 4.1, interviewees state that the change in labelling of the bonds, where a bond is given the label green, sustainable, social or a combination, does not contribute to de-risking investments. Therefore, bonds are the one instrument interviewees strongly agree that is unrightfully included in this thesis' classification of financial de-risking instruments.

Literature highlights the de-risking characteristics of these instruments, except bonds, as well. For example, the Green Climate Fund (2022) emphasizes the de-risking capacity of equity, and the OECD (2023) highlights the de-risking and strengthening of investments through grants. Furthermore, Amin et al. (2014) include concessional loans, grants for risk mitigation and equity in their classification of financial de-risking instruments. IRENA (2024) underscores the de-risking of projects in the energy transition through blended finance instruments. According to Habbel et al. (2021), blended finance instruments include equity, grants, loans, and mezzanine structures, among others. This indicates that the instruments identified through the research, excluding bonds, generally fit the classification of financial de-risking instruments. Nevertheless, this discussion shows that, depending on the chosen and accepted definition of de-risking instruments, there is a fine line between what is considered a financial de-risking instrument and a financial instrument that holds de-risking characteristics.

5.2 Narrowing down: key changes to implement

The thematic analysis (TA) done by the researcher and the analysis done by NotebookLM do not completely overlap, as presented in Section 4.5. This section continues with a comparison between the TA and AI analyses. Furthermore, this section motivates the selection of four required changes as focus for the conclusion: the standardisation of instruments and processes (1), enhanced donor education (2), stronger orchestration and alignment of stakeholders (3) and improvement of the project pipeline (4). The first paragraph examines the presence and importance of these four changes in existing literature. The second paragraph motivates excluding the TA change "Target scale". The third paragraph discusses the inclusion of AI identifications 6 and 7, which do not overlap with the TA identifications, as explained in Section 4.5. The last paragraph summarises and concludes this discussion.

The complexity and high costs are frequently mentioned in the literature as a barrier to implementing financial de-risking instruments. This is particularly evident for derivatives (Violetti et al., 2023), equity (UNFCCC authors, 2024), guarantees (Frisari & Micale, 2015; Hussain, 2013) and mezzanine instruments (Hussain, 2013), which are elaborated in Chapter 2. Accordingly, the standardisation of instruments

and processes to decrease the instrument's and project development's complexity and costs is essential. This complexity and inefficiency suggest that there is, in addition, a need for education on concepts and best practices. Limited literature is available on challenges and required changes for scaling up financial de-risking instruments. Nevertheless, the need for stronger orchestration and alignment of stakeholders, alongside improving the project pipeline, is widely acknowledged in literature as essential for the broader development of clean energy. This will be further explored in Section 5.4.

The identified TA change "More strategic targeting of scale" is not included in the final selection of focus areas needing change for three reasons. First, the AI tool has not identified this change, suggesting that it is not as prominent as reflected in the interview transcripts compared to the other barriers and changes. Furthermore, as discussed in Section 4.5 and illustrated by Figure 4.1, the selected four changes address the full spectrum of identified barriers. To maintain focus, this thesis concentrates on these four changes. Third, while the small scale of projects has been identified as a barrier for clean energy investments and capital mobilisation (OECD, 2023; Hussain, 2013), this has not been a focus of recommendations in the literature.

AI Changes 6 and 7 are not included in these final four required changes, although they are not directly addressed under the TA Changes. AI barrier 6 - Instrument Effectiveness and Appropriateness raises the issue that these instruments are not the "silver bullet" and "cannot fix fundamentally poor projects or low returns". The corresponding change describes that instruments should only be used when deemed appropriate. This indicates that these instruments are not implemented appropriately, for which no substantial evidence exists. Nevertheless, the fact that these instruments only work in specific contexts is important to be aware of and discussed in this thesis in the next section, Section 5.3. AI identification 7 - Incentives and Recognition highlights the incentive mismatch of these instruments. This barrier is motivated by the observation that the instruments do not give equal recognition to stakeholders for their participation and urges under AI change 7 to "address this incentive mismatch to encourage institutions to use instruments". To successfully address this barrier and accomplish this change, a personal and institutional mindset shift is required, which is very complicated and layered and touches upon many actors and stakeholders. Besides this mindset shift, a fundamental change in how organisations do their impact reporting and value their impact is required. Since, from the AI analysis, there is no concrete description on how to fulfil this change, this change is not included in the final set. The mismatch, however, is recognised and addressed in this thesis in Section 4.4

To conclude, this thesis recommends overcoming the barriers that prevent the implementation of financial de-risking instruments for clean energy projects in EMDEs through the standardisation of instruments and processes, enhanced donor education, stronger orchestration and alignment of stakeholders, and improvement of the project pipeline.

5.3 The role of financial de-risking instruments

So far, this thesis has focused on assessing the effective use of financial de-risking instruments for clean energy projects in EMDEs. During the interviews, participants from all backgrounds, working under different mandates and in different geographical locations, have questioned the role these instruments play in the broader challenge of mobilising private investments for clean energy development in EMDEs. This happened almost every time on the interviewees' initiative. The researcher did not ask about the broader role that these financial de-risking instruments fulfil within this challenge. The general view is that, in certain situations, financial de-risking instruments are a useful tool. However, these instruments alone will not provide the required capital for a net-zero trajectory, and other aspects are more important to address.

"*It's* [financial de-risking instruments] *great to have, but don't expect miracles from them*", according to one of the interviewees (Int19). This view is confirmed by Int13, who points out that it is possible to find a bit more appetite amongst investors through blended finance structures. However, it is not ground-breaking and will not immediately result in a significant inflow of additional capital. Another interviewee states:

> "*I get frustrated when people say 'We have the silver bullet. This de-risking instrument will change the game'. De-risking instruments are merely the drugs described by the doctor to tackle the symptoms but do not address the root cause.*" (Int2)

The comparison of financial de-risking instruments with medicine finds resonance and is acknowledged by the five other interviewees with whom the researcher shared Int2's metaphor (Int4, Int7, Int11, Int13, Int16). These instruments should be and are designed to be temporary solutions (Int4, Int7). They are not intended to solve financing challenges requiring longer-term or permanent concessionality (Int20).

Financial de-risking instruments can play an important role in the phase after the early-stage development and before a technology becomes standard (Int6, Int7). That is the stage where financial engineering can make an important difference. However, they can only do so when "everything else" is in place, because, in the words of Int16, "*a de-risking instrument in itself doesn't make a transaction bankable or investable*". It is only possible to "*solve things if they're quite close to being economically viable*" (Int6). When financial de-risking instruments are implemented and cover one of the risks, but still four other risks remain that are not covered, the instrument will not magically make the project financially viable. One of the interviewees illustrates this with the following example: "*It doesn't make sense to design a de-risking instrument when there's a major policy barrier*" (Int21). Another interviewee explains:

> "*Even if you de-risk, if you don't have a project developer, you don't have a market, and you don't have an expectation that you will potentially profit from your investment, the guarantee will not work, and the equity will not work either.*" (Int15)

In other words, if the project design is poor, no due diligence has been done, or the financial return is too low, these de-risking instruments will not magically make the

project attractive for private capital providers. Following the medicine metaphor: when your bone is broken, of course, you can take all the medicine that you want and it will relieve the pain, but still, you will need a surgery to recover completely and get fully back on your feet.

Interviewees attribute the root cause that prevents investments from flowing towards clean energy projects in EMDEs, mainly to the lack of availability of bankable projects:

> "*So, it's not about instruments only. We have the instrument. We have the demand. We don't have a project prepared well, and we don't have funding coming.*" (Int5)

One of the main shortcomings in the field, according to Int12, is that there is a lot of effort going into projects that will never materialise. As mentioned under the change 'Improvement of the project pipeline', a more structured approach in developing projects would improve the capital flowing to these projects and, simultaneously, the deployment of financial de-risking instruments. Starting with a clear business case and a secure demand for the energy makes it possible to extract the projects that might be able to be structured as suitable investments for private investors at an earlier stage.

Another root cause mentioned by participants is the perception and understanding of risk. This does not match the actual risk and results in too high pricing too often:

> "*The price of financing for emerging markets, both sovereigns and non-sovereigns, is not reflecting the actual risk of those projects. It's priced higher in general than what the actual risk is. So, I think even getting rid of that sort of perception pricing or whatever is the reason behind it, I think that would help much more than any blended finance.*" (Int7)

This insinuates that donor education might be the most important area of change to focus on.

To summarise, a holistic approach is required to scale up the investments towards clean energy projects in EMDEs and bridge the finance gap required for a net-zero pathway. An approach where we look at the whole value chain of clean energy and focus on its project preparation and execution. In some cases, the de-risking instruments can be helpful. However, their underutilization is not a concern amongst experts, and their scaling up is not a main priority, as it will come simultaneously when other barriers that hinder investments are tackled.

The role of financial de-risking instruments in the wider challenge of mobilising private capital for clean energy projects in EMDEs is not widely addressed in the literature. The one source that does so, written by one of the interviewees, concludes that finance or investor risk is not the critical issue more often than expected. Other basics, such as establishing a secure demand and revenue for the project, need to be addressed to make capital flow (Duma & Muñoz Cabré, 2024). Other sources that include financial de-risking instruments always mention them in a nuanced way: "*Instruments <u>such as</u> blended finance, green bonds, and carbon credit mechanisms <u>can</u> help manage risk and build confidence among investors looking to invest in EMDEs.*" (IRENA 2025), "*Investment support – <u>including</u> through derisking*

instruments – by multilateral development banks and climate finance institutions remains crucial for upscaling deployment of renewable energy technologies in most developing countries." (UNEPCCC & CTCN, 2024) or "*Risk mitigation instruments such as first-loss debt, subsidised debt-service reserve accounts, and subsidised currency swaps or risk-sharing instruments like unfunded concessional guarantees tied to interest and principal payments can provide the credit enhancement necessary to support larger issuances*" (Convergence Blended Finance, 2024).

Furthermore, the OECD (2023), in their report on scaling up the mobilisation of private finance for climate action in EMDEs, mentions the further use and development of de-risking mechanisms under one of their three identified action areas. This action area stresses the importance of developing clearly defined mobilisation targets and further improving data disclosure and transparency on accounting methodologies, besides the scaling up of de-risking instruments. Another action area from the same report touches upon the scaling up of blended finance and the use of guarantees, which are some of the actions that can be undertaken to de-risk projects and markets. This same action area also highlights the importance of capacity building to improve enabling investment conditions and project development, next to urging developing financiers to exit projects when they become commercially viable progressively.

The nuance with which these instruments are mentioned in the literature indicates that the literature is in line with the interviewees' view on the role de-risking instruments have: de-risking instruments are merely one of the tools that can help, but a wider approach and more holistic view are required to mobilise private finance and effectively implement clean energy systems in EMDEs.

5.4 Assessment of the relevance of the proposed changes

Given that the financial de-risking instruments are not the bottleneck that limits investments and/or the upscaling of these instruments is not the main concern amongst experts, it raises the question whether the identified changes should still be the focus of stakeholders in the field. These four changes should align with the greater objective of mobilising private capital for clean energy projects in EMDEs to remain relevant. To determine their relevance, the four identified changes will be tested to see whether they address the investment barriers for clean energy projects in EMDEs identified in Section 2.2.3. The main investment barriers identified and described in that section are the high costs of capital (1), a lack of data (2), the complexity in the set-up of projects and associated costs (3), a lack of investable projects (4) and the requirement of long-term financing (5). The following paragraphs each address one of the four identified changes and discuss whether they tackle one or multiple investment barriers.

The standardisation of instruments and processes directly addresses barrier three, the complexity of project set-up and associated costs. Additionally, standard-applied and widely acknowledged contracts and assessments that include how to deal with cost overruns or legislative changes might reduce some of the risks experienced by investors. Consequently, this influences the cost of capital of these projects, addressing the first barrier.

As described in Section 4.3, Enhanced donor education can help overcome unrealistic, high perceived risks and support the development of projects that match both development and investors' objectives. This change directly addresses the first barrier, high cost of capital, and the fourth barrier, a lack of investable projects. Furthermore, in combination with standardisation, education on standard project and financing structures can reduce the complexity in the set-up of projects and speed up the delivery of projects. Cull et al. (2024) highlight the importance of promoting successful efforts in mobilising private capital, being transparent about less successful efforts and sharing data and experiences on efforts to enhance private capital mobilisation.

A stronger orchestration and alignment of stakeholders that builds upon their collaboration can facilitate better data sharing, overcoming the second barrier. Organizations operating in isolation, result in a scattered landscape where different organisations work on the same challenge. Multiple leading organisations urge that the improvement of data disclosure and the demonstration of the effectiveness of approaches and methodologies used, which touches upon education as well, is crucial to mobilise private finance (Cull et al., 2024; OECD, 2023; UNEPCCC & CTCN, 2024; Convergence Blended Finance, 2024). Therefore, transparency and willingness to share data should be prerequisites in an orchestrated landscape. Furthermore, the alignment of stakeholders and their objectives will smooth the trajectory from the start of the development of a project to its financial close. This addresses the fourth barrier and increases the availability of investable projects.

The fourth change, improvement of the project pipeline, directly addresses the lack of investable projects. The required improvement of the project pipeline for a wider implementation and faster adoption of clean energy is widely acknowledged in literature (Arezki, 2022; OECD, 2023; IRENA, 2024). The OECD (2023) emphasizes the importance of technical assistance to enhance the availability of investable projects. Especially technical assistance focused on supporting project demonstration, further improving enabling investment environments and ensuring that EMDEs stay on pace with the constantly evolving technologies, markets and regulatory frameworks for these projects. The necessity of a TA for project preparation and design is also highlighted by Arezki (2022). Another way to improve the project pipeline is to implement a structured and streamlined process to evaluate proposals based on precise engineering, environmental, financial and social criteria. This has been done in Brazil, known as "technical qualification" (IRENA, 2024). This approach helps build confidence amongst investors as projects that are more likely to succeed are filtered out early. The recommendations discussed in this paragraph overlap with the recommendations from the interviews. This suggests that these changes will improve the clean energy landscape even in the wider context beyond the application of financial de-risking instruments.

While financial de-risking instruments may not represent the primary bottleneck for mobilising private capital for developing clean energy, the changes identified through this research remain relevant. They address broader, systemic barriers and can facilitate a wider mobilisation of private capital and adoption of clean energy technologies in EMDEs.

6 Conclusion

To reach a net-zero energy system, clean energy technologies must be deployed, especially to cover the growing energy demand in EMDEs. Public capital alone will not be able to provide the funding required for this development. Therefore, the involvement of the private sector is essential. Financial de-risking instruments have the potential to contribute to the mobilisation of private capital. However, their effective implementation remains limited. The literature offers limited insight into the underlying reasons for this gap between theoretical importance and practical application. This thesis addresses this gap by uncovering the barriers that hinder broader implementation of these financial de-risking instruments and identifying actionable changes to support the mobilisation of private capital for clean energy projects in EMDEs. It does so by answering the following research question: *How can the barriers preventing the practical implementation of financial de-risking instruments for clean energy projects in EMDEs be overcome?* This chapter summarises the main findings.

What classifies as a financial de-risking instrument, or instead qualifies as a financial instrument that holds de-risking characteristics, is debated amongst experts. The classification of financial de-risking instruments established by the researcher and widely acknowledged by experts includes derivatives, equity, guarantees, grants, insurances, lines of credit, loans, and mezzanine instruments. Bonds were included in the initial classification; however, they are not redeemable as a "financial de-risking instrument" as the instrument itself does not hold risk mitigation properties, and the labels of green, social and/or sustainable are instead an obligation on the proceeds of the bond rather than that it de-risks investments. The organisations of the interviewees apply different de-risking instruments and preferences for an instrument depends on project characteristics. Of all the instruments, guarantees were most frequently mentioned by interviewees, who consistently expressed positivity and emphasized their growing popularity more than any other instrument.

This thesis identifies five main barriers that prevent the implementation of financial de-risking instruments for clean energy projects in EMDEs based on the expert interviews. (i) First, the complexity of the instruments makes them difficult to manage and hard to sell to investors, who might prefer investing in easier options that give them the same financial benefits. (ii) Second, limited expertise on these instruments is present amongst public donors and local stakeholders, preventing them from implementing and using these instruments. (iii) Third, the risk aversion amongst stakeholders results in an investor landscape where nobody is willing to take the risks associated with clean energy projects in EMDEs, limiting clean energy development. (iv) Fourth, the high associated costs, which mainly result from the complexity of these instruments, make them too expensive, especially for small-scale energy projects. (v) Finally, an insufficient pipeline of viable projects prevents the implementation of financial de-risking instruments. When there are no projects to finance, these instruments cannot be deployed. The main explanations for the insufficient pipeline are the disconnection between capital providers and project developers, the lack of resources, the inability to originate and/or structure deals, and the uncertain demand.

To overcome these barriers, four required changes are identified. All previously mentioned barriers are touched upon and covered under one or multiple of these changes. (i) First, the standardising the instruments and processes will decrease complexity and associated development costs. (ii) Second, enhanced donor education will improve these instruments' effective and efficient implementation. It will help stakeholders to argue and clearly articulate the choice of instruments, so support from the public and private investors will become easier to obtain. (iii) Third, stronger orchestration and alignment of stakeholders will enable a better utilization of each stakeholder's development, technical or financial expertise and allow for an optimal distribution of project risks based on each stakeholder's capabilities. (iv) Fourth, the improvement of the project pipeline, achieved through local capacity building, increased resource availability for project preparation and a shift to demand-led development, will simultaneously result in the broader deployment of financial de-risking instruments.

Interviewees critically question the role of financial de-risking instruments within the broader challenge of mobilising capital for clean energy development. While there is general agreement that these instruments can play a meaningful role, this depends on other enabling conditions. A single financial de-risking instrument, or even a combination, cannot fix a fundamentally weak business case or a poorly designed project. Scaling de-risking instruments is not seen as the primary concern, as it is expected to increase alongside tackling other critical barriers that hinder private investors from financing clean energy projects in EMDEs. Nonetheless, the changes identified in this thesis remain relevant. Even if de-risking instruments are not the central bottleneck, the proposed changes can still meaningfully contribute to mobilising private capital for clean energy development.

Future research could usefully explore the identified areas of change in greater depth. This includes investigating methodologies for standardising general project structures that include financial de-risking instruments to reduce complexity and transaction costs. Additional exploration is also needed on the specific knowledge gaps present amongst donor institutions, to design targeted educational programs tailored to the needs of various stakeholders and the next generation of experts. Additionally, a more nuanced understanding of the multi-layered and complex stakeholder landscape is needed, particularly regarding which actors are most suited to carry specific types of risk. Finally, research identifying which stakeholders are best positioned to lead project origination and development could enhance more effective stakeholder collaboration and promote a more structured approach to project development. This last area is closely linked to improved orchestration and stakeholder role alignment.

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Appendices

Appendix A - Types of finance

Several terms and types of finance exist and different typologies are used by experts, scholars and professionals. This financial landscape is complex, evolving and lacks widely accepted common definitions of different types of finance. This appendix includes an overview of the different typologies of finance that are present and used in relation to the financing of sustainable energy projects. These types of finance are not mutually exclusive, and many projects may involve a combination capital that is classified under multiple of these types of finance.

Note that the definitions below are not commonly agreed upon and may vary at different institutions. Therefore, it is recommended to always read the definitions established by the authors themselves or the institutions they work for when reading documents that include these terms.

Blended finance

The use of public capital or capital from philanthropies to mobilise private capital. Blended finance refers to the financial structure where private and public capital are combined to finance a project or entity (Convergence, 2024). There's an absence of common terminology for blended finance itself and its instruments and there is a need for more clarity, for example in the form of commonly accepted definitions (Habbel et al., 2021).

Climate finance

Funding at local, national, or international levels, sourced from public or private financial streams, aimed at supporting mitigation and adaptation efforts to address climate change (UNFCCC, n.d.). Climate finance can be considered a subset of green finance (ISO, 2022).

Development finance

Public or private capital deployed with the objective to improve quality of life through economic growth (IFC, n.d-b) and/or achieving the UN Sustainable Development Goals (IFC, n.d.-a).

Green finance

Funds that are raised under green finance can be exclusively used for prespecified environmental and sustainable development purposes (Amin et al, 2014). The prespecified green purpose can vary widely per institution. Green finance is broader than climate finance as it also includes other environmental goals such as biodiversity (Spinaci, 2021).

Violetti et al (2023) highlight that there is no universally accepted definition or standard for financial services with the title 'green'. Therefore, there is a risk of greenwashing. Greenwashing is when the label of green is unjustly given to a financial instrument as the product does not serve a green purpose or provides few real climate benefits (Prasad et al., 2022). To prevent greenwashing, stakeholders are constantly working on commonly accepted definitions for principles and procedures.

Sustainable finance

Funds that are raised under sustainable finance can be exclusively used for prespecified environmental, social, governance and economic aspects (ISO, 2022). What is considered sustainable, varies per institution and entity.

Appendix B - Interview protocol

This guide will not be strictly followed and merely serves as a help for the interviewer.

<u>Part 1</u> - Introduction (not recorded)

- **Get to know the interviewee**: Name, function, past experience, geographical scope of work
- **Introduction to the interview**: Notes on the procedure; agreeing on the duration; restate information on the use and release of data (also mentioned in email);

– Start the recording –

<u>Declaration of consent</u> – shown slide with script and questions on informed consent

<u>Part 2</u> - The current use and implementation of financial de-risking instruments

1. **Which instruments do you use/are used by your organisation? (and why?)**

Shown visual: slide with classification of financial de-risking instruments.

Purpose: to make a comparison with literature which instruments that are proposed in literature are actually applied (fulfil research objective 1).

1A. How has the application of instruments evolved over time?

Purpose: to obtain a broader understanding of the landscape and how dynamic it is.

2. **How does your application of instruments differ from other organisations? Why do you believe these differences exist?**

Purpose: to understand the motivation for the choice of instruments (fulfil research objective 1).

3. **What are the main barriers that prevent the practical implementation of financial de-risking instruments and mechanisms for sustainable energy projects?**

Purpose: fulfil research objective 2.

Part 3 - Envisioned future

4. **What would you want to change in your field?**

Purpose: to identify changes that would help practitioners in executing their job and mobilise private capital which can be used to fulfil research objective 3.

Part 4 – The pathway to the envisioned future

5. **What needs to change to improve the application of financial de-risking instruments to mobilise capital?**

Purpose: to identify changes that need to happen and form a base for the recommendations and fulfil research objective 3.

6. **What do you foresee for the future?**

Purpose: to find changes that are happening, identify emerging trends, so they do not need to be included in my conclusion/recommendations because it is not new

Final question: **If anything would be possible, what would you wish for this sector?**

Thank participant for their time and insights.

– End the recording –

- Wrapping up by thanking the interviewee for their time.
- Ask if the interviewee can be contacted in the future, has contacts who can be contacted for an interview (in follow-up email) and wants to get updates on the Thesis.

Appendix C - Overview of interviewees

Important to note is that the insights expressed by the interviewees are their personal opinions and professional experience. Their views do not necessarily represent their respective organisations' views or official positions.

Acronym	Name	Title	Type of organisation	Notes
Int1		(Senior) Investment Officers Syndications	Bilateral DFI	Ticket sizes typically above a million USD
Int2	Mikko Halonen	Senior Leading Consultant at SWECO	Private organisation	
Int3	Paula Tommila	Founder of Osma Advisory	Private organisation	Building sustainable business with a focus on small-scale access to energy projects in Africa
Int4	Jan Cloin	Coordinator of Energizing Development Programme at the Netherlands Enterprise Agency	Governmental development body	Focus on small-scale access to energy projects in Africa
Int5	Jamal Saghir	Former director of energy, transport, and water at the World Bank	Multilateral DFI (MDB)	
Int6		Climate Finance expert		
Int7		Team leader Blended finance	Governmental body	Invests through financial intermediaries
Int8	Isabel Leroux	Program manager at the Nordic Development Fund	Multilateral Fund	Focus on Sub-Saharan Africa; Invests through financial intermediaries
Int9	Ingrid van Wees	Former Vice President for Finance and Risk Management at the	Multilateral DFI (MDB)	

		Asian Development Bank (ADB)		
Int10		(Senior) Managers Sustainable Financing Projects and Programmes	Commercial bank	Located in Africa
Int11	Paul van Aalst	Team Leader of the Finance Catalyst team by GET.invest	Independent multilateral program	GET.invest is a European programme that mobilises investment in clean energy in developing countries, supporting project developers and companies towards investment readiness and link them with financiers.
Int12	Søren Lütken	Senior economist at UNEP-CCC	Multilateral organisation	
Int13	Sebastiaan Surie	Head of New Ventures at Climate Fund Managers (CFM)	Private fund	CFM is an investment management company that focuses on climate-centric infrastructure investments in emerging markets, ticket sizes above a million USD
Int14		Transaction manager	Governmental development agency	Main instruments: grants and guarantees
Int15	Monica Gullberg	Senior Climate Policy Specialist at SIDA and Advisor of the board at the Green Climate Fund (GCF)	Governmental development agency and multilateral fund	

Int16	Alan Narayadu	Guarantee expert	Multilateral Finance Institution	
Int17	Kari Hämekoski	Fund Manager of Beyond the Grid Fund for Africa (BGFA) managed by Nefco	Multilateral Climate Fund	Focus on small-scale access to energy projects in Africa
Int18		C-level executive	Multilateral Climate Fund	
Int19	Daniel Duma	Senior Research Fellow - Programme Lead Finance for Sustainable Development at the Stockholm Environment Institute (SEI)	Research institution	
Int20	Pranab Ghosh	Principal Investment Officer at the International Finance Corporation (IFC)	Multilateral DFI	
Int21	Cecilia Tam	Energy Investments expert	Multilateral organisation	

Appendix D - Results from AI analysis

Despite that NotebookLM shows references in its results to the areas in the text where its results are based on, this direct referencing is not included in this appendix for two main reasons. Firstly, the AI tool mixes up sections and interviewees that certain sections belong to. For example, the tool, even after several tries, displays that there is no interview 2, despite that interview 2 is marked as clearly as other interviews in the provided text. This results in unjust referencing to the corresponding interviews. Second, NotebookLM jumps to conclusions rather quickly. For example, in the AI results the following is stated: “MDBs should share their data publicly [referencing to multiple parts in the text].”. However, none of the interviewees have explicitly mentioned that this is something MDBs should do. There is only one interviewee who stated that more sharing of data would help, that it will be beneficial to the development of projects and hopes that MDBs will be able to share more data in the future (Int14). To prevent the unjust attribution of statements and premature conclusions to interviewees, the results from NotebookLM do not include references to specific interviews.

The following text is generated by NotebookLM based on the anonymised transcripts and notes from the interviews. The results are directly taken from the output of the model:

Based on the provided sources, the underutilisation of financial de-risking instruments for clean energy projects in Emerging Markets and Developing Economies (EMDEs) is linked to several key barriers, and overcoming these requires specific changes:

1. **Lack of Bankable and Ready Projects (Project Pipeline):** A significant barrier is the **insufficient supply of efficient, bankable, and well-prepared projects** in EMDEs. There aren't enough high-quality projects coming forward quickly enough for investors. Project developers need to propose projects that meet financing criteria.
    - **Changes Needed: Fund project preparation facilities** to help countries prepare bankable projects upstream. Provide the necessary resources, potentially from contributors, donors, or philanthropies, for this resource-intensive upstream work. **Develop a portfolio of projects** where feasibility, bankability, and various risks have been analysed. Increase the number of actors capable of scoping out and packaging viable projects. DFIs need to increase technical assistance and play a bigger role in project development, especially in new markets. Standardise project development processes. Find ways to make capital flow to smaller projects, including structuring them to be palatable for investors. **Build capacity** for project developers and local players.
2. **Risk Perception vs. Reality & Investor Behaviour:** The **perception of risk in EMDEs often exceeds the actual risk**. Investors, particularly from the Global North, may lack data, knowledge, or experience in these markets, making them seem "scary". Different investors (commercial, DFIs, institutional) have varying risk appetites and return expectations. Commercial investors are deterred by low loan pricing. DFIs and MDBs are sometimes seen as **too risk-averse**, behaving like private banks despite having different mandates. Institutional investors have specific requirements (risk levels, ticket sizes) and limited interest in smaller projects.
    - **Changes Needed: Governments and development banks need to be ready and enabled to take on more risk**, providing more equity and guarantees. Governments could change the rules and inject grants to buy down risk for DFIs. **Provide more data** to demonstrate actual risks and show a financial case exists for investing in these markets. MDBs should share their data publicly. Improve the understanding and integration of the **cost of inaction** for investors. Ensure DFIs are compensated for political and regulatory uncertainty to maintain financial sustainability while taking necessary

risks. Address the differing expectations among stakeholders, finding a common ground between development impact and return.

3. **Complexity and High Transaction Costs:** De-risking instruments and blended finance structures are often **complex**, **time-consuming**, and involve **large transaction costs**. This complexity, partly driven by the lack of standardisation, scares away private investors. There are also "proper costs" associated with these instruments.

    - **Changes Needed: Increase standardisation** in how instruments are offered, especially among different donors and contributors. Establish a **common language** among providers and with the private sector. **Streamline processes**. Standardise project structure, such as Power Purchase Agreement (PPA) terms and technology-specific structures (like for solar or geothermal). Standardisation in currency management could also help. Simplify the implementation of these instruments. Note that complexity is partly inherent as contributors expect a return, necessitating financial structuring to manage risk and return.

4. **Knowledge and Capacity Gaps:** There is a significant **lack of knowledge and capacity** regarding de-risking instruments among various stakeholders, including government ministries, local governments, and project developers in EMDEs. This hinders their understanding of project bankability and their ability to leverage non-grant instruments effectively.

    - **Changes Needed: Education is needed** on the diversity and application of available instruments. Ministries of foreign affairs and emerging market governments need to improve their financial expertise and understanding of risk-carrying. **Provide technical assistance** and advisory support to project developers and local banks. Cultivate expertise on the ground with local presence. Build the capacity of necessary entities within the market ecosystem.

5. **Regulatory and Policy Environment:** The **absence or inconsistency of supportive regulatory and policy frameworks** in EMDEs is a major hurdle. Different regulations within a country or a lack of regulation for new technologies increases investor risk and cost. Broader policy issues like fossil fuel subsidies also matter.

    - **Changes Needed:** Governments need to **create an attractive and enabling investment climate** by putting in place the right regulations to initiate projects, improve investment requirements, and potentially increase returns. Establish a legislative and regulatory environment that is **friendly for private capital**. Address regulatory barriers and inconsistencies. Put in place broader policy measures like removing fossil fuel subsidies and implementing carbon pricing. Aim for **political stability and regulatory**

certainty, as this directly impacts the cost of capital. While a perfect policy framework is impractical, improvements are needed. Legislation can also drive change (e.g., supply chain requirements).

6. **Instrument Effectiveness and Appropriateness:** De-risking instruments are **not a "silver bullet"** and cannot fix fundamentally poor projects or low returns. They are most effective when used suitably to address specific, significant risks and are often temporary "medicine" for projects that are otherwise sound. Some instruments, like certain lines of credit or bonds, are criticised for not being additional or effective in mobilising capital on their own.
    - **Changes Needed:** Ensure instruments are **designed and applied suitably** to address the most significant risks, not just one among many. Recognise that instruments work in tandem with other project factors to enhance bankability. Use instruments that are flexible and adaptable to volatile local market conditions, such as flexible mezzanine finance or local currency loans. Ensure instruments like lines of credit are offered on concessional terms where necessary to be competitive. Consider results-based finance or grants for markets with insecure revenues or low paying ability.
7. **Incentives and Recognition:** There is a historical **incentive mismatch** for institutions underwriting contingent instruments like guarantees, as this may not receive the same recognition or attribution as direct lending.
    - **Changes Needed:** Address this incentive mismatch to encourage institutions to use instruments that effectively mobilise private capital.
8. **Coordination and Collaboration:** There is a perceived **lack of coordination and a "common language"** among donors and between the development and finance worlds.
    - **Changes Needed:** Improve **harmonisation and standardisation** among donors. Foster greater collaboration, potentially through common platforms. Bridge the gap between the development world and the finance world.
9. **Capital Availability and Cost:** While there is money available, there is a specific **lack of concessional capital** needed for early-stage or riskier commercial projects. The high cost of capital in EMDEs, influenced by country risk and uncertainty, is a barrier. It is difficult and costly to raise equity for smaller projects.
    - **Changes Needed: Increase the massive amounts of concessional capital** flowing into the market, particularly for early-stage companies and riskier segments. Use first-loss structures to reduce

the price of instruments like guarantees. Provide equity grants for smaller projects where capital is considered lost by donors.

In summary, overcoming the barriers requires a collective effort involving governments, DFIs, donors, and the private sector to improve project pipelines, manage risk perceptions through data and action, simplify and standardise instruments and project structures, build local knowledge and capacity, create enabling regulatory environments, align incentives, and increase the catalytic use of capital, particularly concessional finance.