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ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ, ΕΠΙΧΕΙΡΗΜΑΤΙΚΩΝ & ΔΙΕΘΝΩΝ ΣΠΟΥΔΩΝ
ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ

ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ
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Ευγενία Φιλτικάκη

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SCHOOL OF ECONOMICS, BUSINESS AND INTERNATIONAL STUDIES
DEPARTMENT OF ECONOMICS

MSc. IN BIOECONOMY, CIRCULAR ECONOMY & SUSTAINABLE DEVELOPMENT

SUSTAINABLE FINANCE STRATEGIES AND BANKS' ROLE AS CATALYSTS IN THE ECONOMIC TRANSITION

Eugenia Filtikaki

Piraeus, Greece, March 2026

ΤΜΗΜΑ
ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

ΒΕΒΑΙΩΣΗ ΕΚΠΟΝΗΣΗΣ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ

«Δηλώνω υπεύθυνα ότι το έργο που εκπονήθηκε και παρουσιάζεται στην υποβαλλόμενη διπλωματική εργασία, για τη λήψη του μεταπτυχιακού τίτλου σπουδών, στη «*Βιοοικονομία, Κυκλική Οικονομία και Βιώσιμη Ανάπτυξη*» με τίτλο:

«Στρατηγικές βιώσιμης χρηματοδότησης και δράσεις των τραπεζών ως καταλυτών της οικονομικής μετάβασης»

έχει γραφτεί από εμένα αποκλειστικά στο σύνολό της. Δεν έχει υποβληθεί ούτε εγκριθεί στο πλαίσιο κάποιου άλλου μεταπτυχιακού προγράμματος ή προπτυχιακού τίτλου σπουδών στην Ελλάδα ή στο εξωτερικό, ούτε είναι εργασία ή τμήμα εργασίας ακαδημαϊκού ή επαγγελματικού χαρακτήρα.

Δηλώνω επίσης υπεύθυνα ότι οι πηγές στις οποίες ανέτρεξα για την εκπόνηση της συγκεκριμένης εργασίας αναφέρονται στο σύνολό τους, κάνοντάς πλήρη αναφορά στους συγγραφείς, τον εκδοτικό οίκο ή το περιοδικό, συμπεριλαμβανομένων και των πηγών που ενδεχομένως χρησιμοποιήθηκαν από το διαδίκτυο. Παράβαση της ανωτέρω ακαδημαϊκής μου ευθύνης αποτελεί ουσιώδη λόγο για την ανάκληση του πτυχίου μου.»

Ευγενία Φιλτικάκη

Αφιερωμένο στην οικογένειά μου, που στάθηκε δίπλα μου σε κάθε στιγμή αυτού του ταξιδιού· για την αγάπη, την πίστη και τη δύναμη που μου έδωσαν όταν το χρειαζόμουν περισσότερο.

Χωρίς τη δική τους παρουσία, συμπαράσταση και ανιδιοτελή υποστήριξη, τίποτα από αυτό δεν θα ήταν δυνατό.

Ευχαριστίες

Θα ήθελα να εκφράσω την ειλικρινή και βαθύτατη ευγνωμοσύνη μου στον επιβλέποντα καθηγητή μου, κ. Μάρκο Τσελεκούνη, για την καθοδήγηση, την αφοσίωση και την επιστημονική υποστήριξη που μου προσέφερε καθ' όλη τη διάρκεια της εκπόνησης της διπλωματικής εργασίας. Η συστηματική του καθοδήγηση, η διαθεσιμότητά του και οι εύστοχες παρατηρήσεις του συνέβαλαν ουσιαστικά στη διαμόρφωση και την ολοκλήρωση του παρόντος έργου.

Θερμές ευχαριστίες οφείλω και στους συναδέλφους μου, οι οποίοι με μύησαν, μου έμαθαν και με ενθάρρυναν να εργαστώ πάνω στο συγκεκριμένο αντικείμενο. Η καθημερινή τους υποστήριξη, η διάθεση για συζήτηση και επίλυση αποριών, αλλά και η επαγγελματική τους καθοδήγηση, αποτέλεσαν καθοριστικούς παράγοντες στη διεύρυνση των γνώσεων και της εμπειρίας μου. Η συμβολή τους ήταν καταλυτική, όχι μόνο για την επιστημονική πρόοδο της εργασίας, αλλά και για τη δική μου προσωπική και επαγγελματική εξέλιξη.

Στρατηγικές Βιώσιμης Χρηματοδότησης και Δράσεις των τραπεζών ως καταλυτών της οικονομικής μετάβασης

Σημαντικοί Όροι: Βιώσιμη Χρηματοδότηση, Net-Zero Τραπεζική, Δείκτης Πράσινων Στοιχείων Ενεργητικού, Ταξινομία ΕΕ, Κλιματικός Κίνδυνος, Χρηματοδότηση Μετάβασης, Τραπεζική Ρύθμιση, ESG, Απανθρακοποίηση, Ευρωπαϊκές Τράπεζες, Ελλάδα

Περίληψη

Η παρούσα διπλωματική εργασία εξετάζει τον εξελισσόμενο ρόλο των ευρωπαϊκών τραπεζών ως καταλυτών της οικονομικής μετάβασης προς τη βιωσιμότητα και την κλιματική ουδετερότητα. Μέσω μιας ολοκληρωμένης ανάλυσης του ρυθμιστικού πλαισίου, των εσωτερικών στρατηγικών των τραπεζών και εμπειρικών δεδομένων από δείγμα μεγάλων ελληνικών και ευρωπαϊκών τραπεζών, η μελέτη διερευνά πώς εφαρμόζεται η βιώσιμη χρηματοδότηση και πώς υλοποιούνται οι δεσμεύσεις για το net-zero. Η έρευνα αναδεικνύει τη γρήγορη ωρίμανση των πλαισίων βιώσιμης χρηματοδότησης, την ανάπτυξη εξειδικευμένων πράσινων δανείων και την ενσωμάτωση των εποπτικών προσδοκιών στη διακυβέρνηση των τραπεζών. Παράλληλα, εντοπίζονται διαρκή κενά, όπως χαμηλοί δείκτες πράσινων στοιχείων ενεργητικού, άνιση κάλυψη τομέων, περιορισμοί στα δεδομένα και προκλήσεις στην ευθυγράμμιση των χαρτοφυλακίων με φιλόδοξους κλιματικούς στόχους. Η εργασία καταλήγει σε συγκεκριμένες προτάσεις πολιτικής για τράπεζες και ρυθμιστικές αρχές, δίνοντας έμφαση στην εναρμόνιση μεθοδολογιών, την ενίσχυση της υποδομής δεδομένων, τον κλαδικό σχεδιασμό μετάβασης και την ουσιαστική εμπλοκή των πελατών, ώστε να επιταχυνθεί η συμβολή του χρηματοπιστωτικού τομέα σε μια ανταγωνιστική και κλιματικά ουδέτερη ευρωπαϊκή οικονομία.

Sustainable Finance Strategies and Banks' Role as Catalysts in the Economic Transition

Keywords: Sustainable Finance, Net-Zero Banking, Green Asset Ratio, EU Taxonomy, Climate Risk, Transition Finance, Banking Regulation, ESG, Decarbonization, European Banks, Greece

Abstract

This thesis investigates the evolving role of European banks as catalysts in the economic transition toward sustainability and climate neutrality. Through a comprehensive analysis of regulatory frameworks, internal banking strategies, and empirical data from a sample of major Greek and European banks, the study explores how sustainable finance is operationalized and how net-zero commitments are being implemented. The research highlights the rapid maturation of sustainable finance frameworks, the scaling of dedicated-purpose lending, and the integration of supervisory expectations into banking governance. However, it also identifies persistent gaps, including low Green Asset Ratios, uneven sectoral coverage, data limitations, and challenges in aligning portfolios with ambitious climate targets. The thesis concludes with actionable recommendations for banks and policymakers, emphasizing the need for methodological harmonization, enhanced data infrastructure, sector-specific transition planning, and robust client engagement to accelerate the financial sector's contribution to a competitive and climate-neutral European economy.

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Table of abbreviations

EU	European Union
NZBA	Net-Zero Banking Alliance
GAR	Green Asset Ratio
SFF	Sustainable Finance Framework
SIF	Sustainable Investment Framework
GBF	Green Bond Framework
SBF	Social Bond Framework
TFF	Transition Finance Framework
SLL	Sustainability-Linked Loan
SPT	Sustainability Performance Target
RRF	Recovery and Resilience Facility
ESG	Environmental, Social, Governance
SFDR	Sustainable Finance Disclosure Regulation
CSRD	Corporate Sustainability Reporting Directive
ICAAP	Internal Capital Adequacy Assessment Process
SREP	Supervisory Review and Evaluation Process
RAS	Risk Appetite Statement
MREL	Minimum Requirement for Own Funds and Eligible Liabilities
TLAC	Total Loss Absorbing Capacity
ECB	European Central Bank
SSM	Single Supervisory Mechanism
EBA	European Banking Authority
EIB	European Investment Bank
EIF	European Investment Fund
TCFD	Task Force on Climate-related Financial Disclosures
ICMA	International Capital Market Association
LMA	Loan Market Association
PCAF	Partnership for Carbon Accounting Financials
SDGs	Sustainable Development Goals
CapEx	Capital Expenditure
KPI	Key Performance Indicator
SME	Small and Medium-sized Enterprise
CRE	Commercial Real Estate
O&G	Oil and Gas
CCUS	Carbon Capture, Utilization and Storage
PRB	Principles for Responsible Banking
BIS	Bank for International Settlements
BCBS	Basel Committee on Banking Supervision
SBTi	Science-Based Targets initiative
MRM	Model Risk Management

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CHAPTER 1: INTRODUCTION

1.1 Summary

Banks are increasingly recognized as key catalysts in the transition to a sustainable, low-carbon economy, especially within the European Union's policy framework. In recent years, global agreements and EU initiatives have elevated the importance of sustainable finance – the practice of aligning financial flows with environmental, social, and governance (ESG) objectives – and net-zero banking, which refers to banks committing to carbon-neutral portfolios by 2050. Greek banks, alongside their European peers, have actively embraced these principles, demonstrating the dual focus of this research: sustainable finance strategies and net-zero commitments in banking. The timeframe of interest begins around 2019, when international banking pledges gained momentum with initiatives like the UN Principles for Responsible Banking and the Net-Zero Banking Alliance.

1.2 Purpose and Objectives

The purpose of this thesis is to examine how banks in the EU, including Greece's major banks – are integrating sustainable finance into their strategies and how they are implementing net-zero commitments. The research aims to identify the frameworks and practices banks use to support sustainability, and to evaluate the role of banks as catalysts in the economic transition toward climate neutrality. It will shed light on how regulatory and market drivers have shaped banks' sustainable finance strategies, and how banks' net-zero pledges are being translated into action. Key objectives include: understanding the concepts and regulatory landscape of sustainable finance; exploring how banks operationalize these concepts through internal frameworks and products; examining the emergence of net-zero banking alliances and commitments; and assessing challenges and progress in implementing net-zero strategies.

1.3 Research Questions

To guide the analysis, the study is framed by several research questions. These include, for example: Which sustainability frameworks and standards have European and Greek banks adopted to date? What types of projects and sectors are being financed as "sustainable," and

how are these classified? How do banks set and monitor targets for sustainable finance? And critically, how do banks' long-term net-zero commitments translate into near-term action – for instance, how are portfolios being steered to reduce emissions in line with 2050 goals? These questions address both sustainable finance practices and the bridge to net-zero implementation, reflecting the dual focus of the thesis.

1.4 Methodology

The research follows a mixed-methods approach with both quantitative and qualitative components. It involves a comparative analysis of 30 banks across Europe, including the four systemic Greek banks (National Bank of Greece, Alpha Bank, Eurobank, and Piraeus Bank). The sample selection ensures emphasis on Greece and other EU banks, allowing for insight into how Greek banks measure up against broader European trends. The analysis employs descriptive statistics (to quantify adoption of frameworks, loan volumes, etc.) and case-by-case reviews (to qualitatively assess strategy documents and target-setting). Comparative metrics are calculated or obtained from reports to benchmark banks' performance. Where applicable, simple normalization is used to facilitate comparisons across institutions. The qualitative aspect involves examining strategy statements and illustrative initiatives to understand how banks operationalize their commitments. Through this design, the study combines hard data with context, capturing both the scale of sustainable finance and the depth of banks' strategic approaches.

1.5 Data Sources

The analysis draws on a range of primary and secondary sources. Primary sources include banks' own publications – notably, banks' sustainability and annual financial reports, investor presentations, frameworks and Pillar III disclosures mandated by regulators. These often contain detailed breakdowns of sustainable finance activities. Secondary sources complement these with broader context and cross-industry data, including policy reports, industry studies, and academic literature on sustainable banking. Notably, UNEP FI reports and NZBA progress updates are used to track net-zero commitment progress on an aggregate level. Additionally, news releases and press announcements are referenced to capture the timing of key

commitments. By triangulating these sources, the research ensures an accurate and up-to-date portrayal of both the regulatory framework and banks' actions.

1.6 Structure of the Thesis

This thesis is organized into seven chapters, each building on the previous to develop a cohesive analysis:

- **Chapter 1: Introduction** – Provides an overview of the research topic, establishes its importance, and outlines the research purpose, questions, methodology, and sources.
- **Chapter 2: Sustainable Finance – Concepts, Frameworks, and Regulatory Landscape** – Establishes the conceptual and regulatory baseline. Defines sustainable finance, outlines core international and EU frameworks (e.g., SFDR, EU Taxonomy, market principles), explains how banks structure their internal frameworks and product suites, and summarizes supervisory expectations on ESG risk management.
- **Chapter 3: Empirical Analysis of Banks' Sustainable Finance Practices** – Maps how a sample of banks (including Greek institutions) operationalize sustainable finance. Compares frameworks, eligible activities, strategies and targets, and key indicators. Provides a concise, data-driven snapshot across Greek and European peers.
- **Chapter 4**: **Econometric forecasting analysis of sustainable finance metrics -** Provides a comprehensive econometric forecasting analysis that estimates how the Green Asset Ratio (GAR) of European banks is expected to evolve from 2025 to 2029, using a linear growth model informed by regulatory benchmarks, cross-sectional evidence, and sustainability trends.
- **Chapter 5: Net-Zero Banking – Commitments and Implementation Challenges** – Connects financing decisions to real-economy emissions and transition risk. Introduces NZBA (scope and expectations) and examines implementation challenges (data, methodologies, sector prioritization, credibility risks). Uses selective cases to illustrate progress and tension points.
- **Chapter 6: Empirical Analysis of Net-Zero Commitments** – Analyzes timelines, sectoral targets, and reported progress versus ongoing exposure to high-carbon

activities. Reviews financed-emissions disclosures where available and highlights differences across banks in ambition, coverage, and performance.

- **Chapter 7: Conclusions and Policy Recommendations** – Synthesizes insights, identifies best practices and gaps, and sets out practical recommendations: stronger and more comparable disclosures, prudential treatment reflecting climate risk, better data access and sharing, targeted use of EU funding, and a shift from target-setting to tangible portfolio reallocation—particularly relevant for Greek and broader European contexts.

CHAPTER 2: SUSTAINABLE FINANCE – CONCEPTS, FRAMEWORKS, AND REGULATORY LANDSCAPE

2.1 Defining Sustainable Finance and Its Role

Sustainable finance is broadly defined as financial activities – including investment, lending, and insurance – that take into account ESG (Environmental, Social, Governance) criteria with the goal of promoting sustainable economic growth and long-term societal well-being. In the EU's official terms, sustainable finance means incorporating ESG considerations into financial decision-making, which leads to increased investments in projects that contribute to environmental and social goals. Key environmental considerations typically include climate change mitigation (reducing greenhouse gas emissions), climate change adaptation (building resilience to impacts like extreme weather), other environmental protection (water, biodiversity, pollution prevention), while social considerations involve issues such as human rights, labor standards, equality and community impact. Governance relates to corporate governance practices that ensure accountability and transparency on ESG issues.

The role of sustainable finance is to redirect capital flows from unsustainable activities (e.g., fossil fuel extraction, or businesses with poor labor practices) towards sustainable ones (like renewable energy projects, energy-efficient housing, or companies with strong social programs). This transition of capital is considered essential to achieve international objectives, such as the Paris Agreement's climate targets and the United Nations Sustainable Development Goals (SDGs). For example, to limit global warming to well below 2°C, trillions of euros in new investments in clean energy and low-carbon infrastructure are needed this decade. Public resources alone are insufficient for this scale of investment, so private finance must be mobilized – hence the push for sustainable finance (European Commission, EU Green Deal and Sustainable Finance Strategy (Communication), 2019). Within the EU, the European Green Deal (announced in 2019) explicitly noted that sustainable finance is key to meeting the bloc's climate neutrality goal by 2050. This led to the development of a comprehensive EU Sustainable Finance strategy, aiming to create a "financing framework that supports sustainable growth".

A critical aspect of sustainable finance is transparency and accountability. Investors and stakeholders increasingly demand to know how their money is being used and what impact it

has. This gave rise to a proliferation of sustainability reporting and standards. For instance, green bonds (bonds earmarked to finance environmental projects) require issuers to report on how proceeds are used, and standards like the ICMA Green Bond Principles provide guidelines for such reporting. Similarly, banks issuing sustainability-linked loans (loans where the interest rate is tied to the borrower's sustainability performance) must define clear KPI targets and report on them. These practices ensure that sustainable finance is not just a label, but results in measurable outcomes.

In summary, sustainable finance is both a conceptual approach (integrating ESG in finance) and a set of tools/instruments (like green loans, ESG funds, etc.). Its role in the economic transition is to align the financial system with sustainable development pathways, ensuring that capital allocation today does not undermine but rather enhances our environmental and social foundations for the future. As Mark Carney famously said, *"we need to turn the billions of public money into trillions of total climate investment"* – sustainable finance is about making that happen by engaging the vast resources of private finance (Carney, 2021).

2.2 Legislative and Regulatory Frameworks

Over the past few years, a robust framework of laws, regulations, and standards has emerged to guide and accelerate sustainable finance, especially in Europe. Below we outline the most significant elements of this framework.

Legislative Frameworks (Binding Laws)

- **European Green Deal and European Climate Law:** The European Green Deal (2019) is the EU's master plan to make Europe the first climate-neutral continent by 2050. It encompasses numerous initiatives, one of which was proposing the European Climate Law. As mentioned earlier, the European Climate Law (Regulation EU 2021/1119) took effect in July 2021 and made the 2050 net-zero goal legally binding, with the interim goal of -55% emissions by 2030. This law essentially commits all EU Member States and EU institutions to align their policies and budgets with these targets, thereby indirectly influencing the financial sector: it signals that investments need to shift accordingly, and it mandates periodic progress reviews (every 5 years, aligned with the Paris Agreement's global stocktake). For banks and investors, the Climate Law provides

a clear long-term policy signal, reducing uncertainty about the direction of future regulation (which is important for investment decisions in infrastructure, energy, etc.) (European Commission, The European Green Deal, 2019) (European Commission, European Climate Law, 2021).

- **EU Taxonomy Regulation**: It establishes a classification system (a "taxonomy") for environmentally sustainable economic activities. As of 2020 (Regulation EU 2020/852), the Taxonomy provides technical criteria for activities to be deemed contributing to climate mitigation or adaptation (with more objectives like biodiversity to come). The Taxonomy matters for banks because large banks must report the proportion of their assets that are Taxonomy-aligned (the Green Asset Ratio), and it also guides what can be labeled as green in the market. For instance, if a bank claims a loan is "green" because it finances a wind farm, the Taxonomy offers a science-based benchmark to confirm that (e.g., power generation from wind automatically qualifies as sustainable under the climate mitigation objective). The Taxonomy has brought more rigor, although it currently covers mainly environmental objectives and not all sectors (European Union, Regulation - 2020/852 - EN - taxonomy regulation, 2020).

- **Corporate Sustainability Reporting Directive (CSRD)**: Replacing the older Non-Financial Reporting Directive, CSRD (adopted 2022) will significantly expand corporate ESG reporting from 2024 onwards. While not directly a financial regulation, CSRD ensures banks' corporate clients disclose ESG data, which in turn helps banks get the information needed to assess sustainability of their loans (solving part of the data gap issue).

Regulatory Frameworks (Mandatory Rules Implementing Law)

- **Sustainable Finance Disclosure Regulation (SFDR):** Effective March 2021, SFDR requires asset managers, banks, and other financial market participants to disclose how they integrate ESG factors at both entity and product levels. For example, a bank with mutual funds must tell investors if a fund promotes environmental or social characteristics (making it an "Article 8" fund) or has sustainable investment as its objective ("Article 9" fund), and report certain ESG metrics. SFDR aimed to combat greenwashing by standardizing these disclosures (European Union, Regulation - 2019/2088 - EN - sfdr , 2019).

- **EU Green Bond Standard:** The EU is finalizing a voluntary European Green Bond Standard (EU GBS), which issuers can opt into to label their bonds as "EU Green Bonds". This standard, once effective (likely 2024/2025), will require aligning use of proceeds with the EU Taxonomy and external verification. It is expected to become a gold standard in the bond market. For banks, this offers an opportunity and a framework to issue green bonds that investors will recognize as high-quality (European Union, 2023).

Initiatives & Frameworks (Voluntary Standards)

- **ICMA Green Bond Principles (GBP), Social Bond Principles (SBP) and Sustainability-linked Bond Principles (SLBP):** Developed by the International Capital Market Association, these are globally recognized guidelines for issuing green, social or sustainability-linked bonds. They outline transparency and reporting practices (e.g., use of proceeds should be described, an external review is recommended, annual reporting on allocation and impact is expected). Almost all banks that issue green, social or sustainability-linked bonds declare alignment with GBP, SBP or SLBP accordingly (ICMA, 2025).
- **LMA Green Loan Principles (GLP), Social Loan Principles (SLP) and Sustainability-linked Loan Principles (SLLP):** The Loan Market Association has developed a suite of voluntary principles to guide the structuring and documentation of sustainable loans, ensuring transparency, integrity, and market consistency. European banks actively adopt these frameworks to structure green, social, and sustainability-linked loans, ensuring that features such as SPTs are meaningful, measurable, and verifiable. These principles promote credibility and help prevent greenwashing by requiring clear reporting and external review (LMA, 2025).
- **Climate Bonds Initiative (CBI) Standards:** The Climate Bonds Initiative provides a certification scheme for green bonds. Some European banks have obtained CBI Certification for their bonds (which indicates the bond meets strict, science-based criteria). It's more detailed than GBP, focusing heavily on climate impact (CBI, 2025).

- **UN Principles for Responsible Banking (PRB):** Launched in 2019 by UNEP FI, the PRB is a framework for banks to align their business strategy with societal goals like the SDGs and Paris Agreement. Over 300 banks worldwide (including many in Europe

and all 4 Greek systemic banks) have signed the PRB. Signatories commit to periodically assessing their portfolio impacts, setting targets to increase positive and decrease negative impacts, and publicly reporting progress. This is a soft-law, but it represents a public commitment. For example, under PRB, a bank might identify that a large portion of its lending is in carbon-intensive sectors and then set a target to reduce that over time (UNEPFI, Principles for Responsible Banking, 2019).

- **Task Force on Climate-related Financial Disclosures (TCFD):** Created by the Financial Stability Board, TCFD developed recommendations for firms (including banks) to disclose climate-related risks and opportunities in their financial filings, structured around governance, strategy, risk management, and metrics/targets. TCFD is voluntary but has been widely endorsed, and many regulators expect banks to implement it. By 2023, numerous European banks produce annual TCFD reports. These often reveal how the bank is conducting climate scenario analysis, how much of its portfolio is in high-carbon sectors, etc. TCFD is essentially becoming mandatory via incorporation into regulations like CSRD in the EU and proposed SEC rules in the US (TCFD, 2025).

International & Prudential Initiatives

- **Net-Zero Banking Alliance (NZBA):** This alliance commits banks to net-zero by 2050 following specific guidelines. While voluntary, once joined, it has reporting commitments. Many EU regulators encourage banks joining as it demonstrates ambition (UNEPFI, Net-Zero Banking Resources, 2025).

- **Paris Agreement and National Policies:** Banks also heed national climate policies. For instance, some European countries have coal phase-out dates. A bank operating in such countries might proactively restrict coal financing in advance (UNFCCC, 2025).

- **Basel Committee & Pillar 2:** The Basel Committee on Banking Supervision has issued principles on climate risk and is exploring if capital frameworks should adjust for ESG. The direction of travel is that banks will need to quantify climate risks in Pillar 2 processes (supervisory review). The EU's banking package now includes requirements for banks to prepare Transition Plans as part of their business. Such developments mean

sustainable finance considerations are penetrating core banking regulation, not just peripheral disclosures (BIS, 2025).

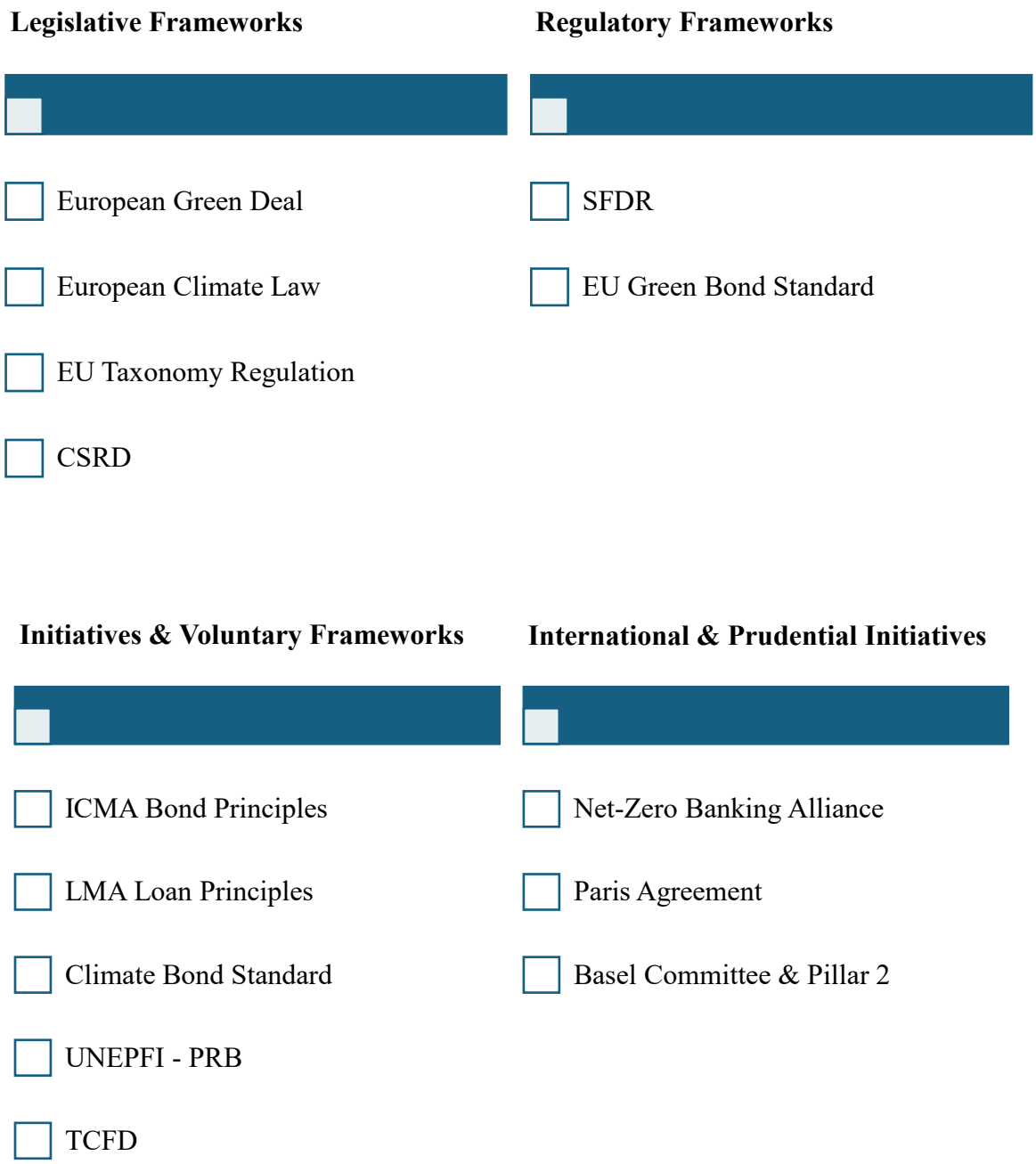

Figure 1: Legislative, Regulatory and Voluntary Frameworks and Initiatives in the Banking Sector

In summary, the regulatory landscape in the EU for sustainable finance is comprehensive and still evolving. It combines mandatory rules with voluntary but widely adopted standards, creating a layered system of incentives and requirements. This landscape pushes banks to be transparent and accountable for their ESG impacts, and increasingly to align their portfolios with climate goals.

2.3 Banking Frameworks for Implementing Sustainable Finance

Banks have responded to the sustainable finance agenda by developing internal frameworks and governance structures to embed sustainability considerations into their operations. These internal frameworks translate high-level principles and regulations into the bank's specific context, detailing processes for classifying and managing sustainable finance activities.

- **Sustainable Finance Framework (SFF):** It serves as the cornerstone for defining what constitutes sustainable lending and investment within a bank. Its primary purpose is to ensure alignment with international standards such as the EU Taxonomy and recognized market principles. The framework typically applies to all financing activities categorized as green, social, or sustainability-linked and covers corporate lending, project finance, and structured products. It sets eligibility criteria for sustainable transactions, often referencing external taxonomies and sector-specific thresholds, and establishes governance structures such as dedicated committees to review and approve deals. In addition, it includes exclusion lists that prohibit financing of activities inconsistent with sustainability objectives, such as coal mining or arctic drilling. Reporting obligations are also embedded, requiring periodic disclosure of sustainable finance volumes and impact metrics. Through these mechanisms, the framework provides a structured approach for integrating sustainability into core banking operations.
- **Sustainable Investment Framework (SIF):** Complementing the SFF, it governs how banks incorporate environmental, social, and governance factors into investment decision-making and portfolio management. Its purpose is to ensure that capital allocation supports long-term sustainability objectives while maintaining financial performance. The scope of this framework typically includes proprietary investments, asset management activities, and advisory services. It outlines integration models that

combine exclusionary screening, positive screening, and thematic or impact investing approaches. Governance provisions assign oversight to ESG investment committees and senior management, while monitoring and reporting requirements mandate periodic evaluation of ESG performance and transparent disclosure to stakeholders. Furthermore, the framework encourages active ownership and engagement with investee companies to drive sustainability improvements, reinforcing the bank's role as a responsible investor.

- **Green and Social Bond Framework (GBF / SBF):** It is designed for banks issuing green or social bonds and aims to ensure credibility and investor confidence by aligning with recognized market standards such as the ICMA Green Bond Principles and Social Bond Principles. This framework applies to all debt instruments marketed as green or social bonds and defines eligible use-of-proceeds categories, including renewable energy, clean transportation, and affordable housing. It details the processes for project evaluation and selection, management of proceeds, and allocation reporting. Annual reporting commitments are standard, often accompanied by impact assessments to demonstrate the environmental or social benefits of financed projects. To enhance transparency and market trust, banks typically obtain independent external reviews, such as Second-Party Opinions or certifications, validating the integrity of the framework and its alignment with best practices.
- **Transition Finance Framework (TFF):** It addresses the financing needs of carbon-intensive sectors undergoing credible decarbonization. Its purpose is to bridge the gap between current high-emission activities and future low-carbon operations, supporting industries that are essential to the economy but face significant challenges in reducing emissions. The scope of this framework generally targets hard-to-abate sectors such as steel, cement, and energy. It establishes eligibility criteria requiring borrowers to present science-based transition plans aligned with net-zero pathways and includes governance mechanisms for assessing the credibility of these plans. Monitoring provisions mandate milestone tracking and periodic reassessment of financed entities' progress, while risk management processes integrate transition risk into credit assessment and pricing models. By doing so, the framework ensures that transition finance contributes meaningfully to climate objectives rather than perpetuating high-carbon activities.

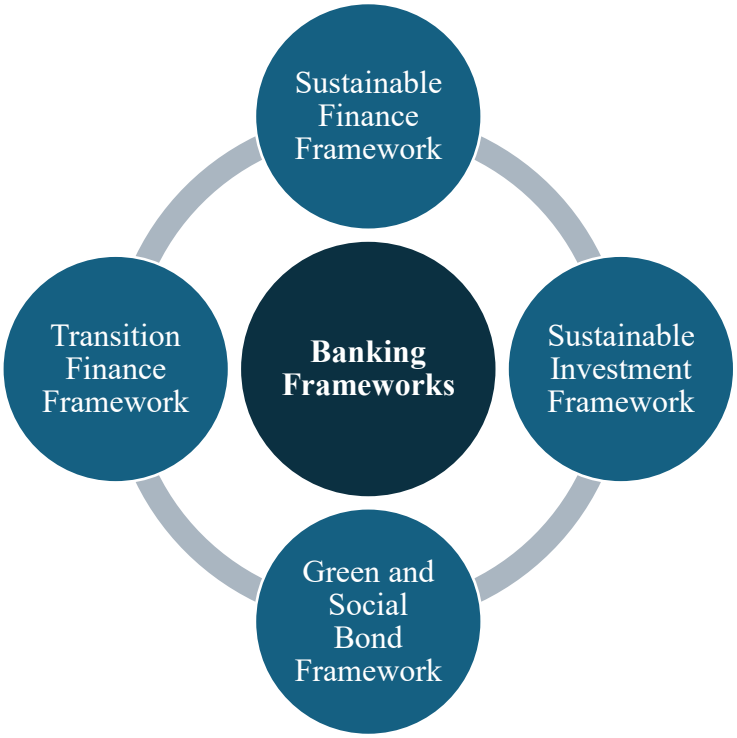

Figure 2: Banking frameworks for implementing and supporting Sustainable finance

Collectively, these frameworks operationalize sustainability within banking institutions by embedding ESG considerations into lending, investment, and capital markets activities. They provide clarity, reduce greenwashing risk, and enable banks to demonstrate alignment with regulatory expectations and voluntary commitments. More importantly, they represent a strategic shift from ad hoc sustainability initiatives to structured, governance-driven approaches that integrate sustainability into the core of banking operations.

2.4 Types of Sustainable Financial Products and Loan Classification

Within the sustainable finance domain, banks offer a range of products tailored to support different sustainability objectives. It's useful to distinguish between these product types and to understand how banks classify loans as green or sustainable. Major categories include:

- **Dedicated-Purpose Green / Social Loans:** These are loans where the proceeds are exclusively used to finance a specific green / social project or asset. For instance, a loan to build a wind farm, a solar park, a hydroelectric plant, or to retrofit a building for energy efficiency. Because the use of funds is clearly defined and restricted to a green or social purpose, such loans are straightforward to classify as Green / Social Loans.

They green loans may also align with categories in the EU Taxonomy (e.g., renewable energy, green buildings). Many banks now have green and social loan products – sometimes even marketed with a slight pricing benefit for the borrower as an incentive. In Greece, for example, banks have offered green mortgage loans (for homes meeting energy standards) or green project finance for renewable energy developers, especially given the country's push for more renewables (WeESG, 2024).

- **General-Purpose Company Business Mix Loans:** When the use of proceeds is not tied to a specific project, banks may classify general-purpose loans as sustainable finance. The underlying principle is that financing a company whose core operations are predominantly sustainable indirectly supports the green transition. To qualify, the company must demonstrate that a substantial majority of its revenue—typically between 80% and 90%—derives from activities considered environmentally or socially sustainable under recognized standards such as the EU Taxonomy. Furthermore, none of its activities should fall within exclusion lists, which commonly prohibit sectors such as tobacco, alcohol, gambling, or other activities deemed incompatible with sustainability objectives. By adopting this methodology, banks expand the scope of sustainable finance beyond project-specific lending, enabling support for companies whose entire business model contributes to climate and social goals.

- **General-Purpose Sustainability-Linked Loans (SLLs):** Not all borrowers need funds for a specific project; they might want money for general corporate purposes. Sustainability-Linked Loans address this by linking the loan's terms to the borrower's overall sustainability performance. In an SLL, the borrower commits to certain Sustainability Performance Targets (SPTs) – for example, reducing its CO_2 emissions by X% by year Y, or increasing the share of renewable energy in its consumption, or perhaps achieving a certain ESG rating improvement. If the borrower meets the targets, the loan's interest rate margin might decrease (reward), and if they fail, it might increase (penalty). The proceeds can be used for anything (hence *general-purpose*), but the sustainability impact is ensured via the performance targets. Banks offer this product because it allows them to engage a wide range of clients in sustainability dialogue. Banks classify SLLs as sustainable finance because they incentivize and result in ESG improvements, although one must ensure the targets are meaningful (avoid "cheap" targets) (Sustainalytics, 2025).

- **Recovery and Resilience Facility (RRF) Loans:** In January 2020, the COVID-19 pandemic arrived in Europe, leading to a health crisis with major socio-economic consequences. The EU's response was immediate, putting in place — among others — a temporary recovery instrument, NextGenerationEU, designed to raise funds on the capital markets and make them then available to its Member States, to implement ambitious reforms and investments. The core of NextGenerationEU is the Recovery and Resilience Facility (RRF), the largest EU funding programme to date, projected to disburse up to €650 billion in grants and loans to Member States. The RRF Regulation entered into force in February 2021, stipulating that each Member State will submit a National Recovery and Resilience Plan (NRRP) identifying the reforms and investments that the Member State commits to implement. The National Recovery and Resilience Plan 'Greece 2.0' was adopted on July 13, 2021, by the Economic and Financial Affairs Council of the European Union (Ecofin), amounting €30.5 billion. On December 2023, its revision was approved, concerning mainly new investments and reforms under REPowerEU as well as expanding the existing loan program, thus increasing its budget to €35.95 billion. Greece 2.0 includes 100 investments and 76 reforms, structured around five pillars: Green Transition, Digital Transformation, Employment-Skills-Social Cohesion, Private Investments and Transformation of the Economy and REPowerEU (National Recovery and Resilience Plan, 2025)

- **Transition Finance Loans:** Transition finance loans are designed to support companies operating in carbon-intensive sectors as they shift toward low-carbon business models. Unlike green loans, which fund activities already aligned with sustainability objectives, transition loans target firms whose current operations are not fully sustainable but have credible plans to decarbonize. These instruments recognize that achieving climate neutrality requires financing the transformation of industries such as steel, cement, chemicals, and energy—sectors that are essential to the economy yet difficult to decarbonize. The purpose of transition finance is to enable companies to implement technologies, processes, and strategies that reduce greenhouse gas emissions over time. Eligibility is typically contingent on the borrower presenting a robust transition plan aligned with science-based targets and international climate pathways, such as those consistent with the Paris Agreement. Banks assess these plans for credibility, including interim milestones, investment commitments, and governance structures to ensure

accountability. By offering transition finance loans, banks play a critical role in facilitating the decarbonization of hard-to-abate sectors. In doing so, they help bridge the gap between current economic realities and long-term climate objectives, ensuring that the transition to a net-zero economy is both inclusive and achievable (Loan Syndications and Trading Association, 2025).

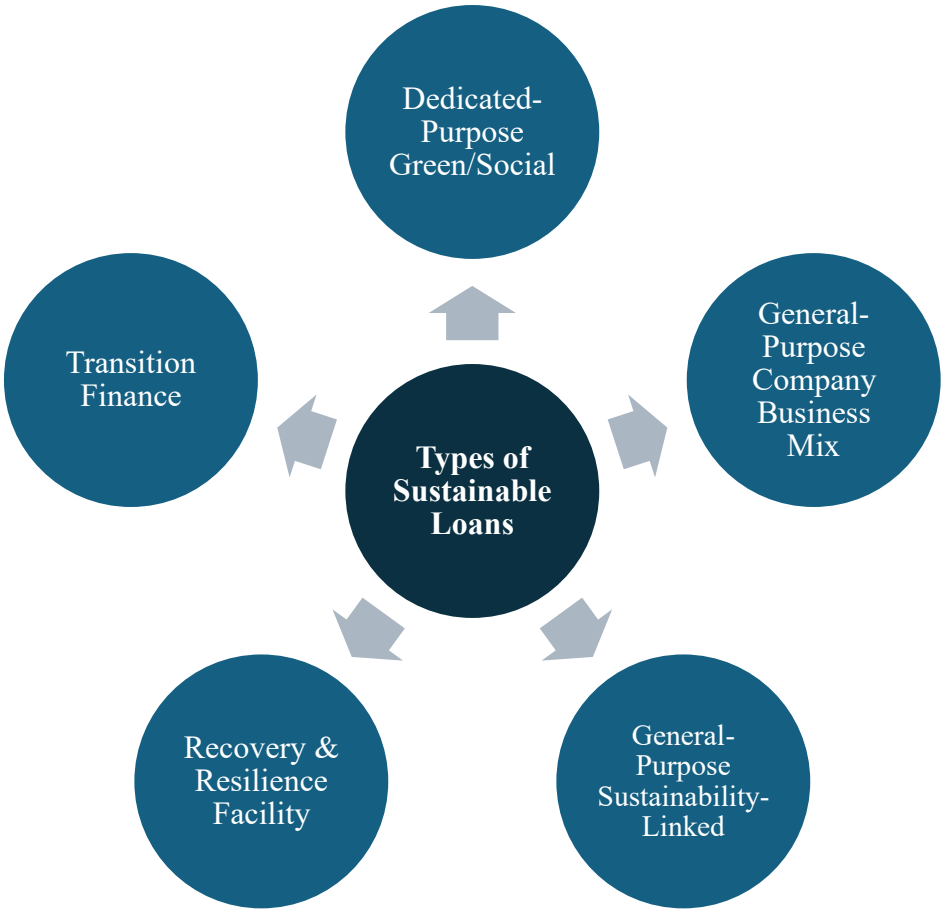

Figure 3: Types of Sustainable Finance Loans

In summary, these product categories illustrate the multifaceted approach banks adopt to integrate sustainability into their lending practices. From dedicated-purpose green loans to performance-linked instruments and transition finance, each product type addresses different dimensions of the climate challenge. Together, they form the backbone of sustainable finance strategies, enabling banks to mobilize capital toward both immediate and long-term decarbonization objectives.

2.5 Supervisory and Prudential Regulations for Banks

Financial regulators and supervisors have increasingly recognized that sustainability risks, particularly climate-related risks, can pose material threats to banks' safety and soundness. As a result, in addition to disclosure rules, there's a whole layer of prudential guidance and supervisory expectations around managing these risks. Key developments include:

Single Supervisory Mechanism (SSM) Expectations: The European Central Bank (ECB) through the SSM supervises the largest banks in the Eurozone, including Greek systemic banks. ECB issued in 2020 a comprehensive "Guide on climate-related and environmental risks" (European Central Bank, Guide on climate-related and environmental risks, 2020). This Guide outlines 13 expectations for banks, covering governance, risk management, and disclosure. For example, Expectation 1 is that a bank's board and management should take responsibility for climate and environmental risks, integrating them into the bank's strategy; Expectation 6 calls for banks to include climate and environmental risks in their credit risk management (client due diligence, credit ratings, collateral valuations, etc.) and Expectation 8 in stress testing, etc. Although initially positioned as guidance, the ECB made it clear that by the end of 2023, it expects banks to fully meet these expectations or face supervisory action.

The SSM also conducted a Climate Risk Stress Test in 2022 across Eurozone banks. While it was more of a learning exercise, it revealed significant data gaps and the potential impact of transition risk on banks. For instance, banks had to estimate losses under scenarios including a disorderly transition to net-zero. The thematic review on climate risks in 2022 further examined how banks are embedding climate in their processes; ECB found many banks have work to do, especially on setting quantitative risk limits and incorporating climate into strategy (European Central Bank, 2022). For our study's banks, this meant that in 2022 each had to go through an intense internal assessment and send data to the ECB, likely accelerating efforts to collect emissions data for big borrowers and to think about long-term strategies to reduce exposures to high-carbon sectors.

EBA Guidelines: The European Banking Authority (EBA) has been active in developing guidelines to integrate sustainability into risk management. Two major ones:

- Loan Origination & Monitoring Guidelines (2020) – These included that banks should consider ESG factors in their credit-granting process for medium-to-long term loans.

For example, before granting a 10-year loan, a bank should assess if environmental issues could affect the borrower's ability to repay (like regulatory changes, physical climate risks) (European Banking Authority, Guidelines on loan origination and monitoring, 2020).

- Guidelines on the management of ESG risks (2023) – After public consultation, EBA finalized guidelines that set minimum standards on how banks should identify, measure, manage ESG risks (covering governance, strategy, risk management, scenario analysis, etc.), and on what transition plans they should have in place. These will become effective by end-2025 (with smaller banks given until end-2026) as noted in the snippet. They basically codify that banks must embed sustainability in risk management and have detailed transition plans aligned to net-zero pathways. National supervisors will enforce these. Therefore banks have clear guidance that ESG risk is part of their overall risk profile, not optional (European Banking Authority, 2025).
- Transition plans (for banks themselves) – Under the forthcoming Capital Requirements Directive (CRD) VI, banks will need to produce plans showing how they will adjust their business model to ensure their own portfolios are aligned with EU climate goals. Supervisors will review these in the annual Supervisory Review and Evaluation Process (SREP). This is a game-changer – it means in a few years, a bank's strategy will be partially judged by regulators on whether it's reducing financing to high-emission activities in line with 2030/2050 goals (European Union, 2024).

ESMA and Capital Markets: ESMA (European Securities and Markets Authority) deals with investor protection and markets. It has guidelines to combat greenwashing and to implement the SFDR and Taxonomy for asset managers. For banks' asset management arms, ESMA's work is relevant to ensure ESG funds are properly managed. ESMA also is working on regulating ESG ratings and assessment providers, which indirectly affects banks who use those services (European Securities and Markets Authority, 2025).

Basel Committee (BCBS): At international level, the BCBS in 2021-22 issued "Principles for the effective management and supervision of climate-related financial risks". These 18 principles largely align with what ECB/EBA have done, emphasizing governance, internal controls, risk assessment, and disclosure. While high-level, it signals that climate risk is now on the agenda for global bank regulators. BCBS has not changed capital rules yet but is studying

whether certain exposures (like fossil fuel loans) should attract higher risk weights or if a "green supporting factor" (lower capital for green loans) could be warranted (Bank for International Settlements, 2022).

Figure 4: Supervisory and Prudential Regulations for Banks

In conclusion, prudential regulation for sustainability has quickly evolved from a non-issue a few years ago to a sophisticated set of expectations today. Banks no longer view sustainability only as a reputational or CSR matter; it is now recognized as a financial risk issue and part of compliance. The combination of EBA guidelines, ECB oversight, and international principles is ensuring that banks identify and manage climate-related risks much as they do credit or market risks. This shift ultimately protects the banking system from future shocks and also reinforces the objectives of sustainable finance by incentivizing banks to reduce exposures to the highest-risk unsustainable activities over time.

CHAPTER 3: EMPIRICAL ANALYSIS OF SUSTAINABLE FINANCE STRATEGIES

The third chapter introduces the reader to the empirical study of the sustainable finance strategies adopted by banks. Following the presentation of the theoretical framework in the previous chapters, the focus here shifts to the gradual integration of sustainability into banking practices. Banks increasingly recognize their role as catalysts for a more sustainable economy—from financing "green" projects to embedding environmental, social, and governance (ESG) criteria into their operations. This shift is driven both by regulatory pressures (e.g., frameworks such as the EU Taxonomy and the CSRD Directive) and by growing market demand for responsible investments. At a more specific level, this chapter examines how four major Greek banks and a group of 26 European banks incorporate the concept of sustainable finance into their strategies.

This introductory section outlines the overall aim of the analysis, while the following subsections (3.1–3.4) will successively develop: (a) the description of the sample and research methodology, (b) findings regarding banks' sustainable finance practices, (c) a comparison between Greek banks and the European banking groups in the sample, and (d) a concise assessment of progress and emerging trends. In this way, the reader is prepared for the detailed research findings that follow, gaining a general overview of the current state and the significance of sustainable finance strategies in the banking sector.

The analysis combines quantitative and qualitative data drawn from a sample of 30 banks—15 large institutions and 15 smaller ones based on turnover—alongside the four systemic Greek banks, as shown in the table below.

Major Banks			Peer Banks		
1		ABN AMRO	1		Eurobank
2		Barclays	2		Alpha Bank
3		BBVA	3		NBG
4		BNP Paribas	4		Piraeus Bank
5		Citi	5		Aareal
6		Credit Suisse	6		AIB
7		Danske Bank	7		Millenium
8		Deutsche	8		Banco de Credito
9		DNB	9		Bawag
10		HSBC	10		Cassa Centrale Banca
11		ING	11		Hamburg
12		Lloyds	12		MuniFin
13		NatWest	13		NWB
14		Santander	14		PBB
15		Societe Generale	15		SFIL

3.1 Mapping of Sustainable Finance Frameworks

The first step in understanding banks' sustainable finance practices is to identify the frameworks they have adopted and analyze their structural characteristics. This section explores the prevalence of sustainable finance related frameworks, focusing on their availability. Mapping these frameworks provides a basis for evaluating the maturity of banks' ESG integration and their alignment with international standards such as the Loan Market Association principles and the EU Taxonomy, as mentioned in Chapter 2.

Mapping the adoption of sustainable finance frameworks among the sampled banks provides critical insights into the structural foundations of their sustainability strategies. The analysis indicates that two dominant framework types prevail: Green Bond Frameworks and Sustainable Finance Frameworks, each reflecting different levels of integration and scope. Green Bond Frameworks typically focus on the issuance of debt instruments earmarked for environmentally beneficial projects, whereas Sustainable Finance Frameworks encompass a broader range of products, including loans and other financial instruments linked to sustainability objectives.

The identification and mapping of sustainable finance frameworks were based on publicly available information disclosed by the sampled banks. Specifically, the frameworks analyzed in this study were obtained from official corporate websites, investor relations sections, and sustainability reporting portals of each institution. These documents are typically published as part of transparency and disclosure obligations under international standards such as the ICMA Green Bond Principles and regulatory requirements including the EU Taxonomy and the Corporate Sustainability Reporting Directive. In most cases, the year referenced corresponds to the latest update or revision of the framework rather than its initial establishment, reflecting the dynamic nature of sustainable finance practices and the need for continuous alignment with evolving regulatory and market expectations.

The reliance on publicly accessible sources ensures the accuracy, credibility, and replicability of the findings presented in this chapter (ABN AMRO, Green Bond Framework, 2024) (Barclays, Sustainable Finance Framework - version 4.1 , 2024) (BBVA, Sustainable Debt Financing Framework, 2024) (BNP Paribas, Green Bond Framework, 2024) (Citi Group, Sustainable Finance Framework, 2025) (Credit Suisse, Green Bond Framework, 2022) (Danske Bank, Green Finance Framework, 2022) (Deutsche Bank, Sustainable Finance Framework, 2024) (DNB, Green Finance Framework, 2025) (HSBC, Green Financing Framework, 2024)

(ING, Green Bond Framework, 2024) (Lloyds Bank, 2023) (NatWest Group, 2022) (Santander, Green, Social & Sustainability Funding Global Framework, 2023) (Societe Generale, Sustainable and Positive Impact Bond Framework, 2022) (Eurobank, 2023) (Alpha Bank, 2023) (NBG, Sustainable Bond Framework, 2023) (Piraeus Bank , 2024) (Aareal, Green Finance Framework - Lending, 2023) (AIB, Sustainable Lending Framework, 2024) (Millenium, 2021) (Banco de Credito, Sustainable Bond Framework, 2023) (Bawag, Green Finance Framework, 2023) (Cassa Centrale Banca, Green, Social and Sustainability Bond Framework, 2024) (Hamburg, Sustainable & Transformational Finance Framework, 2024) (Kuntarahoitus, 2024) (NWB Bank, 2022) (PBB, 2024) (SFIL, Group Green, Social & Sustainability Bond Framework, 2024).

Among the 15 large banks, the distribution of frameworks is relatively balanced, with 53% adopting Sustainable Finance Frameworks and 47% implementing Green Bond Frameworks, as illustrated in the figure below. This near parity suggests that major institutions pursue both comprehensive sustainability strategies and targeted green bond issuance to meet investor expectations and regulatory requirements.

In contrast, smaller banks demonstrate a more pronounced preference for Sustainable Finance Frameworks, with 67% of peer banks adopting this approach compared to only 33% relying on Green Bond Frameworks. This divergence indicates that smaller institutions may prioritize integrated frameworks to enhance flexibility across multiple financial products and align with broader sustainability objectives, whereas larger banks leverage Green Bond Frameworks to capitalize on capital market instruments and investor-driven demand.

Overall, the aggregated data reveal that 60% of all banks in the sample have implemented Sustainable Finance Frameworks, underscoring a market-wide trend toward holistic sustainability integration.

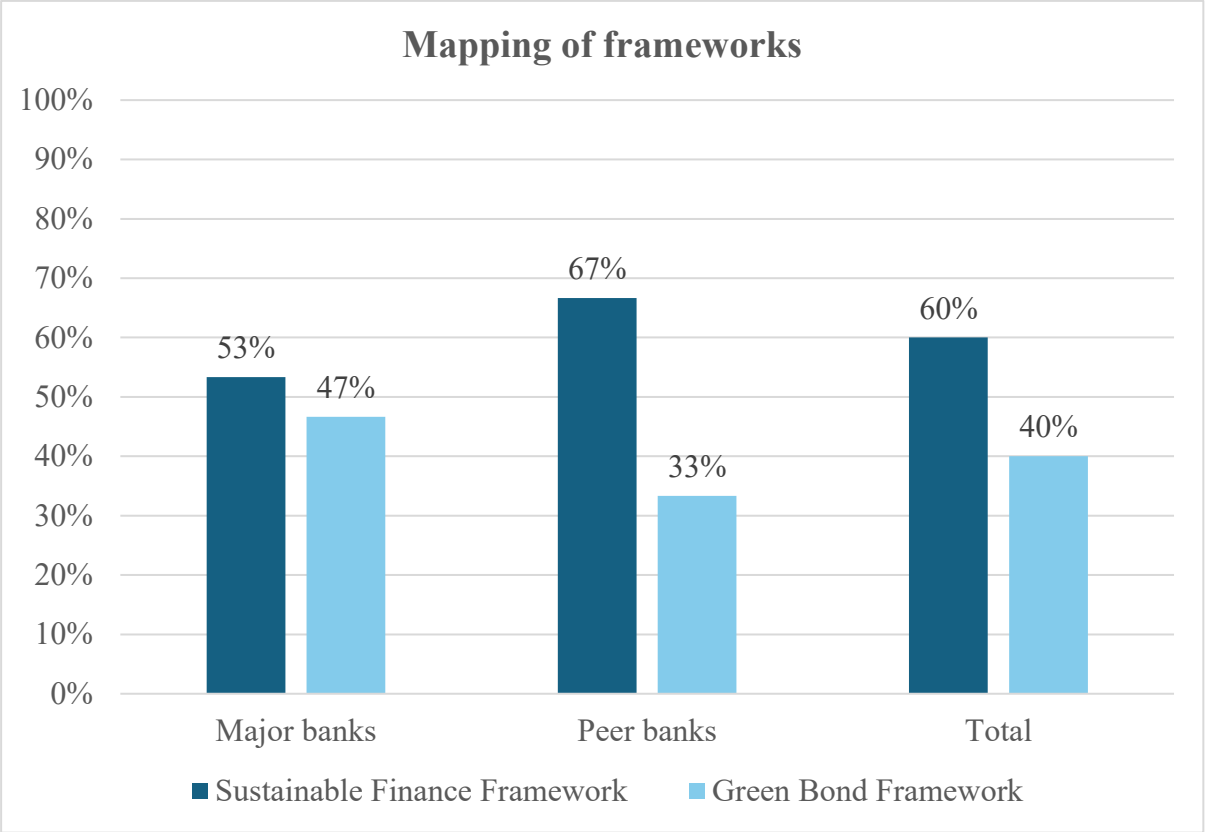

Figure 5: Mapping and distribution of frameworks among the major and peer banks of the sample

The temporal dimension of framework adoption provides a compelling view of the evolution and refinement of sustainable finance practices among banks. As illustrated in the below figure, the distribution of framework availability across years reveals a clear acceleration in recent periods. While early adoption was limited—only 3% of frameworks were updated in 2021, primarily among peer banks—the pace increased significantly in subsequent years. In 2022, updates accounted for 27% among major banks and 20% among peer banks, signaling the first wave of alignment with emerging regulatory guidance such as the EU Taxonomy and the European Green Deal. This upward trend continued into 2023, with similar proportions (27% for major banks and 20% for peers), reflecting incremental adjustments rather than wholesale redesigns.

The most notable surge occurred in 2024, when 47% of major banks and 53% of peer banks updated their frameworks, representing 50% of all frameworks in the sample. This concentration suggests a strong response to regulatory developments and supervisory expectations, including the European Banking Authority's ESG risk management guidelines

and enhanced disclosure requirements under the Corporate Sustainability Reporting Directive (CSRD). It is important to note that these years often correspond to framework updates rather than initial establishment, indicating a dynamic process of adaptation to evolving standards and market pressures. By contrast, 2025 shows a sharp decline, with only 13% of major banks and 7% of peers reporting updates, which may reflect a temporary stabilization following the intense activity of the previous year.

Overall, the temporal analysis underscores the iterative nature of sustainable finance framework development. The clustering of updates in 2024 highlights the sector's accelerated convergence toward regulatory compliance and investor expectations, while earlier and later years demonstrate a gradual but persistent trajectory of refinement. This pattern suggests that sustainable finance frameworks are not static instruments but evolving structures shaped by regulatory milestones and competitive dynamics.

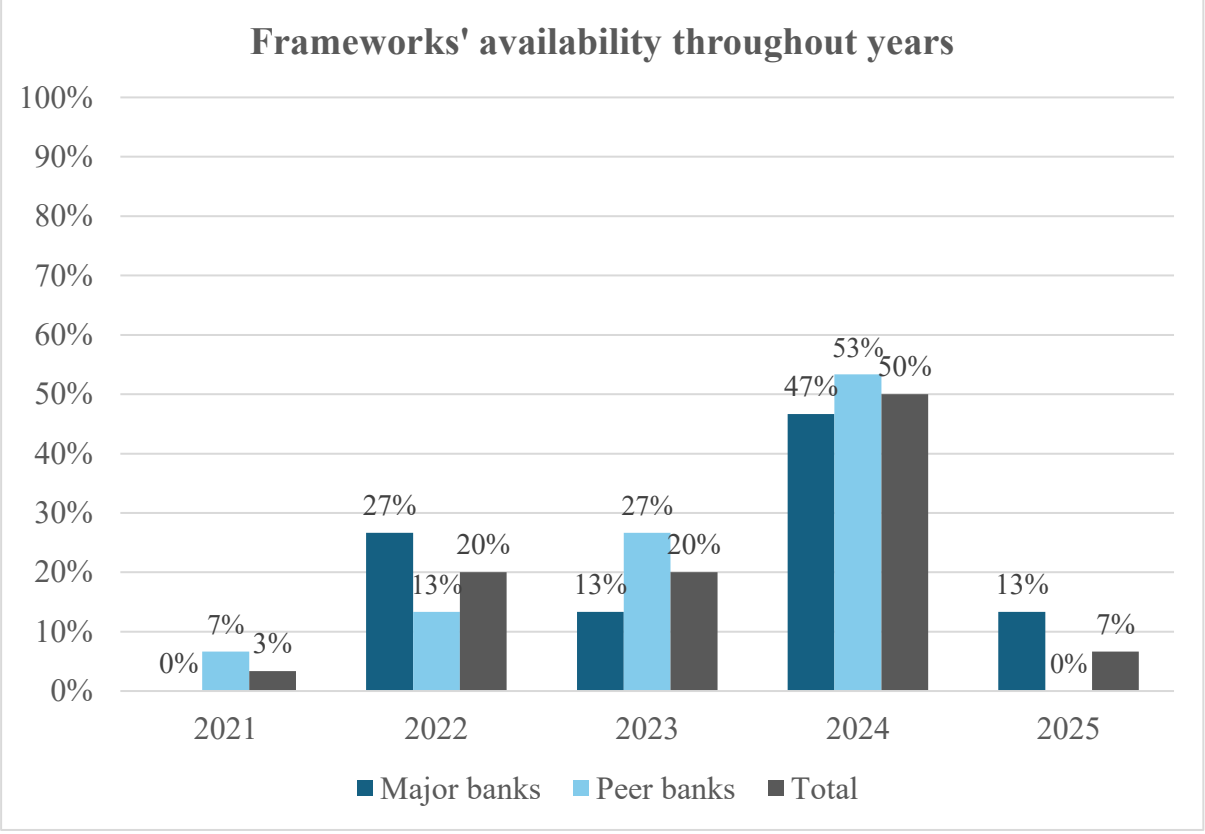

Figure 6: Establishment or update of sustainable finance related frameworks from 2021 to 2025

3.2 Eligible Activities under Each Framework

Determining which activities qualify for sustainable financing is essential to assess the real economic impact of these frameworks. This section analyzes the most common categories of eligible green and social activities financed by banks. By comparing these categories across the sample, the analysis identifies sectoral priorities and emerging trends, as well as variations linked to institutional size and regional focus. This evaluation sheds light on how banks channel capital toward activities that support the transition to a low-carbon economy. Below is an overview of the main categories identified in the frameworks analyzed, along with their typical scope.

Green Eligible Activities

1. **Green Buildings**: This category includes the construction or renovation of buildings that meet recognized green certification standards (e.g., LEED, BREEAM) or achieve significant improvements in energy performance. Eligible projects often involve low-carbon materials, efficient heating and cooling systems, and integration of renewable energy sources.

2. **Renewable Energy**: Financing under this category supports the development, installation, and operation of renewable energy projects such as solar, wind, hydro, and geothermal power. It may also include investments in energy storage solutions and grid infrastructure that facilitate renewable integration.

3. **Clean Transportation:** Eligible activities encompass the deployment of low-emission or zero-emission transport systems, including electric vehicles, charging infrastructure, rail systems, and public transit solutions. Projects aimed at reducing transport-related greenhouse gas emissions fall within this scope.

4. **Energy Efficiency:** This category covers projects that improve energy performance in industrial processes, residential and commercial buildings, and public infrastructure. Examples include retrofitting, advanced insulation, and high-efficiency appliances or systems.

5. **Sustainable Water and Wastewater Management:** Activities include water conservation, treatment, and recycling systems, as well as wastewater management

technologies that reduce pollution and enhance resource efficiency. Investments may target infrastructure upgrades or innovative water reuse solutions.

6. **Pollution Prevention and Control:** Projects under this category aim to reduce air, water, and soil pollution through advanced filtration systems, waste management technologies, and industrial process improvements. It also includes initiatives to minimize hazardous waste generation.

7. **Climate Change Adaptation:** Eligible investments focus on enhancing resilience to climate risks, such as flood defenses, coastal protection, and infrastructure designed to withstand extreme weather events. Adaptation measures often complement mitigation strategies.

8. **Sustainable Agriculture, Fisheries, and Forestry:** This category supports practices that maintain ecosystem health while ensuring productivity, such as precision farming, organic agriculture, sustainable forestry management, and responsible aquaculture.

9. **Technologies and Processes for Circular Product Manufacturing:** Financing here promotes circular economy principles, including resource-efficient production, recycling, and reuse of materials. Eligible projects may involve innovative technologies that extend product life cycles and reduce waste.

10. **Conservation of Terrestrial and Aquatic Biodiversity:** Activities include habitat restoration, species protection programs, and conservation projects that safeguard ecosystems. Investments often target areas of high biodiversity value or critical habitats.

11. **Information and Communication Technology (ICT):** ICT projects are eligible when they contribute to environmental objectives, such as smart grids, digital solutions for energy efficiency, and platforms that enable sustainable resource management.

The analysis demonstrates a strong emphasis on activities directly linked to climate mitigation and resource efficiency. Green buildings and renewable energy emerge as the most prevalent categories, included by 93% of major banks and 87% of peer banks. This dominance reflects the central role of energy-efficient construction and clean energy generation in achieving decarbonization targets and aligning with the EU Taxonomy.

Similarly, clean transportation ranks highly, with 87% of major banks and 67% of peer banks incorporating this category, underscoring the sector's commitment to reducing emissions in mobility systems.

Other frequently included activities include energy efficiency (73% major banks; 67% peers) and sustainable water and wastewater management (73% peers; 47% major banks), indicating a growing recognition of resource conservation and infrastructure resilience.

In contrast, categories such as pollution prevention and control (47% major banks; 27% peers) and climate change adaptation (53% major banks; 33% peers) appear less consistently, suggesting that adaptation measures and pollution control remain secondary priorities compared to mitigation-focused investments.

Lower inclusion rates are observed for technologies and processes for circular product manufacturing (33% major banks; 13% peers), conservation of terrestrial and aquatic biodiversity (33% peers; 7% major banks), and information and communication technology (ICT) (27% peers; 13% major banks).

These findings indicate that while circular economy principles and biodiversity conservation are recognized, they have yet to achieve widespread integration within banking frameworks, possibly due to measurement challenges and limited client demand.

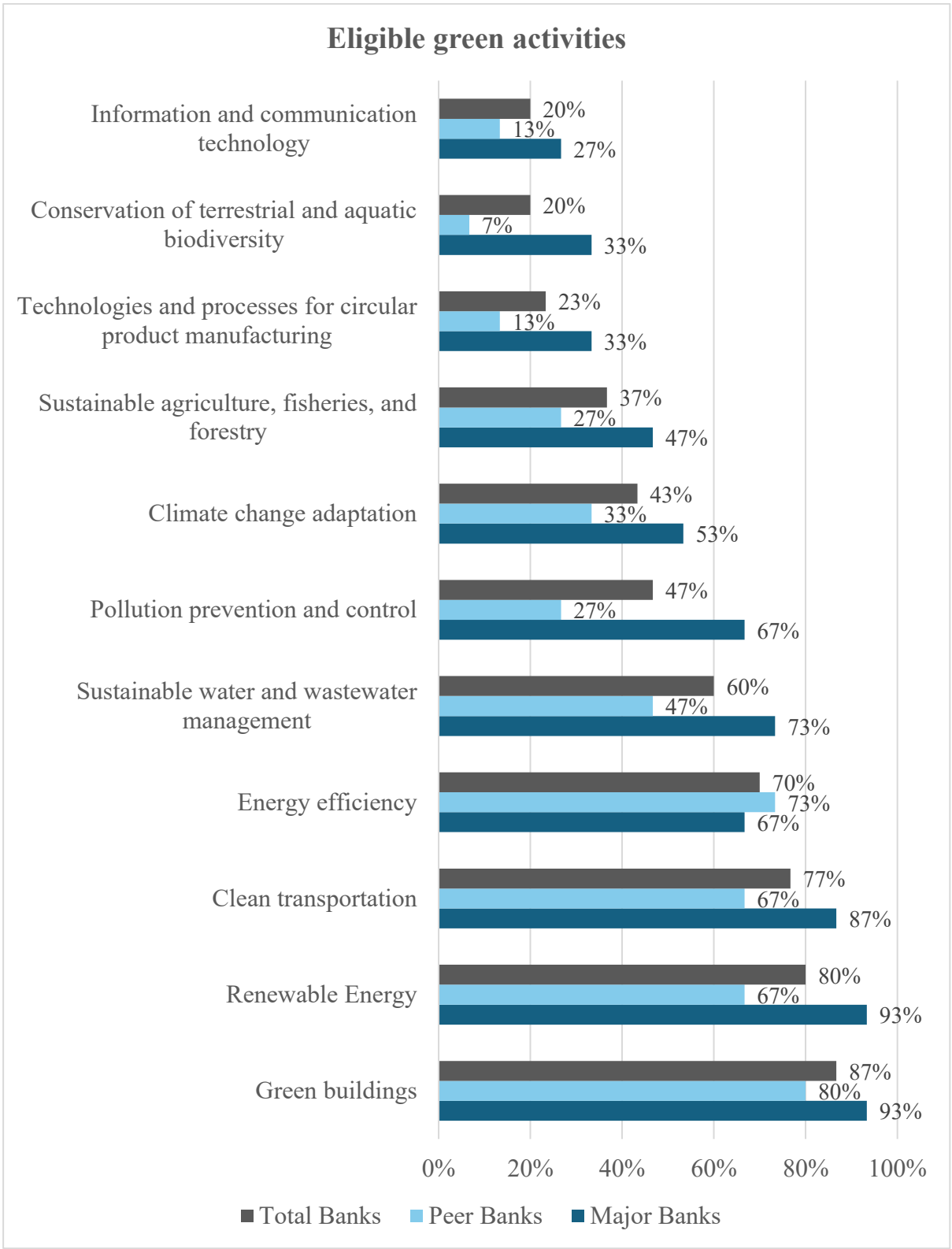

Figure 7: Eligible green activities financed by banks, as mentioned in their publicly available frameworks

Overall, the data reveal a clear hierarchy of priorities: energy-related activities dominate, followed by water management and transportation, while biodiversity and circular economy initiatives remain niche areas. This pattern reflects both regulatory drivers—such as the EU Taxonomy's emphasis on climate mitigation—and market dynamics favoring sectors with mature investment opportunities.

Social Eligible Activities

1. **Access to Basic Services:** This category includes financing for healthcare, education, and other essential services that improve quality of life and social inclusion, particularly for underserved populations.
2. **Employment Generation:** Eligible projects create jobs, either directly through infrastructure development or indirectly via support for small and medium-sized enterprises (SMEs). Initiatives often target regions with high unemployment or vulnerable groups.
3. **Affordable Housing:** Financing supports the construction or renovation of housing units that meet affordability criteria, ensuring access to safe and adequate living conditions for low-income households.
4. **Affordable Basic Infrastructure:** This includes investments in essential infrastructure such as clean water supply, sanitation, and energy access, particularly in disadvantaged or rural areas.
5. **Socioeconomic Advancement and Empowerment:** Projects under this category aim to reduce inequality and promote social mobility through vocational training, financial inclusion programs, and community development initiatives.
6. **Food Security and Sustainable Food Systems:** Eligible activities enhance access to nutritious food and support sustainable agricultural practices that ensure long-term food availability while minimizing environmental impact.
7. **Financing of Charitable Organizations and Non-Profit Institutions:** This category covers funding for organizations that deliver social services, humanitarian aid, and community support programs, contributing to broader social welfare objectives.

The inclusion of social categories within frameworks is more evenly distributed, though certain areas exhibit stronger representation. Access to basic services and employment generation are the most common, each appearing in 53% of major banks and 47–53% of peer banks, signaling alignment with social impact objectives and Sustainable Development Goals (SDGs). Affordable housing also ranks prominently (53% major banks; 33% peers), reflecting the growing importance of housing affordability in ESG strategies.

Conversely, categories such as affordable basic infrastructure (27% peers; 33% major banks) and socioeconomic advancement and empowerment (40% major banks; 27% peers) show moderate inclusion, suggesting that banks selectively target initiatives with measurable outcomes. Food security and sustainable food systems (17% peers; 0% major banks) and financing of charitable organizations and non-profit institutions (20% peers; 0% major banks) are the least represented, indicating that philanthropic and food-related projects remain peripheral within mainstream sustainable finance frameworks.

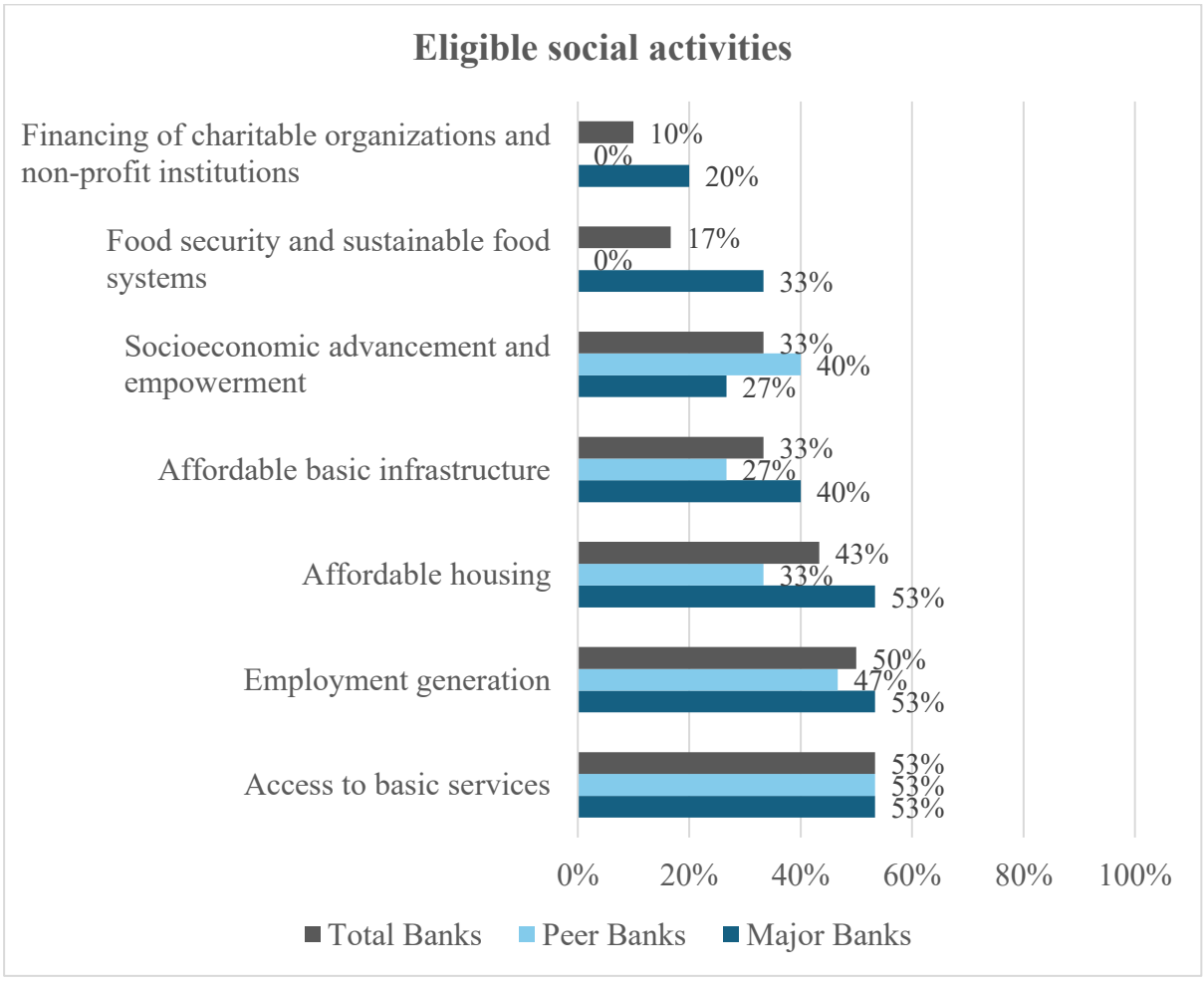

Figure 8: Eligible social activities financed by banks, as mentioned in their publicly available frameworks

The overall trend suggests that social objectives are integrated primarily through activities with direct economic and community benefits—such as job creation, housing, and essential services—while categories requiring complex impact measurement or offering limited financial returns receive less attention.

The inclusion of these categories within sustainable finance frameworks reflects alignment with international standards such as the EU Taxonomy and the ICMA Green and Social Bond Principles. By defining clear eligibility criteria, banks ensure that financed projects deliver measurable environmental and social benefits, thereby enhancing transparency and investor confidence.

3.3 Green Asset Ratio (GAR) Analysis

The Green Asset Ratio (GAR) is the cornerstone metric introduced under the EU Taxonomy framework to assess the degree of environmental alignment in banks' balance sheets. It measures the proportion of assets that qualify as environmentally sustainable under taxonomy criteria, providing a standardized benchmark for comparability across institutions. GAR reporting is mandatory for European banks under Pillar 3 disclosures and is typically presented in annual sustainability statements, ensuring transparency and regulatory compliance.

Two key indicators underpin GAR reporting:

1. **GAR stock (%)**

   This represents the share of total assets classified as taxonomy-aligned for climate change mitigation and adaptation. It is calculated primarily using the turnover KPI of counterparties, with CapEx KPI applied in specific cases. GAR stock is the headline figure for benchmarking banks' progress toward green alignment.

2. **Coverage (% over total assets)**

   Coverage indicates the proportion of the bank's balance sheet assessed for taxonomy eligibility. Since GAR stock is derived only from the covered portion, coverage is critical for interpreting GAR figures. Low coverage may suggest that the reported GAR reflects a narrow scope, limiting comparability across institutions.

The data analyzed in this section were sourced from publicly available Pillar 3 reports and annual sustainability disclosures, ensuring methodological consistency and transparency (Pfandbriefbank, 2024) (NWB, Pillar 3 Full Year Disclosure, 2024) (Aareal, 2024) (Barclays, 2024) (MuniFin, Pillar III Disclosure Report, 2024) (BBVA, 2024) (Hamburg, 2024) (BNP Paribas, 2023) (Citi Group, 2024) (Deutsche Bank, 2024) (Cassa Centrale Banca, 2024) (Millennium, 2024) (SFIL, 2024) (Alpha Bank, 2024) (Societe Generale, 2024) (NBG, 2024) (Danske Bank, 2024) (Banco de Credito, 2024) (Piraeus Bank, 2024) (Eurobank, 2024) (Santander, 2024) (AIB, 2024) (DNB, 2024) (Bawag, 2024) (ING, 2024) (ABN AMRO, 2024).

The figure below illustrates the relationship between GAR stock (%) and coverage (%) across the sample of major and peer banks. Dark blue markers represent major banks, while light blue markers correspond to peer banks. The scatter plot reveals significant heterogeneity in both GAR levels and coverage:

- **High coverage, low GAR**: Most banks cluster in the upper-left quadrant, with coverage above 60% but GAR stock below 2%. This suggests that while these institutions have assessed a substantial portion of their balance sheet, the share of taxonomy-aligned assets remains modest.
- **High GAR, high coverage**: A few outliers appear in the upper-right quadrant, combining strong coverage with GAR stock above 6%. These banks demonstrate advanced integration of green assets into their portfolios.
- **Low coverage, low GAR**: Several banks report coverage below 20% and GAR stock below 1%, indicating early-stage implementation or limited disclosure scope.
- **Low coverage, high GAR**: No banks fall clearly into this category, underscoring that high GAR figures generally coincide with broader coverage.

This distribution highlights the importance of considering coverage alongside GAR stock when comparing institutions. A high GAR figure based on narrow coverage may overstate actual alignment.

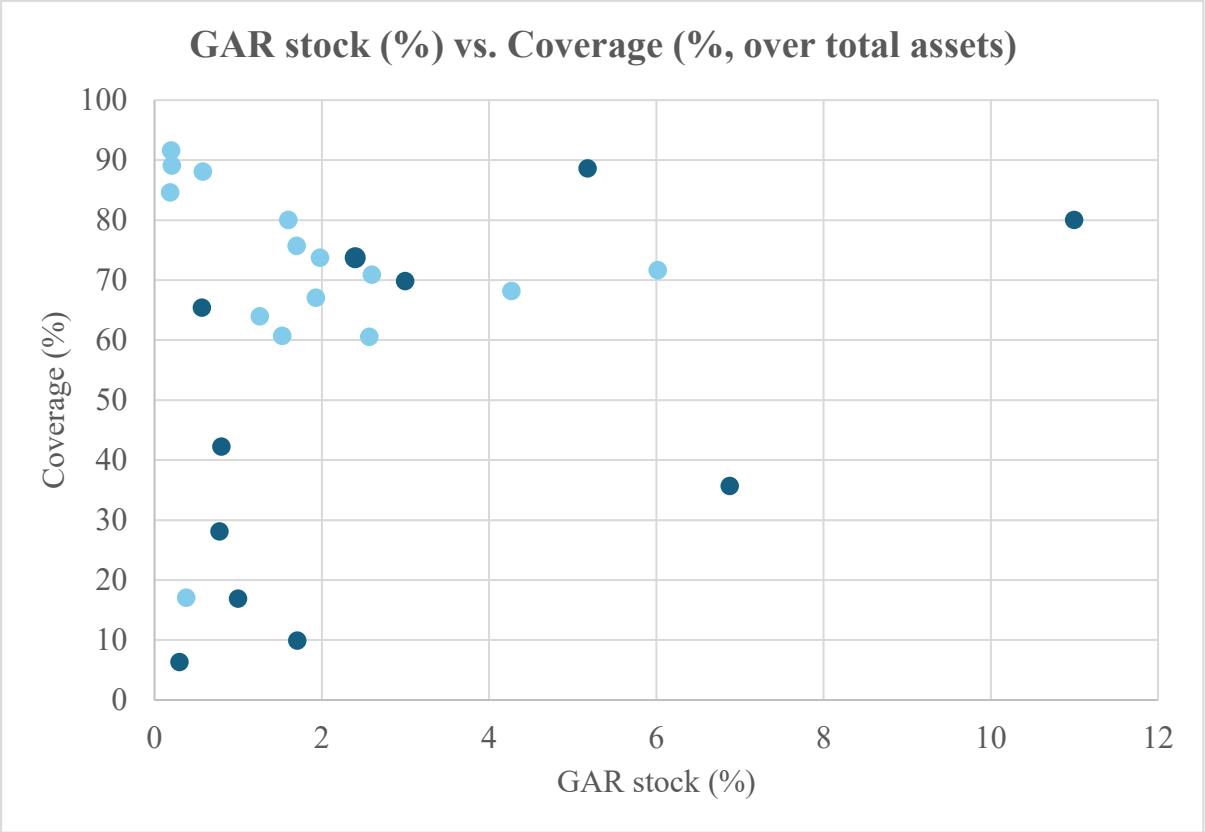

Figure 9: Relationship between Green Asset Ratio (GAR) stock (total %) and reporting coverage (over total assets)

The figure below ranks banks by GAR stock (total %) for climate change mitigation and adaptation. ABN AMRO leads with an exceptional GAR of approximately 11%, followed by ING (6.88%) and Bawag (6.02%). These institutions significantly outperform the sample median, which lies below 2%. Peer banks such as Eurobank, Piraeus Bank, and NBG report GAR values between 1% and 2.5%, reflecting moderate progress. At the lower end, major banks including Barclays, BBVA, and BNP Paribas report GAR stock below 1%, suggesting that green asset integration remains limited despite regulatory requirements.

This ranking reveals a pronounced gap between leaders and laggards. While a handful of banks exhibit strong performance, the majority remain below 2%, indicating that the sector is still in the early stages of transitioning toward sustainable portfolios. The disparity also suggests that GAR performance is influenced by strategic choices, client base composition, and the maturity of green financing products.

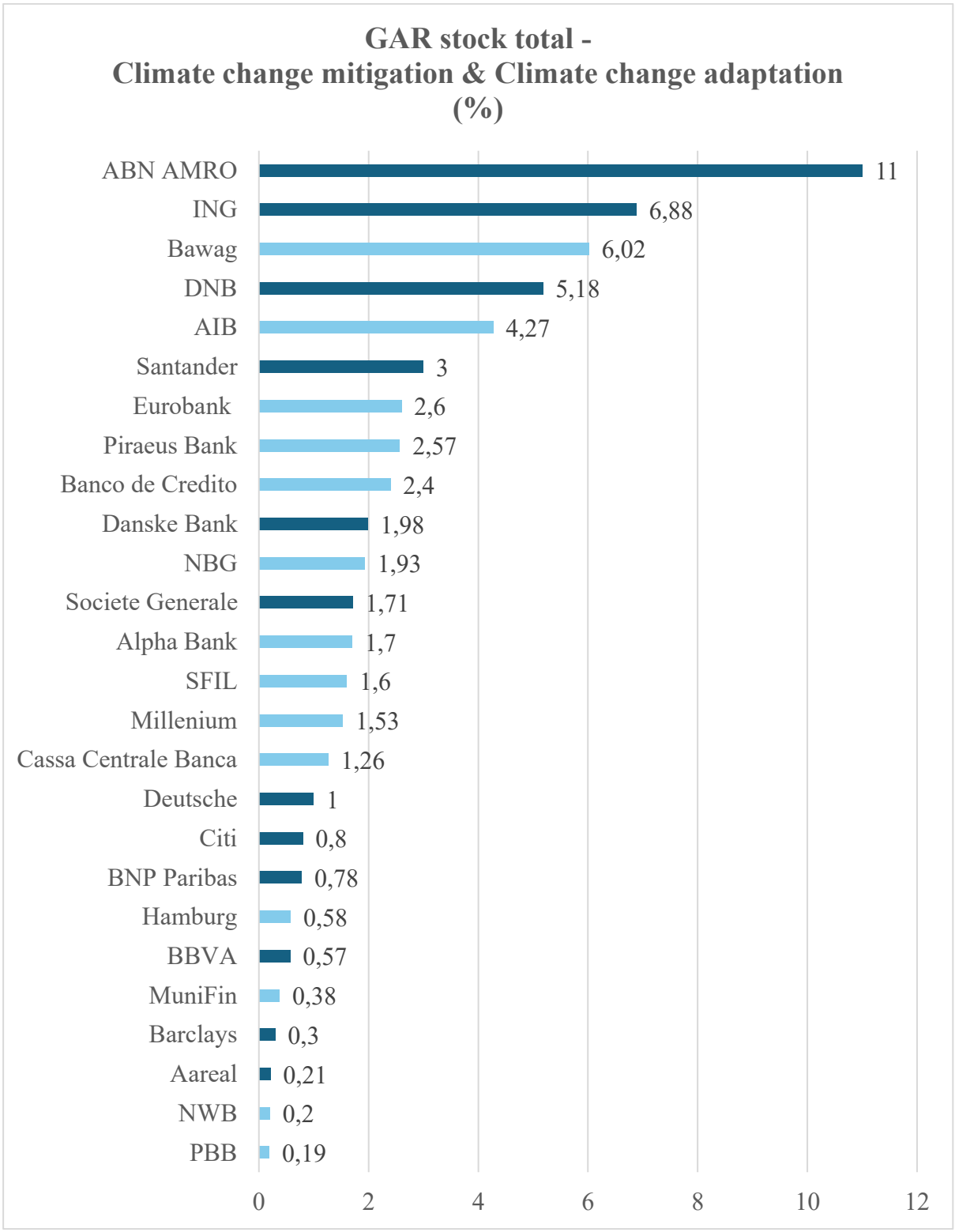

Figure 10:Ranked Green Asset Ratio (GAR) stock (total %) across the sample

Strategic and Regulatory Implications

The GAR analysis highlights two critical insights:

- **Coverage as a comparability factor**: GAR figures without coverage context can be misleading. A high GAR based on narrow coverage may overstate actual alignment. Regulators and investors increasingly emphasize coverage disclosure to ensure transparency and comparability.
- **Slow sectoral progress**: Despite regulatory pressure and market expectations, GAR levels remain low for most banks. This raises concerns about the pace of taxonomy integration and the ability of institutions to meet long-term decarbonization targets. Supervisory bodies such as the ECB have signaled that GAR will play a growing role in climate risk assessments and stress testing, making it a strategic priority for banks.

Overall, the GAR metric provides a valuable lens for assessing environmental alignment, but its interpretation requires careful consideration of coverage and methodological nuances. The observed patterns underscore the need for accelerated efforts to embed taxonomy-aligned assets into lending portfolios and for harmonized disclosure practices to enhance comparability across the sector.

3.4 Banks' Sustainable Finance Strategies and Targets

Banks' sustainable finance strategies are increasingly shaped by regulatory frameworks, investor expectations, and global climate commitments. These strategies often translate into quantitative targets, expressed as cumulative volumes of sustainable financing to be achieved by a specific year. Such targets serve as indicators of ambition and readiness to support the transition toward a low-carbon economy. The primary sources for these commitments are publicly available sustainability reports, annual statements, and ESG disclosures, ensuring transparency and comparability across institutions (ABN AMRO, 2024) (DNB, 2024) (Lloyds, 2024) (Barclays, 2024) (NatWest, 2023) (ING, 2024) (Deutsche Bank, 2024) (Santander, 2024) (BBVA, 2024) (Danske Bank, 2024) (Societe Generale, 2024) (Credit Suisse, 2022) (BNP Paribas , 2024) (HSBC, 2025) (Citi, 2025) (Eurobank, 2024) (Bawag, 2024) (MuniFin, 2024) (NWB, 2024) (Hamburg, 2024) (Banco de Credito, 2024) (Pfandbriefbank, 2024) (NBG, 2024)

(Millennium, 2024) (SFIL, 2024) (AIB, 2023) (Piraeus Bank, 2023) (Cassa Centrale Banca, 2023) (Aareal, 2024).

This section analyzes the scale and timing of sustainable finance targets across major and peer banks, using data normalized to euros for consistency. Two dimensions are critical:

- **Target Amount (€ billions)**: Reflects the financial volume committed to sustainable finance activities.
- **Target Year**: Indicates the time horizon for achieving these commitments, which influences strategic urgency and implementation pace.

The below graph shows significant variation in the scale of commitments among major banks. Global institutions such as Citi and HSBC lead with €920 billion each, targeting 2030 as the horizon for achieving these volumes. These long-term commitments align with global net-zero pathways and reflect their extensive international portfolios.

European universal banks—including BNP Paribas (€350 billion), Credit Suisse (€312 billion), and Societe Generale (€300 billion)—also set ambitious targets for 2030, signaling strong alignment with EU Taxonomy objectives. Mid-tier commitments are observed for Santander (€220 billion) and Deutsche Bank (€200 billion), while ING (€125 billion) adopts a shorter horizon (2025), indicating a more immediate focus on sustainable lending.

UK-based banks such as Barclays (€115 billion), NatWest (€115 billion), and Lloyds (€58 billion) exhibit moderate ambitions, with target years ranging from 2024 to 2025. At the lower end, DNB (€45 billion by 2030) and ABN AMRO (€4 billion by 2025) represent conservative strategies, likely reflecting regional market constraints.

Target Year Interpretation:

- 2030 targets dominate among global and large European banks, suggesting a strategic alignment with long-term climate neutrality goals.
- Shorter-term targets (2024–2025) are common among UK banks and ING, indicating tactical approaches focused on near-term delivery.

- This divergence highlights differences in strategic planning horizons, with global banks emphasizing transformational change and regional banks prioritizing incremental progress.

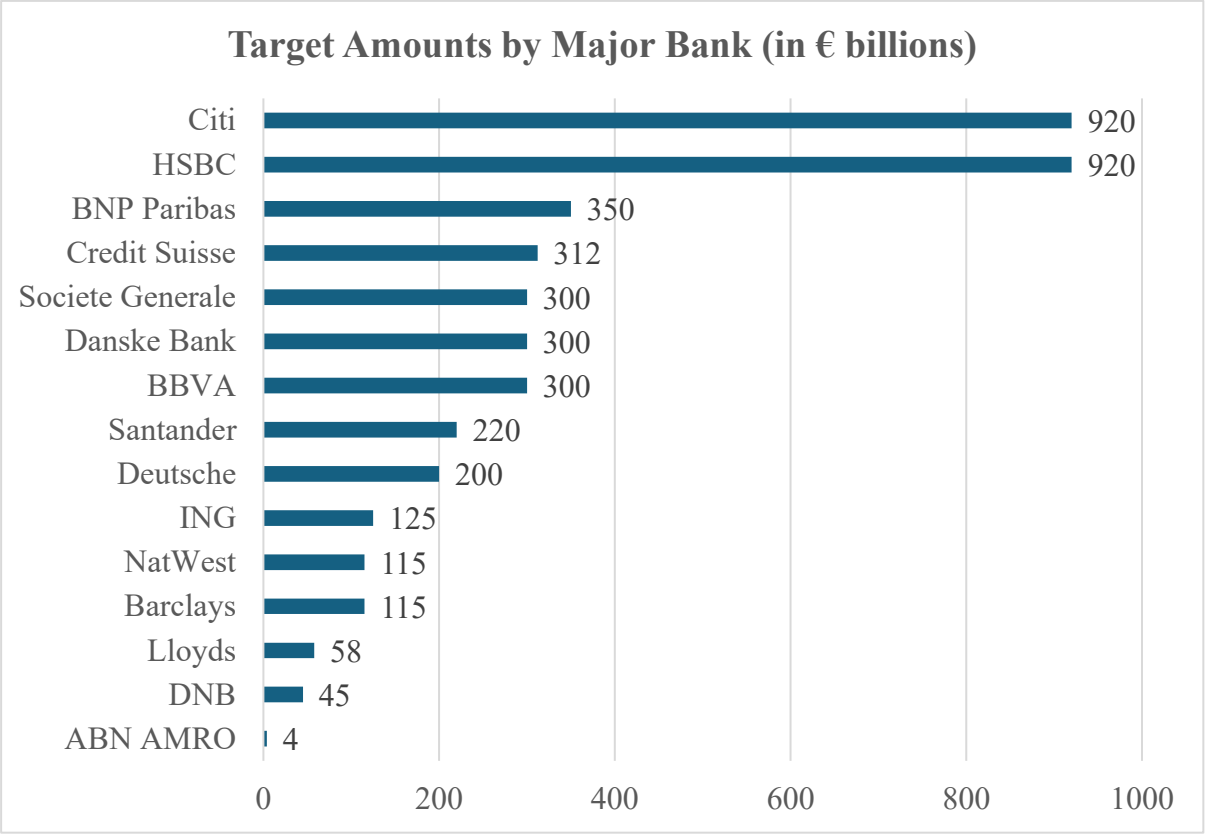

Figure 11: Sustainable finance target amounts by major bank (in € billions)

Peer banks display significantly smaller commitments, typically between €2 billion and €10 billion. AIB and NWB lead with €10 billion each, targeting 2030, which mirrors the long-term orientation of larger institutions despite their smaller scale. Greek banks—Piraeus (€7 billion), Eurobank (€5 billion), and NBG (€5 billion)—cluster around mid-range targets with shorter horizons (2025–2026), reflecting national transition priorities and regulatory timelines.

Specialized lenders such as Aareal (€4 billion), PBB (€3 billion), and Hamburg Commercial Bank (€3 billion) focus on green real estate and infrastructure financing, consistent with their business models. Cooperative and municipal banks, including Cassa Centrale Banca (€2 billion) and Kuntarahoitus (€2 billion), set modest goals for 2025, underscoring scale limitations.

Target Year Interpretation:

- Most peer banks adopt short-term horizons (2025–2026), suggesting tactical compliance rather than transformational strategies.
- Exceptions like AIB and NWB (2030) indicate selective alignment with long-term climate objectives.

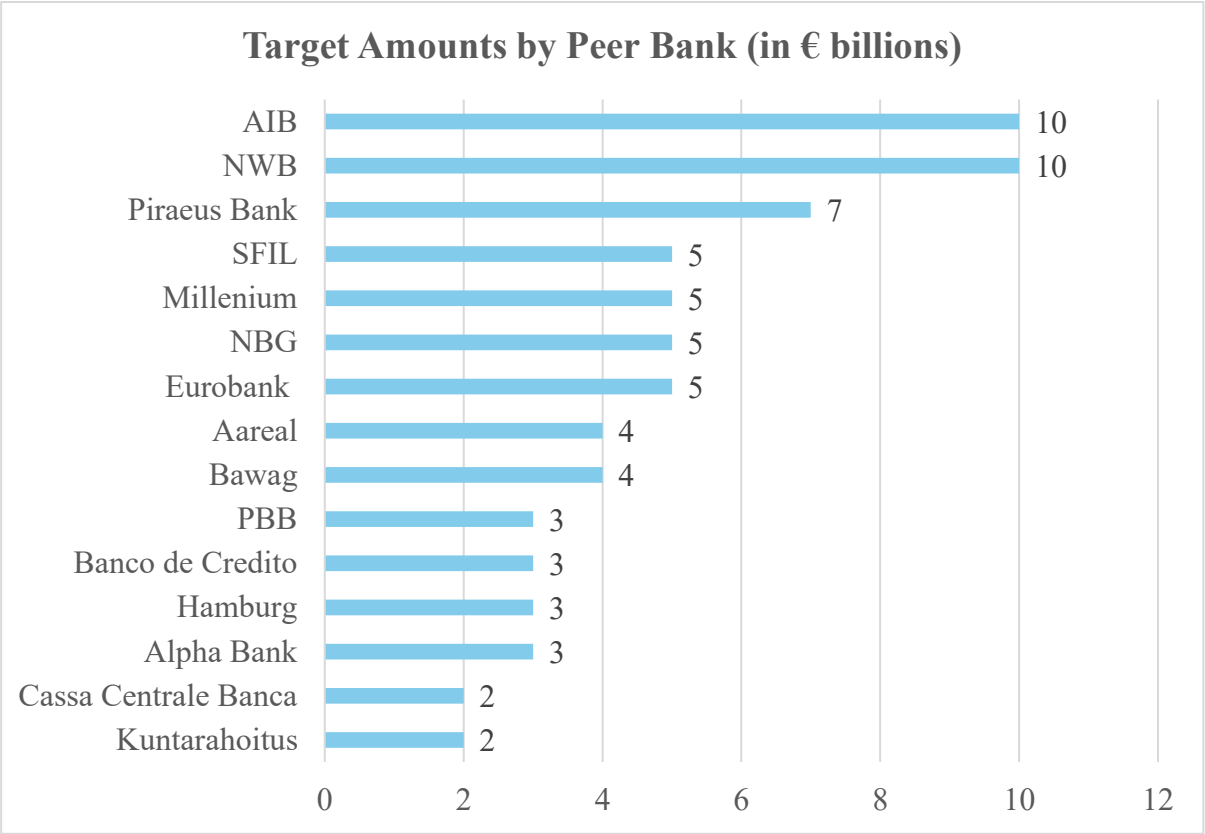

Figure 12: Sustainable finance target amounts by peer bank (in € billions)

The analysis reveals two critical insights:

1. **Scale and Horizon Disparity**: Major banks commit hundreds of billions with long-term horizons, while peer banks set modest, short-term goals. This reflects structural differences in balance sheet capacity and strategic positioning.
2. **Regulatory and Market Drivers**: Longer horizons align with EU climate neutrality targets and investor expectations, while shorter horizons may reflect immediate regulatory compliance or domestic market constraints.

From a supervisory perspective, these commitments will increasingly influence climate risk assessments under the ECB's guidelines and stress testing frameworks. For banks, the challenge lies not only in meeting these targets but also in ensuring that financed activities genuinely contribute to the transition objectives defined by the EU Taxonomy.

CHAPTER 4: ECONOMETRIC FORECASTING ANALYSIS OF SUSTAINABLE FINANCE METRICS

This chapter presents a detailed econometric analysis aiming to forecast the evolution of a key sustainable finance indicator for European banks over the period 2025–2029. The analysis focuses on the Green Asset Ratio (GAR), defined as the proportion of a bank's balance-sheet assets that qualify as taxonomy-aligned green exposures. The GAR is selected as the central metric because it provides a standardized and comparable measure of the financial sector's contribution to environmentally sustainable economic activities. The dataset used for the analysis consists of the information compiled in the preceding chapters, which includes 2024 baseline GAR disclosures and a set of relevant bank-specific characteristics for 26 EU institutions, complemented by insights drawn from publicly available regulatory and supervisory documentation.

The analysis includes:

- A description of the data's nature and quality, and justification for selecting GAR as the forecast variable.
- A thorough explanation of the methodology and model used (including terminology from time-series econometrics and regression analysis).
- Clarification of the model's assumptions.
- Presentation of the forecast results (in both tabular and graphical form).
- Interpretation of the results and discussion of their reliability.
- An overview of the limitations of the analysis and suggestions for future research.

4.1 Data Description and Variable Selection

Dataset characteristics

The primary data source is a cross-sectional dataset of 26 European banks, largely drawn from year-end 2023 disclosures (reported in early 2024). Each bank entry includes its reported Green Asset Ratio (GAR) under the new Pillar 3 ESG disclosure requirements, along with various contextual variables, e.g., whether the bank has a comprehensive Sustainable Finance

Framework, membership in the Net-Zero Banking Alliance, sustainable finance target amounts, taxonomy eligibility coverage, etc. Notably, this data is not a time series – it represents a single snapshot in time for each bank (the first year of GAR disclosure). For our forecasting purpose, this poses a challenge: we have very limited historical observations of the metric itself. In fact, banks were not required to publish GARs until 2024, so there is essentially one official data point per bank for alignment (2024).

Quality and scope of data

The GAR figures reported in 2024 are considered high-quality in terms of being audited, harmonized metrics, but they come with methodological constraints. By design, GAR calculations exclude certain asset categories (trading book, sovereign exposures, interbank loans) and cannot count others as green (e.g., loans to SMEs and non-EU clients are ineligible for the numerator). These structural features mean that even a bank heavily financing renewable energy might still show a modest GAR if much of its balance sheet is outside the scope. For the analysis, this implies that the absolute level of GAR is limited by definition, and comparisons or projections must account for potential changes in methodology over time. The data's breadth (26 banks) is sufficient for cross-sectional analysis, but for time projection the analysis relies on industry-level aggregates and trends rather than bank-specific time series.

Choice of forecast variable – GAR

The Green Asset Ratio is selected as the target variable for forecasting because it condenses the outcome of banks' sustainable finance activities into a single, comparable metric. The ratio increases when institutions expand their green lending or investment portfolios, or when a greater share of assets becomes taxonomy-aligned, either through shifts in portfolio composition or through the progressive enlargement of the EU Taxonomy scope. As a regulatory indicator closely monitored by supervisory authorities and market participants, the GAR provides a meaningful measure of the financial sector's contribution to the economic transition and aligns directly with the overarching objective of assessing banks' support for sustainable development.

Moreover, external benchmarks exist. For instance, a 2021 EBA pilot exercise estimated an EU-wide average GAR of 7.9% (using a top-down model on a sample of 29 banks), providing a reference point for what "full alignment" might look like. As of the 2024 disclosures, however,

observed GARs are much lower. An Accenture analysis of 50 banks' first disclosures found an average GAR of only ~2.06%. The thesis' sample of 26 banks is consistent with this, with a mean around 2–3% (median ~1.7%). This starkly low baseline underscores why forecasting future GAR is interesting – it will reflect how quickly banks might ramp up their green financing.

4.2 Methodology and Model Selection

Econometric approach

A hybrid forecasting methodology is adopted, integrating elements of time-series analysis with cross-sectional benchmarking. The industry-wide trajectory of the Green Asset Ratio is derived through a time-series extrapolation approach, interpreting the limited historical observations within the broader context of evolving regulatory and policy developments. To inform the assumed growth rate, the analysis incorporates cross-sectional evidence and external reference points, such as publicly stated bank-level commitments to expand green financing and indicative regulatory estimates, including the European Banking Authority's initial benchmark of 7.9%.

Consideration of models

The application of a traditional ARIMA (AutoRegressive Integrated Moving Average) time-series model is not feasible due to the absence of a sufficiently long historical data series. ARIMA-type models generally require a substantial number of observations to estimate parameters reliably, or at minimum a discernible pattern—such as a stable trend or seasonality—based on several data points. In the case of the Green Asset Ratio, historical annual values are essentially unavailable, preventing the use of ARIMA or any of its simplified variants.

Alternative smoothing techniques, including exponential smoothing and Holt's linear trend method, were also assessed. These approaches can function with limited data by imposing structural assumptions on the level and trend components. However, given the lack of historical observations, the initial trend would necessarily rely on an arbitrary assumption. Under such conditions, the output of a smoothing algorithm would be practically indistinguishable from a

manually imposed linear projection. For reasons of methodological transparency, the analysis therefore employs a straightforward linear trend extrapolation.

Multiple linear regression provides meaningful insights in a cross-sectional context—such as explaining differences in 2024 GAR values across banks based on institutional characteristics—but it does not independently generate time-series forecasts. Nonetheless, the regression results offer important qualitative information: no bank-specific characteristic examined in the earlier analysis exhibited a statistically significant relationship with the 2024 GAR. This absence of significant predictors suggests that, at the current stage of regulatory implementation, the presence of strong sustainability frameworks does not yet translate into higher GAR values. Consequently, the projected evolution of the GAR is treated as primarily driven by system-level forces, including regulatory developments and macro-economic shifts, rather than by institution-specific factors. This justifies the adoption of a unified industry-wide trend rather than constructing separate forecasts for each bank.

Given these considerations, the model for the average GAR is a simple linear growth model:

$$\mathbf{GAR}_t = \mathbf{GAR}_{t-1} + \boldsymbol{\Delta},$$

where Δ is an assumed constant annual increase (in percentage points). The calibration of Δ is based on:

- **Recent momentum:** Recent developments in sustainable finance indicate that, although the Green Asset Ratio has only recently begun to be disclosed, European banks have already exhibited a gradual increase in green financing activity. The proportion of taxonomy-eligible assets—representing a broader category than taxonomy-aligned exposures—was in the range of 20–50% for many large institutions as early as 2021, while the aligned share remained close to 2% in 2024. As institutions progressively convert eligible assets into aligned assets, for example by ensuring compliance with technical screening criteria for green building loans, a moderate acceleration in the GAR is expected. The analysis assumes an initial annual increase of approximately 0.7–1.0 percentage points (Δ), implying that the absolute value of the GAR will rise by roughly one point per year. This is consistent with the view that, starting from a baseline of about 2% in 2024, an additional 1% of balance-sheet assets could be allocated to green

financing annually, leading to a gradual doubling of green exposures over the medium term.

- **Policy signals:** Policy developments are expected to play a significant role in shaping the future trajectory of the GAR. The EU regulatory roadmap foresees that, from 2025 onward, banks will need to report alignment with additional environmental objectives beyond climate mitigation and adaptation, such as biodiversity and circular economy considerations. This expansion has the potential to increase the numerator of the ratio by allowing a broader range of activities to qualify as green. However, the concurrent requirement to report certain components of the trading book may introduce a substantial volume of assets with low or zero alignment, thereby increasing the denominator and exerting downward pressure on the GAR. As a result, the net policy effect remains uncertain. For modelling purposes, the projection assumes that these opposing forces broadly offset one another, producing a stable linear trend without pronounced discontinuities. Nonetheless, it is acknowledged that actual outcomes may diverge, particularly if new sectors are incorporated into the taxonomy—potentially increasing the GAR—or if additional exposures with very low alignment come into scope, which could temporarily reduce it.
- **Banks' targets:** Sustainable finance commitments publicly announced by European banks provide an additional perspective on plausible GAR trajectories. Many institutions in the sample have set green financing targets for 2030 amounting to several hundred billion euros. When translated into balance-sheet implications, such commitments typically correspond to implied GAR levels in the range of 5–10% by the end of the decade, depending on the institution's size and strategic orientation. The linear growth scenario applied in the analysis, which results in an estimated GAR of approximately 7% by 2029, is broadly consistent with this range while adopting a conservative interpretation of banks' ability to fulfil their commitments. Although individual targets are not modelled explicitly, they inform the chosen annual increment by supporting expectations of steady, moderate growth rather than stagnation or rapid acceleration.

Terminology and model details

The industry-average Green Asset Ratio for each year is treated as the time series of interest. Given that the projection specifies only a deterministic trend without cyclical components, the resulting model is equivalent in time-series terms to an ARIMA(0,1,0) specification with drift, where ARIMA(0,1,0) represents a random walk with no autoregressive or moving-average structure, and the drift term corresponds to the fixed annual increment Δ.

Considerations regarding stationarity are addressed as follows: although the GAR is theoretically bounded between 0% and 100%, the forecasted values—rising from approximately 2% to around 7%—remain sufficiently distant from these bounds, making potential non-stationarity or boundary violations irrelevant within the analysed range.

The model also assumes the absence of mean reversion, an assumption justified by the very low initial level of the GAR and the structural nature of its expected growth, which is driven by regulatory implementation rather than by fluctuations around a historical long-run mean. Standard statistical tests for unit roots, such as the Augmented Dickey–Fuller (ADF) test, cannot be applied meaningfully due to the scarcity of historical observations; with effectively a single time point, such diagnostics are not applicable.

Use of external data

To complement the limited time-series information, external benchmarks are incorporated to validate the plausibility of the assumed drift term. The European Banking Authority's pilot exercise, which produced a theoretical starting GAR of 7.9%, provides an indicative upper bound reflecting what could be achievable under idealised conditions with complete data and broad methodological coverage. Although actual reported GAR values remained far below this level by 2024, the pilot results nonetheless suggest that medium-term values in the 7–8% range are not unrealistic in the context of expanding taxonomy criteria and increasing green financing activity.

Additional insights are drawn from banks' previous disclosures on the proportion of taxonomy-eligible assets. These disclosures allow an assessment of potential headroom; for example, a bank reporting 30% taxonomy-eligible exposures implies a theoretical maximum GAR of 30% should all eligible assets become aligned. Such observations support the view that

a projected GAR of approximately 7% within five years remains conservative, as it represents only a partial conversion of eligible assets into fully aligned exposures.

Broader macroeconomic trends are also considered, particularly expectations of rising EU-wide green investment as a share of GDP, which is likely to feed into bank lending portfolios over time. However, macroeconomic variables are not modelled explicitly due to the substantial uncertainty and the difficulty of establishing a robust causal linkage between macro indicators and the GAR.

4.3 Model Assumptions

The forecasting model relies on several key assumptions, which are outlined explicitly below:

- **Linearity:** The projection assumes that the industry-average Green Asset Ratio increases in an approximately linear manner over the forecast horizon. This simplification is adopted in the absence of empirical evidence supporting a non-linear trajectory. In practice, GAR dynamics may deviate from linearity; early years could exhibit slower growth followed by acceleration, or the opposite pattern might occur. Alternative shapes—such as S-curves reflecting gradual adoption phases or stepwise movements triggered by regulatory changes—remain plausible. Nonetheless, linearity provides a transparent and tractable baseline for the modelling exercise.
- **Absence of major shocks:** The forecast does not incorporate macroeconomic shocks, financial crises, or abrupt policy disruptions. Events such as recessions could reduce overall lending volumes—affecting the denominator of the GAR—or temporarily shift institutional priorities away from green activities. Conversely, significant legislative initiatives or rapid escalations in climate-related policies could accelerate the expansion of green financing. The projection therefore reflects a business-as-usual scenario, corresponding to a baseline case in standard scenario-analysis terminology.

- **Stability of the regulatory framework:** The model incorporates known regulatory developments, including the expansion of environmental objectives and the inclusion of elements of the trading book in GAR calculations from 2025 onward. Beyond these anticipated changes, the forecast assumes no substantial deviations in regulatory design. Material alterations—such as broadening the set of eligible activities, significantly

easing or tightening technical criteria, or rapidly expanding the scope of the Taxonomy—could lead to outcomes that diverge from the projected linear path. The assumption of regulatory stability reflects the expectation that future changes will be evolutionary rather than abrupt.

- **Industry-wide averaging:** The analysis focuses on the industry average, implicitly assuming that the collective trajectory is representative of the overall sector. In practice, individual institutions may differ considerably: some banks have already reached higher GAR levels and are expected to continue progressing rapidly, while others remain at very early stages. However, given the low initial baseline across the sector, leading institutions still anticipate further increases, and lagging institutions are likely to face supervisory and market pressures to improve. These dynamics suggest that divergences may partially offset each other, making the average a reasonable proxy for the sector's general direction.

- **Ceteris paribus treatment of the denominator:** The GAR's denominator—total assets within the reporting scope—may evolve over time as a result of balance-sheet growth, mergers, divestments, and strategic shifts. The model abstracts from such complexities by projecting the ratio directly rather than separately forecasting its numerator and denominator. This implies that any growth in total assets is matched by proportionate growth in green exposures, in addition to the assumed annual increment. Although this assumption may not hold if banks expand aggressively in areas with limited potential for taxonomy alignment, available information does not allow for a reliable modelling of such institution-specific structural changes. The simplified approach therefore treats denominator dynamics as broadly neutral.

With the methodology and underlying assumptions defined, the next section presents the results of the forecast.

4.4 Forecast Results: 2025–2029 Trajectory

Applying the described modelling framework produces the forecasted trajectory for the average Green Asset Ratio (GAR) of European banks over the period 2024–2029. The projected values

indicate a substantial relative increase, with the GAR approximately tripling from its 2024 baseline by 2029.

Despite this significant proportional rise, the ratio remains in the single-digit range throughout the forecast horizon, implying that even by 2029 the vast majority of banking assets—around 93% on average—would remain non-aligned with the EU Taxonomy under this scenario.

Year	Projected Average GAR (%)	Annual Increase (Δ in pp)
2024	**2.1** (baseline)	–
2025	3.0	+0.9
2026	4.0	+1.0
2027	5.0	+1.0
2028	6.0	+1.0
2029	**7.0**	+1.0

Figure 13: Forecasted average Green Asset Ratio (GAR) for EU banks, 2024-2029

To illustrate the evolution of the projected path, the corresponding visualization depicts a smooth linear increase consistent with the model's assumptions. No pronounced discontinuities or abrupt jumps appear in any specific year; instead, each successive period adds a comparable incremental increase, resulting in a steady upward trend over the five-year horizon.

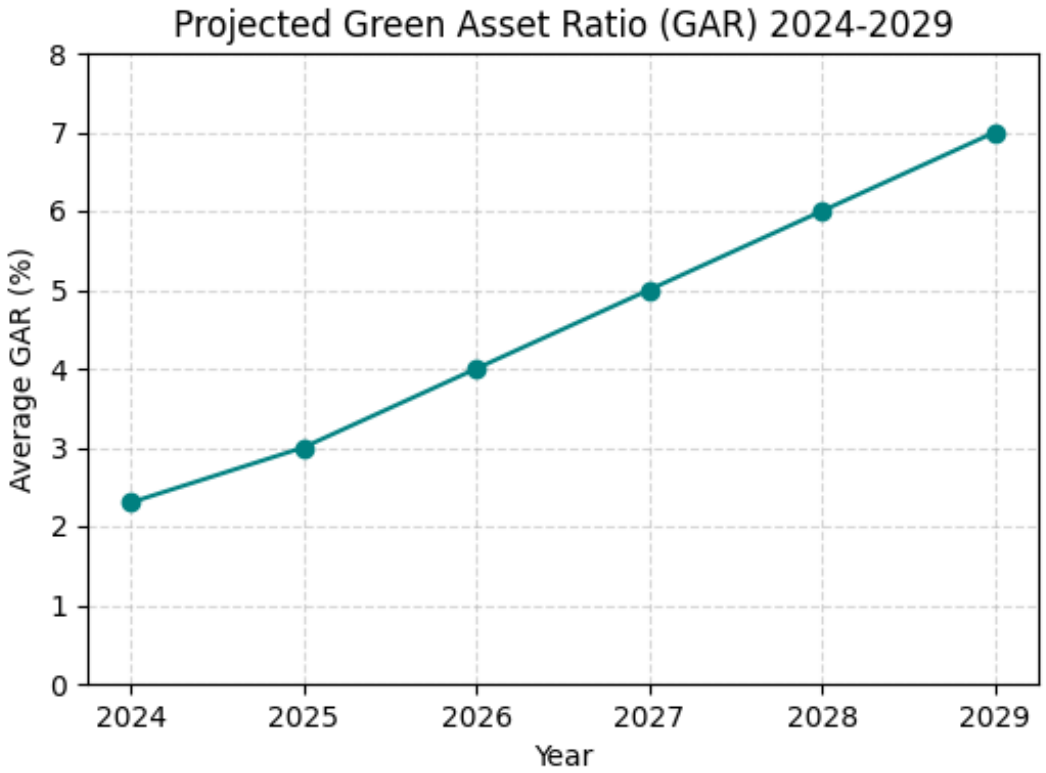

Figure 14: Projected Green Asset Ratio (GAR) for EU Banks (2024-2029).

Cross-check with external benchmarks

A useful validation check for the forecast is provided through comparison with external benchmarks. The projected industry-average GAR of approximately 7% by 2029 is notably close to the European Banking Authority's theoretical estimate of 7.9% derived in its 2021 pilot exercise. One interpretation of this alignment is that the level initially presented by the EBA as a hypothetical "starting point"—assuming full data availability and complete methodological application—may instead represent a level attainable only after nearly a decade of implementation efforts. This comparison underscores the gradual nature of taxonomy adoption and suggests that the forecast is not overly optimistic; it effectively posits that banks will reach by 2029 a level that early modelling exercises had considered theoretically achievable much earlier. Given the stringency of taxonomy criteria and the operational challenges associated with meeting them, achieving an industry-average GAR of around 7% by 2029 would constitute a meaningful advancement.

Further cross-checking can be performed using observed variation within the sample. A small number of leading institutions reported GAR values close to 5% in 2024. If the industry average reaches approximately 7% by 2029, the distribution of outcomes would likely place these leading banks in the vicinity of 15%, while institutions currently at very low levels may reach values in the range of 3–5%. Such a distribution is plausible and reflects underlying business-model differences: institutions with substantial mortgage portfolios may achieve higher GAR levels due to the potential for energy-efficient building loans to qualify as aligned, whereas institutions with capital-markets-focused balance sheets may continue to exhibit lower alignment. This heterogeneity supports the reasonableness of the projected industry-average trajectory.

Conclusion

In conclusion, the econometric forecast of the GAR for European banks over 2025–2029 indicates a trajectory of significant growth from a very low base, carrying important implications for the banking sector's sustainability transition. Under the baseline scenario developed in this chapter, the average GAR approximately triples from about 2% in 2024 to ~7% by 2029, implying that banks' green financing activities could expand substantially over five years. This projected level of ~7% is notably in line with external benchmarks: it approaches the 7.9% GAR that the European Banking Authority's 2021 pilot exercise identified as a theoretical full-alignment scenario. Likewise, the starting point of ~2% accords with industry analyses such as Accenture's finding of an average ~2.06% GAR in initial disclosures, underscoring the significant gap that must be closed. Together, these comparisons suggest that the forecast is plausible and perhaps conservative – essentially positing that banks will reach by 2029 a level of green asset alignment that early studies treated as an optimistic starting benchmark.

This dual outcome conveys a nuanced message. On one hand, tangible progress is expected: tripling the share of green assets in five years reflects a rapid scaling-up of sustainable finance activities, consistent with banks mobilizing to meet their public commitments and with the policy push for greening the financial system. On the other hand, the absolute level remains modest, implying that there is still a long journey ahead to fully integrate sustainability into bank lending portfolios. From a policy and industry perspective, this means that while recent initiatives (frameworks, alliances, disclosure mandates) are likely to yield measurable

improvements, much greater efforts will be required beyond 2029 to approach the levels of green financing needed for climate objectives.

CHAPTER 5: TOWARDS NET ZERO – BANKS' COMMITMENTS AND CHALLENGES

5.1 Linking Sustainable Finance to Climate Goals

The transition to a low-carbon economy has positioned banks as key actors in achieving climate objectives. While sustainable finance encompasses a broad range of ESG issues, addressing climate change has become a central priority. This is because banks, through their lending and investment portfolios, finance a significant share of economic activity—thus directly influencing the carbon emissions of the real economy. Notably, more than 95% of many banks' carbon footprint comes from the indirect emissions of their portfolios (financed emissions), a figure hundreds of times greater than their operational emissions (Asuncion, 2025). According to the PCAF standard, a bank's financed emissions can be up to 700 times its own operational emissions. Therefore, to limit global warming in line with the Paris Agreement, it is critical for banks to redirect lending flows toward sustainable activities and gradually disengage from carbon-intensive industries (CDP, 2021).

The link between sustainable finance and climate goals is reflected in banks' commitment to "Net Zero" by 2050. This term refers to achieving a balance of greenhouse gas emissions—offsetting or eliminating emissions to reach zero net impact. For banks, this means that by 2050 they must eliminate emissions arising not only from their own operations but primarily from the loans and investments they finance. This ambitious target aligns with 1.5°C scenarios (the upper limit for global temperature increase). This development has led to the creation of specialized tools and standards: for example, the GHG Protocol (Scope 3) and the PCAF standard provide methodologies for banks to accurately measure financed emissions. Additionally, initiatives such as the Science-Based Targets initiative (SBTi) help financial institutions align their goals with the latest climate science. Overall, sustainable banking practice is now inseparably linked to climate action: banks must act not only as financiers of the green transition but also as guardians ensuring that economic growth goes hand in hand with a drastic reduction in emissions (PCAF, 2025).

5.2 The Net-Zero Banking Alliance and Banks' Climate Commitments

To collectively support the transition to net-zero emissions, more than 130 banks worldwide participate in international alliances under the auspices of the United Nations. The most significant of these is the Net-Zero Banking Alliance (NZBA), launched in April 2021 with 43 founding banks, membership has more than tripled to **144 institutions**, representing over 40% of global banking assets. The NZBA operates within the Glasgow Financial Alliance for Net Zero (GFANZ), consolidating the financial sector's climate commitments in line with COP26 goals. Through this alliance, banks agree to a common set of principles and obligations to achieve net-zero by 2050.

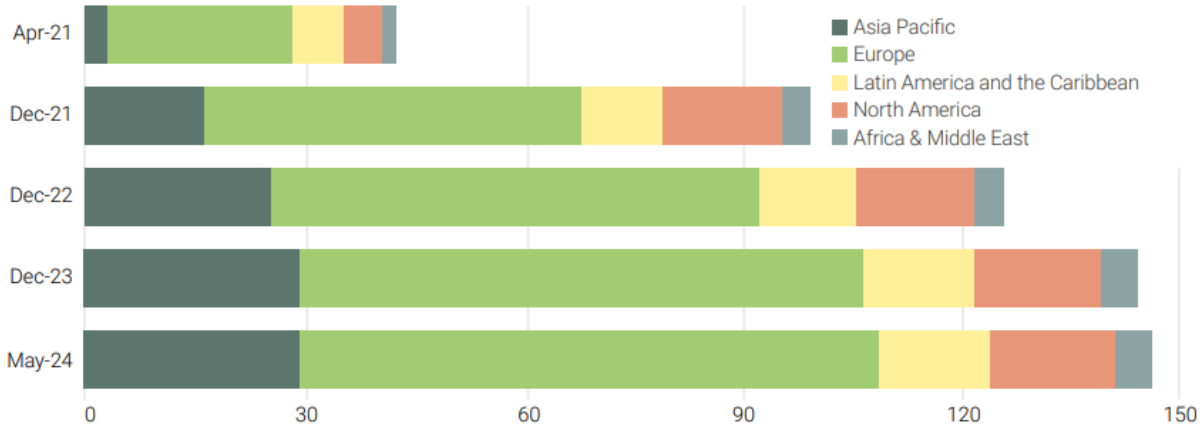

Figure 15: Growth in number of NZBA members by region from 2021–2024

Specifically, each bank joining NZBA commits to:

- **Portfolio alignment with Net Zero by 2050:** Transitioning operational and financed emissions toward zero by 2050, consistent with 1.5°C scenarios.
- **Setting interim targets for 2030:** Within 18 months of joining, establishing sector-specific emission reduction targets for 2030, with further targets every five years. Initial targets focus on the most carbon-intensive sectors (e.g., energy, transport, industry).
- **Coverage of all major sectors:** Within 36 months, extending target-setting to all—or the vast majority—of high-emission sectors such as oil and gas, power generation, metals, and construction.

- **Client engagement in the transition:** Committing to achieve targets through active collaboration with borrowers, helping them adapt their business models rather than abruptly cutting financing.
- **Transparency and accountability:** Annual disclosure of emissions (absolute and intensity) and progress toward targets, supported by a board-approved transition strategy. Progress reports are subject to review, and targets are updated based on the latest science.
- **Limited use of offsets:** While some offsetting is allowed, NZBA prioritizes real emission reductions over offsets, especially for mid-term targets (Net-Zero Banking Alliance, 2024).

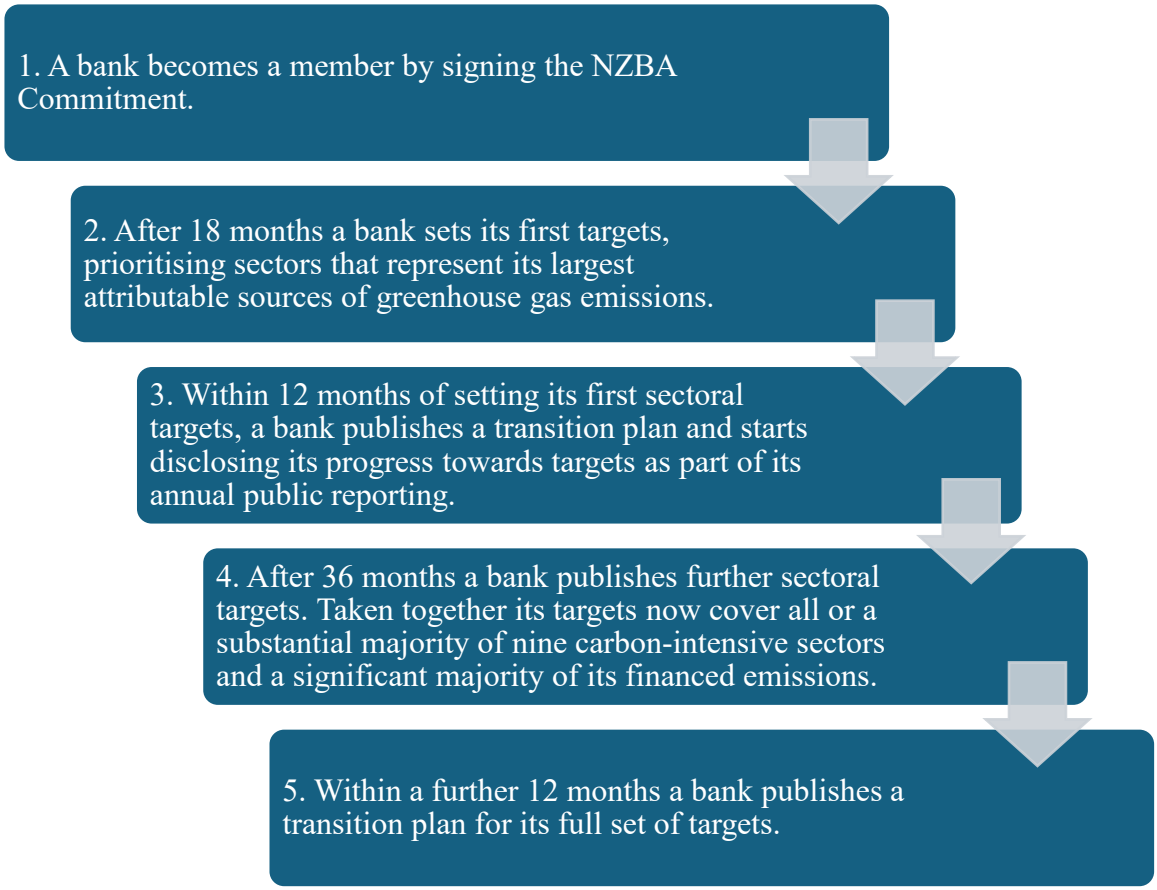

Figure 16: Key milestones for banks making NZBA commitments

These principles make NZBA a framework for accountability. Participation enhances the credibility of a bank's climate commitments, as it comes with a clear roadmap. All systemic Greek banks have responded: Alpha Bank was the first to join (June 2023), followed by

National Bank of Greece (November 2023) and Eurobank (June 2024) (Alpha Bank, Commitment to net zero greenhouse gas emissions by 2050, 2023) (National Bank of Greece, 2023) (Eurobank, Eurobank Holdings Joins UN-Convened Net-Zero Banking Alliance, 2024). Piraeus Bank, although not officially a member by 2025, has published its own Sustainability Blueprint, including a net-zero commitment by 2050 and science-based targets validated by SBTi for 2030 (Piraeus Bank, Piraeus Sustainability Blueprint, 2025).

These commitments are not mere declarations but are being translated into measurable targets and actions. For example, NBG disclosed specific 2030 reduction targets for six high-carbon sectors in its 2022 ESG Report, while Eurobank began internal work on defining its first generation of financed emissions targets in 2024. Implementation relies on portfolio analysis tools and carbon accounting standards such as PCAF, though data collection remains a challenge, as many clients lack verified emissions data.

Through NZBA and related initiatives, the banking system is setting a common course toward climate neutrality. European banks in our sample are also aligned: many large institutions (e.g., HSBC, BNP Paribas, Santander) joined NZBA at its inception in 2021. Thus, most European banks have now adopted net-zero targets for 2050, either through NZBA membership or via independently validated commitments.

5.3 Challenges on the Path to Net Zero for Banks

Although the direction is clear, the journey toward net zero is fraught with challenges:

- **Conflict between climate goals and traditional business models:** Commitments require banks to reallocate capital away from carbon-intensive activities, which historically formed a significant part of loan portfolios and revenues. This creates tension between environmental ambition and short-term profitability.
- **Data availability and measurability:** Reliable measurement of financed emissions remains a technical challenge, especially for SMEs and emerging market clients. Banks often rely on estimates or sector averages, reducing accuracy.
- **Meeting interim targets under time pressure:** The 2030 milestones demand rapid portfolio shifts, increased green financing, and withdrawal from fossil fuel projects—all amid market volatility and economic uncertainty.

- **Regulatory and compliance costs:** Supervisory authorities, particularly in Europe, are tightening climate-related requirements, adding complexity and cost to banks' operations.

Despite these obstacles, leading banks may gain long-term competitive advantages by developing expertise in green finance, safeguarding portfolios against climate risks, and building a strong reputation as responsible institutions. The ultimate challenge is to balance immediate pressures with strategic transformation to thrive in a climate-neutral economy.

CHAPTER 6: EMPIRICAL ANALYSIS OF NET-ZERO COMMITMENTS

This chapter presents the empirical investigation into the adoption and implementation of net-zero commitments by European banks, with a particular focus on the sample of systemic institutions analyzed in previous sections. The analysis aims to assess the extent to which these banks have operationalized their pledges, the sectors prioritized for decarbonization, and the progress achieved toward interim and long-term emission reduction targets. Furthermore, it examines the exposure to high-emission sectors and the associated financed emissions, drawing on publicly available disclosures and regulatory reporting frameworks.

6.1 Adoption of Net-Zero Targets (2019 onwards)

The first section evaluates the evolution of net-zero commitments among European banks from 2019 onwards, marking the period when such pledges began to gain traction following the launch of global initiatives like the Net-Zero Banking Alliance (NZBA). The analysis considers the adoption patterns within the selected sample of banks. Particular attention is given to identifying institutions that have subsequently withdrawn or diluted their commitments, as this provides insight into the durability and credibility of these pledges. This assessment establishes the baseline for understanding the degree of alignment between the banking sector and the objectives of the European Green Deal and the Paris Agreement.

Status of Commitments Across Banks

The empirical evidence indicates that a majority of banks have embraced net-zero targets, albeit with notable variation between major institutions and their peers. As illustrated in the below figure, approximately 57% of banks in the sample maintain active net-zero commitments, with major banks demonstrating a higher adoption rate (67%) compared to peer banks (47%). This disparity suggests that larger institutions, often subject to more intense regulatory scrutiny and investor pressure, are more proactive in aligning with climate transition objectives.

However, the data also reveal a significant proportion of banks that remain outside the net-zero framework. More than half of peer banks (53%) have not adopted any formal commitment, whereas only 7% of major banks fall into this category. This uneven engagement underscores

the persistence of structural and strategic differences within the sector, particularly in relation to resource capacity and perceived materiality of climate-related risks.

Attrition and Exits

A critical finding is the emergence of attrition among committed banks. The figure below shows that 27% of major banks have exited NZBA, compared to 13% of peer banks, signaling that even institutions with strong initial commitments face challenges in sustaining these pledges. The reasons for withdrawal are multifaceted, ranging from methodological disagreements over target-setting to concerns about legal liability and competitive positioning. This trend raises important questions about the robustness of voluntary alliances and the extent to which they can drive systemic change without binding regulatory mandates.

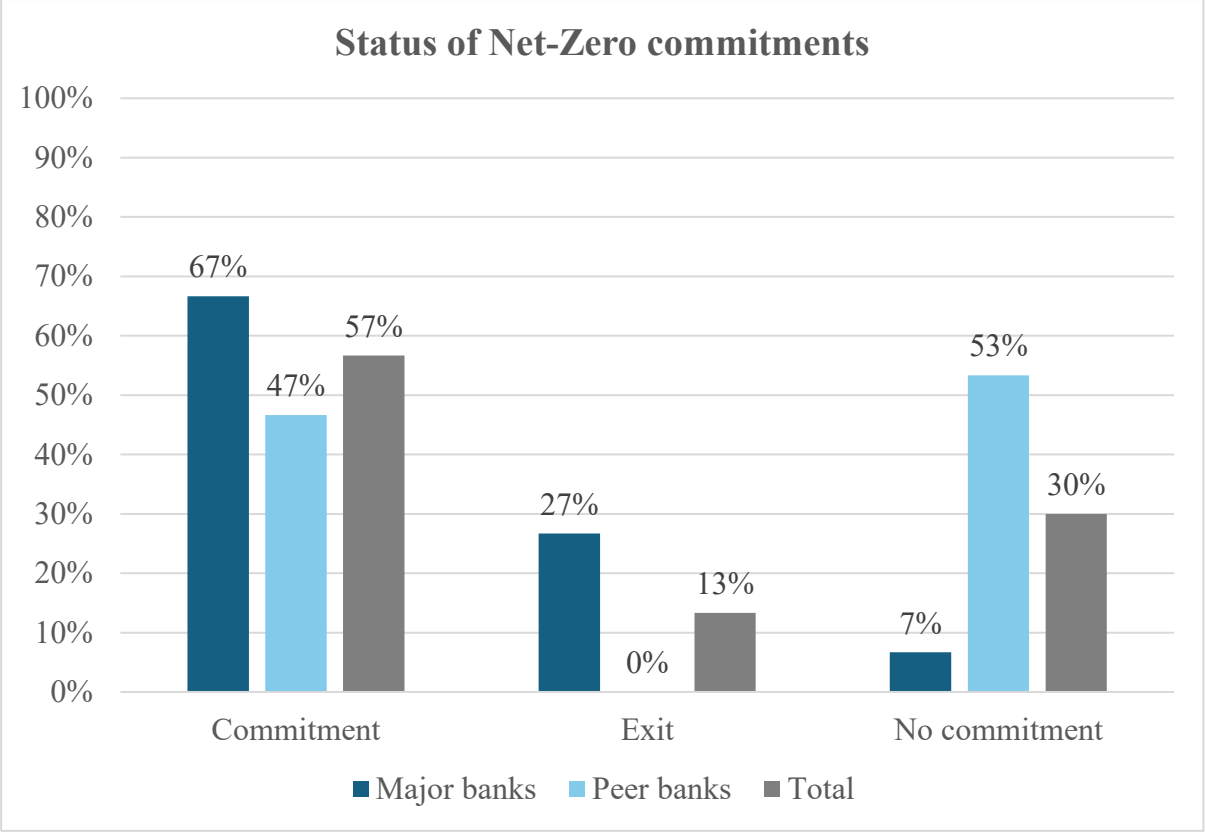

Figure 17: Status of net-zero commitments among major and peer banks of the sample

Temporal Dynamics of Commitments

The temporal analysis presented in the figure below highlights the trajectory of net-zero adoption and exits between 2020 and 2025. The initial uptake was modest, with only two banks

committing in 2020, followed by a gradual increase in 2021 (four commitments) and 2022 (two commitments). The year 2023 marked a peak, with seven new commitments, reflecting heightened momentum driven by regulatory developments and investor activism. However, this surge was not sustained; commitment activity slowed considerably in 2024 and 2025, with only one new entrant per year, suggesting a plateau in voluntary adoption.

Conversely, exits began to materialize in 2024, with one bank withdrawing, and accelerated in 2025, when three banks exited NZBA. This pattern indicates growing challenges in maintaining alignment with net-zero pathways, possibly due to operational constraints, evolving regulatory expectations, or strategic recalibration in response to market conditions. The simultaneous slowdown in new commitments and rise in exits may signal a critical juncture for voluntary climate alliances, emphasizing the need for stronger governance and accountability mechanisms.

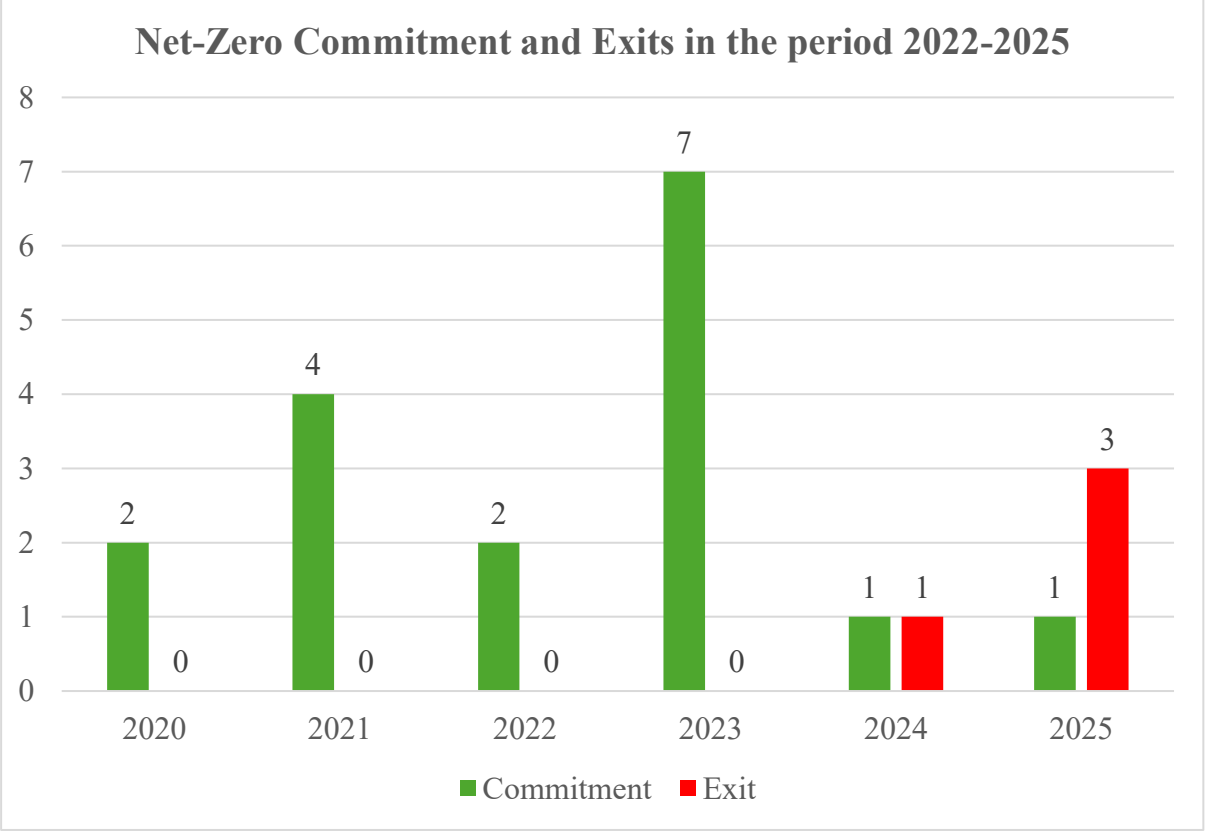

Figure 18: Evolution of net-zero commitments and exits (2020–2025)

Implications for Credibility and Transition Risk

The observed dynamics have significant implications for the credibility of net-zero commitments and the management of transition risk within the banking sector. While the overall adoption rate remains substantial, the attrition among major banks—institutions that are typically considered leaders in sustainability—suggests that voluntary frameworks alone may be insufficient to ensure long-term adherence. This underscores the importance of integrating net-zero objectives into binding regulatory regimes and supervisory expectations, as discussed in previous chapters.

6.2 Sectoral Prioritization

This section explores the sectors that banks have prioritized for decarbonization within their net-zero strategies. Given the heterogeneous nature of financed emissions, banks typically focus on high-impact sectors such as energy, power generation, transportation, and real estate. The analysis investigates the extent to which these sectors are consistently targeted across institutions and whether prioritization reflects materiality assessments or regulatory expectations. By mapping sectoral coverage, this section provides a lens into the strategic choices underpinning banks' transition plans and highlights potential gaps in addressing hard-to-abate sectors.

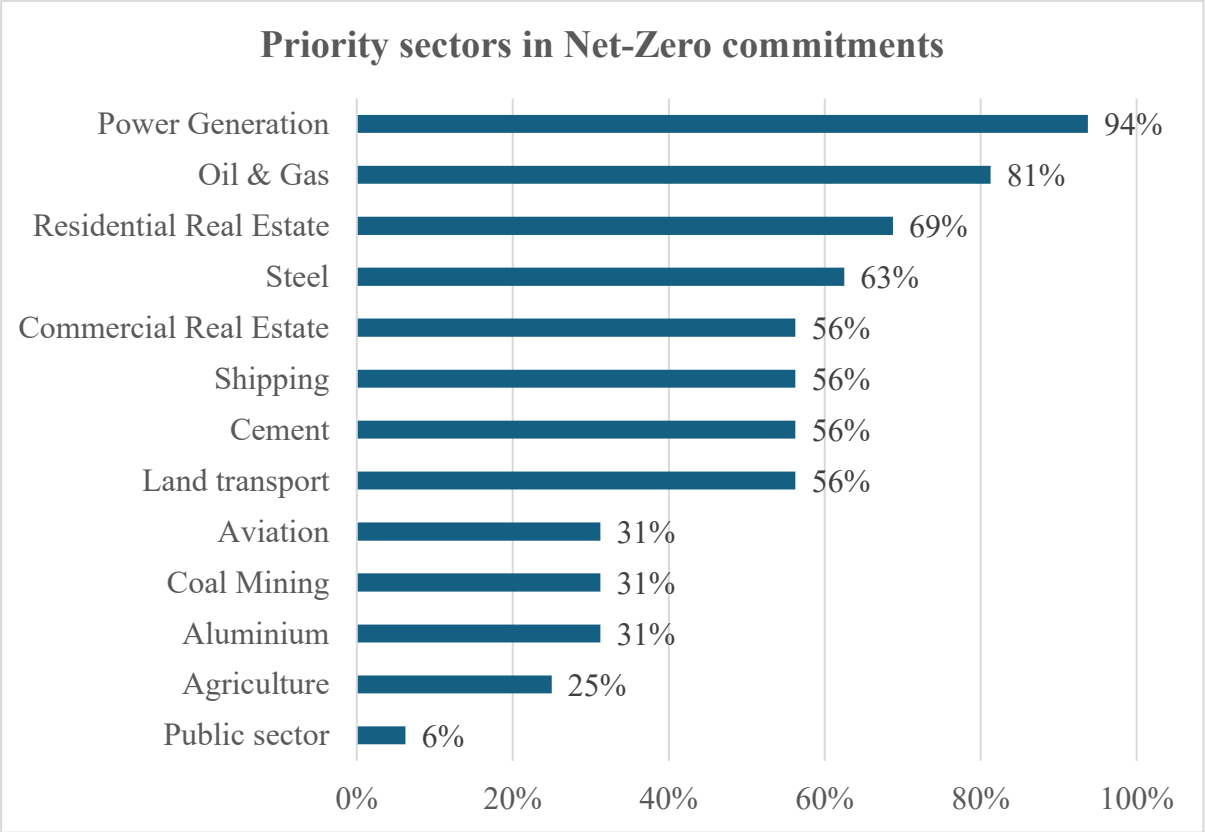

Figure 19: Prioritized sectors for decarbonization within their net-zero strategies

Dominance of Energy and Power Sectors

The most prominent sector is power generation, which appears in 94% of banks' net-zero commitments. This overwhelming focus underscores the sector's critical role in global decarbonization efforts, given its direct link to electricity production and its potential for rapid emissions reduction through renewable energy deployment. Closely following is oil and gas, prioritized by 81% of banks, reflecting the sector's materiality in financed emissions and its strategic importance in transition planning. These findings align with the broader regulatory emphasis on phasing out fossil fuels and accelerating clean energy investments.

Real Estate and Industrial Sectors

Beyond energy, real estate emerges as a significant area of attention. Residential real estate is included in 69% of commitments, while commercial real estate appears in 56%, highlighting the sector's substantial carbon footprint and the growing importance of energy efficiency in buildings. Similarly, steel production—a hard-to-abate sector—features in 63% of strategies, indicating banks' recognition of industrial decarbonization as a priority.

Transport and Shipping

Transport-related sectors, including shipping, cement, and land transport, each appear in 56% of commitments, suggesting a balanced approach to addressing emissions from mobility and construction. These sectors are integral to global supply chains and infrastructure, making their inclusion essential for achieving net-zero objectives.

Limited Coverage of Aviation and Agriculture

In contrast, sectors such as aviation, coal mining, and aluminium are prioritized by only 31% of banks, while agriculture appears in 25% of commitments. This limited coverage may reflect methodological challenges in measuring emissions, perceived lower materiality for certain portfolios, or strategic deferral of engagement with sectors that present complex transition pathways.

Negligible Focus on Public Sector

Finally, the public sector is included in only 6% of commitments, indicating minimal direct engagement. This likely stems from the sector's unique financing structures and the assumption that sovereign and municipal entities will pursue decarbonization through policy rather than bank-driven initiatives.

Implications

The observed prioritization pattern suggests that banks are concentrating efforts on sectors where decarbonization pathways are relatively well-defined and where regulatory and investor pressure is most pronounced. However, the limited inclusion of sectors such as agriculture and aviation raises concerns about the comprehensiveness of transition strategies, particularly given their significant contribution to global emissions. This selective approach may expose banks to reputational and transition risks if hard-to-abate sectors remain under-addressed.

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

Synthesis of Findings

Conceptual and regulatory foundations

The thesis established that sustainable finance in the EU is anchored in a layered architecture of binding legislation (European Climate Law; EU Taxonomy; CSRD), implementing regulations (SFDR; EU GBS), and market standards (ICMA Principles; LMA Principles; TCFD; PRB). Banks have responded by institutionalizing sustainability through internal frameworks—Sustainable Finance Frameworks (SFF), Sustainable Investment Frameworks (SIF), Green/Social Bond Frameworks (GBF/SBF), and Transition Finance Frameworks (TFF)—which embed eligibility criteria, exclusion lists, governance, and reporting. Product design reflects this architecture: dedicated-purpose green/social loans ensure direct, taxonomy-compatible impacts; business-mix loans extend sustainable finance to corporate models predominantly aligned with environmental/social objectives; SLLs price performance against credible SPTs; transition loans finance decarbonization of hard-to-abate sectors; and RRF-linked lending channels EU public finance into national reform and investment pipelines. Supervisory expectations (ECB/SSM; EBA) have moved climate risk management into the prudential core, raising the bar on governance, data, stress testing, and transition plans.

Empirical mapping of sustainable finance

Across the sample, frameworks have accelerated and converged—with a pronounced update cycle in 2024, consistent with regulatory milestones and supervisory reviews. Eligible activities skew toward energy, buildings, transport, and water, where taxonomic criteria and investability are mature; biodiversity and circular economy remain less integrated, reflecting measurement and pipeline constraints. GAR performance is heterogenous: a small set of leaders exhibit GAR stock >6% with robust coverage, while most banks remain below 2%, highlighting the early stage of balance-sheet realignment and the importance of coverage disclosure for comparability.

Net-zero commitments and implementation dynamics

NZBA and parallel pledges have catalyzed 2050 alignment with 2030 sectoral targets, but attrition has emerged among major institutions. The adoption analysis shows 57% of banks with active commitments, higher among major banks (67%) than peers (47%), while exits

concentrate among larger players. Temporal trends indicate a commitment peak in 2023 followed by slower additions and rising exits in 2025, suggesting pressure from methodological complexity, legal/supervisory scrutiny, and commercial trade-offs. Sectoral prioritization in net-zero strategies is energy-centric—power generation (94%) and oil & gas (81%)—with strong coverage of real estate and industrial emitters (steel, cement), but limited inclusion of aviation (31%), agriculture (25%), and the public sector (6%). This selectivity mirrors where pathways and data are tractable, yet leaves material emissions pockets under-addressed.

Overall conclusion

In summary, European banks have successfully constructed a comprehensive architecture for sustainable finance, encompassing robust frameworks, innovative financial products, and enhanced governance mechanisms. These institutions have articulated clear ambitions, notably through their participation in the Net-Zero Banking Alliance and the establishment of sector-specific targets for 2030 and 2050. However, despite these advances, the alignment of bank portfolios with net-zero objectives remains incomplete. The empirical evidence presented in this thesis highlights several areas of strength, including the rapid maturation of internal frameworks, disciplined approaches to eligibility and reporting, the scaling up of dedicated-purpose lending, credible structuring of sustainability-linked loans, and the growing integration of supervisory expectations into strategic planning.

At the same time, notable weaknesses persist. Most banks continue to report low Green Asset Ratios, indicating that taxonomy-aligned assets constitute only a modest share of their balance sheets. Sectoral coverage remains uneven, with limited engagement in areas such as aviation, agriculture, and aluminium, which are critical for a comprehensive transition. Data scarcity, particularly regarding financed emissions, undermines the credibility and trackability of targets.

Furthermore, there are ongoing risks related to the durability and credibility of commitments, as well as a limited articulation of concrete pathways for reallocating balance sheets in a manner that reconciles traditional business models with the demands of the 2030 climate milestones. Collectively, these findings underscore that while the foundations for sustainable finance and net-zero alignment are firmly in place, significant work remains to translate ambition into tangible, system-wide transformation.

Best Practices Identified

A review of leading practices among European banks reveals several key elements that contribute to the credibility and effectiveness of sustainable finance strategies. Foremost among these is the coherence and traceability of internal frameworks. Banks that successfully integrate their Sustainable Finance Frameworks, Green and Social Bond Frameworks, and Transition Finance Frameworks under a unified governance structure—anchored by eligibility criteria referencing the EU Taxonomy, comprehensive decision logs, and regular external reviews—achieve a higher degree of transparency and significantly reduce the risk of greenwashing. This integrated approach ensures that sustainability considerations are embedded consistently across all financial products and activities.

Another area of best practice is the design of sustainability-linked loans (SLLs). The most credible SLLs are characterized by the use of science-based, sector-specific sustainability performance targets, which are underpinned by verified baselines and transparent methodologies. Clear mechanisms for margin adjustments, coupled with annual independent assurance, elevate these instruments from mere marketing tools to genuine vehicles for driving measurable sustainability outcomes. This approach not only incentivizes borrowers to achieve meaningful improvements but also enhances the integrity of the bank's sustainable finance portfolio.

Transition finance is most effective when it is structured with explicit conditionality. Leading banks embed time-bound decarbonization milestones, detailed capital expenditure plans, and escalation clauses—such as pricing adjustments, restrictive covenants, or limits on the expansion of carbon-intensive activities—directly into their transition finance products. By doing so, they ensure that financing is closely aligned with real emissions reduction trajectories, rather than simply supporting aspirational commitments.

In the realm of reporting, best practice is demonstrated by those institutions that provide coverage-aware disclosures of their Green Asset Ratio (GAR). These banks report not only the proportion of taxonomy-aligned assets but also the extent of coverage, the methodologies employed (such as turnover versus capital expenditure key performance indicators), and detailed sectoral breakdowns. Such transparency enables meaningful comparability across institutions and supports effective supervisory oversight.

Finally, the integration of supervisory expectations into core governance and risk management processes stands out as a hallmark of advanced practice. Banks that tie board-level oversight, risk appetite statements, sectoral exposure limits, and climate scenario analysis directly to their strategic planning, Internal Capital Adequacy Assessment Process (ICAAP), and Supervisory Review and Evaluation Process (SREP) cycles are able to move sustainability from a policy aspiration to a risk-capable, operational reality. This alignment ensures that sustainability objectives are not only articulated at the highest levels but are also embedded in day-to-day decision-making and long-term strategic direction.

Collectively, these best practices illustrate how a holistic, disciplined, and transparent approach can enhance the credibility, comparability, and impact of sustainable finance initiatives within the European banking sector.

Key Gaps and Challenges

Despite the considerable progress made by European banks in developing sustainable finance frameworks and articulating ambitious climate targets, several persistent gaps and challenges continue to impede the full realization of portfolio alignment with net-zero objectives. One of the most significant obstacles is the ongoing issue of data quality and availability. In particular, the measurement of financed emissions remains problematic for small and medium-sized enterprises as well as private issuers, where reliable data is often sparse or must be estimated. This lack of robust data undermines the credibility of targets and hampers the ability of banks to accurately track progress toward their sustainability commitments.

Methodological fragmentation further complicates the landscape. Banks employ divergent approaches to target-setting, with some favoring absolute emissions reductions while others rely on intensity-based metrics. The scope of targets and the choice of transition pathway providers also vary widely across institutions. This lack of standardization impairs comparability between peers and creates confusion for both regulators and market participants seeking to assess the sector’s overall progress.

Sectoral blind spots represent another critical challenge. Coverage remains particularly low in sectors such as aviation, agriculture, and aluminium, as well as in the assessment of value-chain emissions, notably Scope 3 emissions for certain industries. These omissions create material

gaps in alignment, as significant sources of financed emissions remain unaddressed within banks' transition strategies.

The durability and governance of climate targets also present vulnerabilities. Recent instances of banks exiting voluntary alliances or revising their commitments highlight the susceptibility of these pledges to legal, political, and commercial pressures. In many cases, escalation and remediation mechanisms are insufficiently specified, leaving institutions exposed to reputational and regulatory risks should progress stall or targets be missed.

Capital allocation inertia further slows the pace of change. The progression of Green Asset Ratios and the reduction of financed emissions often lag behind stated ambitions due to constraints in the pipeline of eligible projects, internal profitability thresholds, and heightened credit risk concerns associated with emerging technologies. These factors can discourage banks from reallocating capital at the scale and speed required to meet interim climate milestones.

Finally, the readiness of clients to undertake meaningful transitions remains uneven. Many borrowers, especially those operating in hard-to-abate sectors or within the mid-market segment, lack viable and credible transition plans. This deficiency not only increases execution risk for banks' sectoral targets but also threatens the broader effectiveness of the financial sector's contribution to the net-zero transition.

Taken together, these challenges underscore the complexity of translating high-level commitments into tangible, system-wide transformation. Addressing these gaps will require coordinated action across data infrastructure, methodological harmonization, sectoral engagement, governance structures, capital allocation practices, and client support mechanisms.

Recommendations for Banks

To accelerate credible progress toward net-zero alignment, banks must embed sustainability into the core of governance, strategy, risk management, product design, data infrastructure, and client engagement. At the governance level, it is essential for banks to elevate transition planning to the highest echelons of decision-making. This involves the development and board approval of comprehensive, multi-year transition plans that explicitly tie net-zero targets to sector-specific risk appetite statements, set clear limits on high-emission exposures, and establish glide paths and early warning triggers. Such plans should also be integrated into capital planning processes, ensuring that considerations around risk-weighted assets, capital

buffers, and minimum requirements for own funds and eligible liabilities (MREL/TLAC) are aligned with the institution's climate objectives.

Methodological rigor is equally important. Banks should standardize the use of both absolute and intensity-based key performance indicators, transparently disclose the assumptions underlying climate scenarios, and ensure that all methodologies are fully aligned with the requirements of the EU Taxonomy and the European Banking Authority's guidelines. This approach not only strengthens internal management but also ensures that banks are well-prepared for prudential review and supervisory scrutiny. In parallel, institutions should set ambitious internal targets to increase the proportion of taxonomy-aligned assets across their balance sheets, supported by robust data pipelines and the inclusion of contractual data clauses in client agreements to facilitate comprehensive and reliable reporting.

In terms of portfolio steering and product design, banks are encouraged to develop detailed sectoral playbooks that address the unique transition pathways, financing structures, eligibility criteria, and phase-out schedules relevant to each major sector, including power generation, oil and gas, real estate, steel, cement, shipping, aviation, and agriculture. Transition finance should be structured with clear conditionality, linking loan disbursements to verifiable capital expenditures—such as retrofits, fuel switching, or process electrification—and embedding time-bound milestones, step-up pricing, and restrictive covenants to ensure that progress is both measurable and enforceable. The credibility of sustainability-linked loans must be reinforced through third-party verification of sustainability performance targets, the prohibition of minimal or symbolic targets, and the introduction of ratchets that adjust pricing based on both achievements and slippages, with a particular focus on key performance indicators that capture Scope 1, 2, and 3 emissions.

Banks should also prioritize the decarbonization of the real estate sector by scaling up green mortgages, retrofit loans, and commercial real estate efficiency finance, integrating building performance certificates and taxonomy thresholds directly into underwriting processes. To overcome the financial barriers associated with hard-to-abate technologies, institutions should actively pursue blended finance solutions, combining their own lending with European Union or sovereign guarantees, Recovery and Resilience Facility tranches, and risk-sharing arrangements with entities such as the European Investment Bank or European Investment

Fund. This approach can help crowd in private capital and reduce the cost of financing for innovative but higher-risk projects.

Data, disclosure, and assurance are foundational to the credibility of sustainable finance. Banks should introduce ESG data covenants into credit documentation, requiring clients to report on emissions, energy mix, and other relevant metrics, with penalties for non-compliance. Support for small and medium-sized enterprises can be enhanced through the provision of standardized templates and access to approved data vendors. The publication of a unified climate disclosure pack—encompassing Green Asset Ratio and coverage, sectoral exposures and financed emissions, sustainability-linked loan outcomes, and the status of transition loan milestones—should be assured by independent reviewers to ensure accuracy and comparability. Internally, banks must invest in digital infrastructure, including data lakes and model governance systems for climate scenario analysis and taxonomy mapping, and adopt model risk management practices for climate models that are on par with those used for market and credit risk.

Finally, client engagement and the pursuit of a just transition are critical to the success of sustainable finance strategies. Banks should offer comprehensive advisory services to clients, helping them navigate technology choices, policy incentives, and carbon pricing, and co-designing credible transition plans prior to financing. Social safeguards must be embedded in high-carbon phase-outs, ensuring that workforce reskilling and regional impacts are addressed, and that transition loans are paired with social components such as access to basic services and employment generation. The development of dedicated origination hubs focused on industrial decarbonization, grid and storage solutions, clean transport corridors, and nature-based projects will be essential for expanding the pipeline of taxonomy-aligned, Green Asset Ratio-eligible assets.

Recommendations for Policymakers and Supervisors

To enable the banking sector to fulfill its potential as a catalyst for the economic transition, policymakers and supervisors must address several structural and regulatory challenges through coordinated and forward-looking interventions. A primary area of focus should be the alignment and standardization of regulatory frameworks. Harmonizing methodologies is essential; policymakers should provide binding guidance on the use of target metrics—clarifying the application of absolute versus intensity-based targets, defining sectoral decarbonization pathways, and specifying the treatment of Scope 3 emissions. Such harmonization would not

only improve comparability across institutions but also reduce the risk of litigation and regulatory arbitrage. In parallel, the EU Taxonomy should be expanded and calibrated to encompass sectors that are currently underrepresented, such as agriculture, aviation, aluminium, and nature-based activities. Thresholds within the taxonomy must be refined to strike a balance between scientific rigor and the practical realities of bankability, ensuring that ambitious standards do not inadvertently stifle the flow of capital to critical transition activities.

Disclosure requirements also demand greater coherence. Policymakers should work to align the templates and reporting obligations of the Corporate Sustainability Reporting Directive (CSRD), the Task Force on Climate-related Financial Disclosures (TCFD), and Pillar 3 disclosures. This alignment would facilitate consistent and comparable reporting of financed emissions and Green Asset Ratios, including clear requirements for coverage, thereby enhancing transparency for both supervisors and market participants.

From a prudential and incentive design perspective, the integration of climate risk into capital frameworks must continue to advance. Supervisors should further develop Pillar 2 practices, considering risk-sensitive adjustments—such as additional capital requirements for fossil asset exposures where justified by risk—while avoiding the introduction of simplistic green supporting factors that lack empirical support. Public guarantees, first-loss tranches, and credit enhancements provided by institutions such as the European Investment Bank, the European Investment Fund, and national facilities should be scaled up to crowd in private capital, particularly for transition technologies and small and medium-sized enterprise retrofits that may otherwise struggle to access affordable financing. Investment in national ESG data infrastructure is also critical; by funding data hubs that aggregate corporate emissions and energy performance information, policymakers can reduce the reporting burden on SMEs and improve the overall quality and reliability of sustainability data. Furthermore, just transition policies must be embedded in the regulatory response. Sector phase-out timelines should be paired with regional development funds, workforce reskilling programs, and consumer protection measures to mitigate social impacts and ensure the stability of bank portfolios during the transition.

Market integrity and accountability are equally vital. Policymakers should establish minimum criteria for sustainability-linked loans, including materiality thresholds and verification requirements, to prevent the proliferation of weak key performance indicators and to ensure

that pricing adjustments reflect genuine sustainability outcomes. Supervisory authorities should require banks to develop and maintain comprehensive transition plans at the institutional level, subjecting these plans to regular review, escalation, and remediation mechanisms. The publication of aggregate progress across the sector would further sustain the credibility of climate commitments and foster a culture of accountability.

By pursuing these recommendations, policymakers and supervisors can create an enabling environment that supports banks in scaling up their contribution to the net-zero transition, while safeguarding market integrity, social cohesion, and financial stability.

Final Remarks

European banks have progressed from intent to infrastructure, building frameworks, products, and governance that enable sustainable finance and net-zero alignment. Yet the decisive test lies ahead: reallocating capital at pace into taxonomy-aligned, real-economy decarbonization while de-risking and supporting clients through credible transition plans. The recommendations presented here—spanning governance, portfolio steering, data, client engagement, and policy design—translate the thesis' theoretical and empirical insights into actionable steps. Implemented in concert by banks and policymakers, they can strengthen credibility, close sectoral gaps, and accelerate the financial system's contribution to a just, competitive, and climate-neutral European economy.

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