



Sustainable business model for climate finance. Key drivers for the commercial banking sector

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ABSTRACT

The identification of a reference framework—the sustainable business model structure—exposes a new tool for banks to reanalyse their business models and adapt to a climate-resilient economy. The identification was done by a combination of analysis of current literature with regard to common and sustainable business models, which indicated three key levers for commercial banks looking to boost climate: target, sustainable value proposition, and sustainable value creation. Through a case study comparing the application of sustainable business model structure to a selection of five global banks, a collection of best practices was gathered to improve a bank's profitability while reducing its clients and its own contribution to climate change. These banks were chosen through a series of criteria that ensure their eligibility as global commercial banks undergoing a business model transition to adapt to a climate-resilient economy.

1. Introduction

As environmental issues gain greater significance, companies and financial institutions are confronted with the demand to play an active role in effectively reducing environmental burdens. Although the financial sector is generally not considered environmentally friendly, financial institutions can play an important role in making a profitable impact through their efforts to reduce the effects of climate change. This means a change of paradigm (Triodos Bank, 2019) where financial transactions need to be aligned and related risks can no longer be analysed only within the economic bubble (Donthu & Gustafsson, 2020; Liu et al., 2020). Social, ethical, and environmental parameters should be integrated into financial decision making (Weber, 2005). Within the banking sector, the collection of new business models that prioritise climate change and what it entails is referred to as climate finance. The role of banking institutions as major sources of financing investment is vital (Laguir et al., 2018; Salman & Sumaira, 2018). The question arises as to whether banks are indeed ready to become catalysers of climate finance.

Eric Usher, Head of United Nations Environment Programme (UNEP) Finance Initiative, states that a sustainable bank is one that not only understands and manages the risks that arise because of sustainability issues but also perceives the strategic dimension of these issues. This

means thinking ahead about business implications and opportunities brought about by the increasingly pervasive environmental, social, and developmental challenges of our time (UNEP – Finance Initiative, 2016). Banks are in a unique position to improve their relationships with their clients by adopting certain drivers, such as positioning themselves aligned with their clients' values, broadening their product and services portfolios, or reducing the physical and transition risks that come with a client-resilient economy. However, banks are not eager to finance transformation in the industry, because of the lack of knowledge on how to become profitable. Therefore, this study focuses on identifying a reference framework for banks that can adapt to a climate-resilient economy.

Previous studies have already recommended banks to adopt a sustainable business model (SBM) and have given steps on how to achieve it (Lüdeke-Freund et al., 2017; Stankeviciene & Nikonorova, 2014; Bocken et al., 2014; Polonskaya & Babenko, 2012), but fewer studies have been conducted on the extent to which sustainability is already integrated into a bank's business model and its effectiveness (Schutten, 2016; Yip & Bocken, 2014). Although more sustainable banks with changed corporate purposes have emerged in different contexts, such as the Grameen Bank (Yunus et al., 2010) or Triodos Bank, these types of banking are not yet mainstream. The extension of the sustainable business conceptualisation of the banking industry remains in its early stages of

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development. The present article is an attempt to respond to the lack of research on the mechanisms and processes involved or affected by the transition from the traditional business model (BM) to an Sustainable Business Model (SBM), and how its success can actually be measured.

This theoretical study consists of a thorough literature review based on the definition of a business model and a SBM while keeping in mind the Principles for Responsible Banking. Thereafter, the identified SBM structure was applied to five specific banks, chosen through a series of steps based on research, analysis, and categorisation. Three key levers have been identified as SBM for banks looking to boost the climate: target, sustainable value proposition, and sustainable value creation. By comparing each bank's content to each lever and sub-lever, a collection of best practices has been gathered to improve a bank's profitability while reducing its clients, as well as its own contribution to climate change.

This study is part of a larger work developed during a study conducted at the Universidad Politécnica de Madrid (García-Wang, 2020). The sources of the empirical study are as follows: (i) primary data collected from managers and experts and (ii) secondary data, consisting mainly of banks' annual reports, sustainability reports, and websites.

The remaining study is organised as follows. To motivate the research and to establish the goals, Section 2 begins with the identification of climate finance and the specific actions and effort put by different players for its development, and the relevant literature on SBMs is reviewed. Section 3 presents the methodology adopted to build a sustainable framework. In Section 4, the SBM structure (SBMS), including its value proposition is introduced. Section 5 presents a case study in which the conceptual business model is used as a cognitive tool. Its application to the five leading banks in climate finance results in knowledge of its outcomes and impacts. Section 6 discusses the logic of application of the SBMS, current sustainable practices of the SBMS, and the sector's strengths and weaknesses. Finally, Section 7 presents the main conclusions of the study, discusses some limitations, and proposes future research directions.

2. Literature review

2.1. Climate finance

There is no international agreement on what the term 'climate finance' precisely means, and the terms of 'sustainable finance', 'green finance', and 'climate finance' are frequently mixed. According to the United Nations Framework Convention on Climate Change (UNFCCC), 'Climate Finance refers to local, national, or transnational financing—drawn from public, private, and alternative sources of financing—that seeks to support mitigation and adaptation actions that will address climate change' (United Nations Framework Convention on Climate Change, 2022).

Climate change may be associated with increases in the intensity and frequency of extreme weather events, which, in turn, can affect economic activity and physical risk, becoming significant for some sectors such as the financial system. It is particularly important because of its key role in the economy. Its role as a mediator for the savings and investments of households and firms makes it potentially capable of amplifying the negative impact of adverse events connected to climate change and green transition (Bernardini et al., 2021). Financial system operators do not limit themselves to distributing resources from one agent to another; however, in this transfer of funds, they assume financial and non-financial risks, such as ethical, social, and environmental risks (Pampillón et al., 2010). Risks have increased owing to the lack of a comprehensive and universally accepted taxonomy of sustainable activities and the difficulty of obtaining reliable and consistent environmental, social, and governance (ESG) scores (Bernardini et al., 2021).

Climate finance represents a paradigm shift in financial activity, with implications ranging from the strategic dimension, through governance

and risk management (Triodos Bank, 2019; Weber, 2005), to the emergence of new business opportunities which are being mobilised not only through a range of instruments from a variety of sources, international and domestic, public, and private (Fankhauser & Stern, 2016), but also pressure from various stakeholders through regulations and other norms (Khan et al. 2021; Pyka & Noco, 2021).

The banking sector has been the last to embrace the overall need to incorporate, in a coordinated way, guidelines that link its activity with more sustainable and responsible development (Banque de France, 2019). In 2009, two initiatives arose almost simultaneously: the global alliance for banking on values (GABV) initiative and the banking environment initiative. The first was co-founded by Triodos Bank as an alliance consisting of the creation of a network of independent banks that deliver sustainable social, environmental, and economic development through finance. The second was founded by a group of leading bank chief executives and the University of Cambridge Institute for Sustainability Leadership, with the thought that a new and fresh approach is needed for banks to support environmentally and socially sustainable economic activities.

With the growing corporate client requirement for sustainability, the *Guide to Banking and Sustainability* was published in 2011. It provides a functional overview of what a sustainable bank would look like and a set of actions that banks could apply to include ESG principles in their day-to-day operations. Two years later, the Global Reporting Initiative published a report on sustainability topics for sectors: What do stakeholders want to know? (Global Reporting Initiative, 2021). One hundred and ninety-four organisations from different sectors either directly contributed to or were researched for the report. The conclusions regarding the financial sector were of utmost importance, as 34.4 % of the proposed topics came from stakeholders in the financial markets. More specifically, the category 'Banks', 'Diverse Financials and Insurance' ranked 7th for quantity of topics that need improvement, with 42 identified topics. Among them, there is a need for new business models that include long- and short-term values. This study addresses this need by adapting a business model structure to a banking system that focuses on climate change, thus addressing the short- and long-term opportunities, challenges, and risks that arise when addressing sustainable development.

Recent studies show an increasing interest in these matters and that the number of banks that have developed internal ESG systems has increased and adhered to external codes (PNUMA – CAF, 2020). The commitment of leaders to attain sustainable development goals (SDGs) by 2030 will be impossible without bank involvement (Weber & Feltsmate, 2016). Adoption of these practices also generates benefits and opportunities for the banking sector. Performance and commitment have positive economic returns. The MSCI index shows that those with better results in this area have higher profitability, better market valuation, fewer bad loans, and a lower ratio of losses to provisions than those with the worst ratings (Triodos Bank, 2019). The SDGs have been treated as a turning point, aligning the actions of millions of people on a personal, corporate, or national level. Recently, the UN Secretary-General António Guterres called on world leaders for the UN Climate Action Summit 2019. The focus was on climate finance by considering it an important action portfolio. During the summit, financial players consisting of 130 banks, accounting for one-third of the global banking sector, from 49 countries representing EUR 42.5 trillion assets, joined the discussion and officially signed the Principles for Responsible Banking. They are meant to provide a framework for a sustainable banking system and to take a holistic approach to sustainability, including all three aspects: social, environmental, and economic. In this study, these principles are also considered, although the focus on climate finance refers mainly to the environmental and economic pillars.

2.2. Sustainable business models

Interest in business models for sustainability or SBMs has become an

important concept in literature and practice owing to both increasing competitive pressures (Ritala et al., 2018) and, at the same time, issues such as the urgency of mitigating climate change (IPCC, 2018). Thus, SBMs can also act as a key driver for business model innovation (sustainable business model innovation, SBMI) and create new forms to capture economic value while generating environmental and social value (Bocken et al., 2013; Schaltegger et al., 2016b, Guo et al., 2022).

Table 1
Principle Related Frameworks helping to assess new business model proposals.

Types of business model	Classification results	Representative literature
Business model	Based on the interdependent activities or transactional structures approach	Zott & Amit, 2010; Parida et al., 2019; Anzenbacher & Wagner, 2020
	Based on the value extraction devices approach	Porter & Kramer, 1999; Osterwalder & Pigneur, 2010; Teece, 2010; Zott & Amit, 2010
Business model innovation	Based on the mechanisms for structuring the organisational approach	Winter & Szulanski, 2001; Morris et al., 2005; Tikkanen et al., 2005
	Based on the source of value criterion	Adner & Levinthal, 2001; Parida et al., 2019; Chen et al., 2018; Frank et al., 2019; Veile et al., 2022;
	Based on the innovation degree criterion	Chen et al., 2018; Frank et al., 2019; Mostaghel et al., 2022; Wang et al., 2022
	Based on the market perception criterion	Chen et al., 2018; Frank et al., 2019; Wang et al., 2022
Sustainable business models	Based on innovation scope criterion	Herkovits et al., 2013; Chen et al., 2018; Geissdoerfer et al., 2018
	Based on the source of competitive advantage criteria	Chen et al., 2018; Geissdoerfer et al., 2018; Frank et al., 2019; Veile et al., 2022
	Based on strategies or archetypes balancing short-term and long-term objectives for focal firm	Bocken et al., 2014; Schaltegger et al., 2016; Geissdoerfer et al., 2018; Yip & Bocken, 2018; Bocken et al., 2019; Botella-Carrubi et al., 2022; Trapp et al., 2022
	Based on a comprehensive and systemic adoption of sustainable value strategies which incorporate the triple bottom line: people, planet, and profit	Yunus et al., 2010; Polonskaya & Babenko, 2012; Stankeviciene & Nikonorova, 2014; Joyce & Paquin, 2016; Schutten, 2016; Ritala et al., 2018; Norris et al., 2021
Sustainable business models innovation	Based on an organisational-centric view with a limited consideration of value creation by focal firm's stakeholders	Osterwalder and Pigneur, 2010; Loorbach & Wijsman, 2013; Boons, 2016; Joyce & Paquin, 2016; Schaltegger et al., 2016; Lüdeke-Freund & Dembek, 2017; van Bommel et al., 2020; Freudenreich et al., 2020; Franceschelli et al., 2018; Geissdoerfer et al., 2018;
	Based on strategies or archetypes improving long-term resilience and short-term performance	
	Based on an adoption of collaborative paradigm with firm's stakeholders and natural environment to build an integrated value creation framework	Osterwalder and Pigneur, 2010; Chen et al., 2018; Geissdoerfer et al., 2018; Grijalvo et al., 2021; Guo et al., 2022;
	Based on an inter-organisational-centric view with a broad consideration of value creation which involves organisational boundary changes and requires multi-actor collaboration	Boons & Lüdeke-Freund, 2013; Chen et al., 2018; Grijalvo et al., 2021; Goncearuc, 2022;

Over the last few years, SBM research has proliferated and has been published in a wide range of journals, including in various special issues. Table 1 describes the most relevant concepts related to the SBM and SBMI frameworks, and it shows interesting contributions from different approaches to explain the current state of the art.

Although scarce literature discusses the approaches to sustainability-driven business model designs for the banking sector and its effectiveness (Lüdeke-Freund et al., 2017a; Schutten, 2016; Bocken et al., 2014; Stankeviciene & Nikonorova, 2014; Yip & Bocken, 2018; Polonskaya & Babenko, 2012; Yunus et al., 2010; Stubbs & Cocklin, 2008), Table 1 shows the frameworks related to different principles that help to develop and assess new SBMs proposals for the banking sector. First, these studies consider SBM a modification of the business model concept with certain attributes (Norris et al., 2021). It is particularly interesting in the context of sustainability because it highlights the value creation logic of an organisation and its effects, and potentially facilitates the development of new governance forms, helping transcend models that focus on profit and profit maximisation (Schaltegger et al., 2016b).

Second, these studies take an interesting approach to explain how firms can adopt a broad variety of activities and practices that enable them to create shared value (Porter & Kramer, 1999) by combining economic goals that are aligned with social and environmental values. SBMs see firms as actors that are connected to and interrelated with other actors in the socioeconomic system (Boons & Lüdeke-Freund, 2013). The concept of SBMs appears partly to help understand economic value creation by solving social and ecological problems (Norris et al., 2021). SBMs promote a systems-based view which includes a more long-term perspective (van Bommel et al., 2020), and an extension of the conventional focus on customer value (Osterwalder & Pigneur, 2010) towards multiple stakeholders, beyond firm owners, business partners, and customers (Lüdeke-Freund & Dembek, 2017; Schaltegger et al., 2016b). Both criteria need to be taken into consideration because they allow the conceptualisation, reconceptualisation, and connection of multiple types of value propositions within the business model perspective (Geissdoerfer et al., 2018), and develop an extended notion of value capture in terms of those for whom value is created (Freudenreich et al., 2020).

Finally, these emergent activities and practices contribute to a sustainability transition and to changing the firm's dominant logic and, as a result, the business model (Boons, 2016; Loorbach & Wijsman, 2013). Large corporations (as in our study) have been criticised for their lack of trust in their ethical, social, and environmental behaviour (Carroll and Shabana, 2010; Banerjee, 2008) based on the premise that corporations are mostly guided by self-interest that pursue economic profits over social and environmental concerns (Banerjee, 2010). This indicates the importance of reconsidering the classical concept of performance evaluation, which relies on a single shareholder's point of view, top management, or investors, by incorporating other key stakeholders such as regulators and civil society at the macro level and employees and customers at the micro level.

This study employs an integrative approach that has not been adopted by previous studies in the commercial banking sector (Yip & Bocken, 2018; Schutten, 2016; Stubbs & Cocklin, 2008). It shows interesting contributions by offering a holistic, multilevel, and dynamic framework governed by the multiple dimensions of value, which focuses on understanding firm performance (Donthu & Gustafsson, 2020) both at the macro level (e.g. regulators and civil society) and the micro level (e.g. shareholders, customers, managers, and employees). The ongoing attempts of five leading global commercial banks in terms of climate finance have served as a framework for the formulation of the following research questions:

RQ 1: When SBMs are considered, which approach and perspectives from value analysis in the interaction with stakeholders are meaningful?

RQ 2: What are the key mechanisms that help banks adapt their business models to a climate-resilient economy?

3. Methodology

For the development of this study, a thorough diligent process was conducted, consisting of two stages. The first focuses on developing the business model in relation to the objectives and research questions mentioned above, and during the second stage, the developed model was reviewed and validated empirically.

The research follows a deductive approach by going through the theory on SBMs and their value creation process for specific banks and their activities (Saunders et al., 2009). The research strategy consists of case studies that use multiple sources of evidence (Saunders et al., 2009).

Case studies are becoming more frequently accepted in the field of scientific research (Rialp 1998), especially in recent domains where there are not enough samples to work on quantitative projects. Eisenhardt and Graebner (2007) and Yin (2003) Yin (1994) recommend case studies as a research methodology where the knowledge of specific areas is recent or limited (Trapp et al., 2022; Mouzas, 2022; Wang et al., 2022), similar to the case of SBMs applied to the banking sector (Stubbs & Cocklin, 2008; Schutten, 2016; Yip & Bocken, 2018; Rebai et al., 2016). According to van Bommel et al. (2020), there is a need for more case study research, despite the large number of SBM case studies.

It has also been noted that case studies, as a qualitative technique, are not exempt from negative reviews, many of which are associated with the generalisation of the case study results, which is limited by the context (Gummerson, 1991, 2000). In this regard, it is important to consider the distinction established by Glaser and Strauss (1987) between research designed to prove, verify, and refine models and existing theories and research designed to generate theory and propose new conceptual developments.

Research based on case studies can identify-four specific roles in building the general research theory methodology on applied domains, such as the social sciences (Lynham, 2001). The four specific roles described in Lynham's article are conceptualisation, operationalisation, application, and confirmation (or rejection). The main difference between these roles is that case study research may imply the development of existing theories for the research itself. Within the scheme of different research alternatives to be considered, in the context of this research, the role that best applies is conceptualisation, which is aimed at creating or promoting a reference framework for a SBM for the banking sector. A process of continuous refinement and development was carried out through the successive elaboration of the proposed models based on analysis of data until a final model is derived.

Once the case studies were established as the fundamental axis in the methodological framework of this research, data collection was undertaken through two different activities:

- Available public information from companies, such as annual reports, journalistic articles, and corporate webpages
- Interviews with company representatives. Several interviews were conducted with two of the selected banks. The interviews took place with employees or experts with knowledge of existing internal innovation initiatives, as well as the general operational process of each company. The experts were—
 - o A strategic institutional and business director with extensive international experience within the banking sector (over 30 years). She has performed roles as an investment analyst and investor in banks such as Chase Manhattan and Santander Bank. In the latter, she performed the role of Country Manager in China for six years;
 - o A banking professional with ample experience in the retail sector (over 30 years) and performed different roles, such as the Retail Area Director at BBVA Bank, Spain; and

- o An expert consultant in ESG-Green Finance of International Finance Bank.

For data selection, a specific criterion has been created consisting, first, of identifying and categorising how each country addresses climate change, and then, selecting the most impactful banks within each country category. Once 40 banks were selected, initial analyses were performed to further understand the market and the possibilities of applying the business model framework.

Once data collection begins, it is time for the research team to begin data analysis. The data analysis in this research is based on the research questions and guided by the theoretical framework of the study. The initial data analysis guides later data collection, and this reciprocal process continues until no new findings are identified.

The analysis phase not only overlaps the data collection phase but also includes data triangulation through the use of different data collection techniques within this research. This ensures that a critical analysis categorises the findings (Saunders et al., 2009) as well as confirms its robustness and reliability (Elliot, 2018). These two research objectives were met by conducting interviews. First, World Bank experts are conceptualised on levers and practices. Second, model conceptualisation is adapted to experts based on information retrieved from existing open sources (Seidman, 2006).

For the selection of the data to be analysed, specific criteria have been created consisting, first, of identifying and categorising how each country addresses climate change and, then, selecting the most impactful banks within each country category. Once 40 banks were selected, initial analyses were performed to further understand the market and the possibilities of applying the business model framework. To select which banks to analyse, a criterion was developed for first classifying countries in relation to climate change. Four main categories were highlighted as most relevant when considering a country's possible relationship with climate change, and several indexes were used in each case. To develop a bigger picture of how countries deal with climate change but not forget the financial factor, three new criteria were applied to create the final list.

From this country categorisation and based on the criteria and sub-criteria created, 10 countries were selected. Further research was performed to select the top banks per country according to their sustainable accreditation and total assets. The aim of this stage is to obtain a general overview of existing intentions and practices related to climate finance globally and introduce an initial categorisation of these practices, which can then be compared with the series of business models and SBMs analysed. For disclosure, banks where information was either not accessible or not in English or Spanish were disregarded. This was the case for many banks whose work took place mainly in the Middle East, in countries such as Qatar or Saudi Arabia, owing to inaccessible data, and other banks from Switzerland, France, or Germany owing to their lack of English reports. All data were gathered from the banks' annual reports, sustainability reports, and websites.

Experts were continuously consulted throughout the study. Specifically, 4 interviews of 45 min were conducted with each expert at the key stages of country categorisation, first-lever categorisation from the study of the 40 banks, business model application, and lever adaptation, and once the final model for each of the five selected banks was performed.

4. Sustainable business model for the banking sector

4.1. Adapting business model framework to the banking sector

This study presents a framework which is an adaptation of the existing business model frameworks to the banking system. It was designed by first examining the SBM Canvas which is a modified version of Osterwalder and Pigneur's BM Canvas (Osterwalder & Pigneur, 2010). The SBM Canvas maintains Osterwalder and Pigneur's division in

nine blocks but ensures that these blocks have a sustainable twist to them. This twist consists of examining each block with two questions in mind: 1) How can it create sustainable-related value for stakeholders? 2) How can an enterprise capture this value? In their article ‘Clarifying business models: origins, present, and future of the concept’, Osterwalder et al. (2014) compare the main blocks of what was to become the BM Canvas, developed in 2010, to those contemplated by fellow experts in the field. These five models are contrasted with the general business model of a bank and the main known drivers for change to determine, through this study, which parts of the business model should be tackled to introduce a more sustainable banking model when it comes to climate finance.

This analysis, together with the expert pieces of advice from Agustín Figueroa, has led to the decision to address six of the nine blocks introduced by Osterwalder and Pigneur (2010), as well as Morris et al.’s (2005) block on external positioning. The final result, the SBMS, also includes a focus on SDGs, and can be found below (Fig. 1):

The three key levers and sub-levers identified for a sustainable business model for banks looking to boost climate work are as follows:

Target. A bank’s target considers who is the bank doing business for and for whom the financial products are aimed. The most impactful levers found in this area were customers and the SDGs.

- Customers are retail and commercial clients for whom the financial offer is directed.
- SDGs refer to those that, according to the Paris Agreement framework, are mainly addressed by the bank and help classify the means to identify the bank’s current and potential stakeholders. Although

long-term elements are usually linked to the strategy and not the model of a business, to track its progress and compare it to the world’s, there should be a constant link between the value proposition, creation, and delivery elements to their sustainable development goal.

The block ‘Key Partners’ from Osterwalder and Pigneur (2010) will not be addressed directly but through the ‘SDGs’ lever as SDG 17. *Partnerships for Goals*.

Sustainable value proposition. This area focuses on what banks can offer. It is important to analyse it through the lenses of the financial offer for the bank’s customers, the attributes that come along with the offer and ensure their proposal, the distribution channels they can count on for the value proposition to reach stakeholders, and the positioning they take towards the world. This last sub-lever, coming from Morris et al.’s (2005) block on external positioning, has been included because of the long-term nature of the concept of sustainability. The transition towards a sustainable model rarely provides short-term outcomes that can quickly prove the applied transformation process; thus, it is necessary to understand how a bank positions itself towards its stakeholders. As a strong sustainable business model should help determine value decisions and their role in ecosystems (Upward & Jones, 2015), having a section explicitly dedicated to positioning will allow banks to understand where they stand and where they would like to stand.

Sustainable value creation. This area looks at the carbon-resilient plan defined by each bank, the collaboration within the different departments, the implementation of such a plan, and whether it is actually followed through and its achievements and impacts measured. As there

Business Model Structure	Osterwalder & Pigneur’s Business Model Canvas, 2010	Principles for Responsible Banking, 2019	GIIN Roadmap for the Future of Impact Investing, 2019
Target			
Customers	Customer segments ✓	Clients ✓	Identity ✓
SDGs	N/A (Partnerships)	Investors ✓	✗
Sustainable value proposition			
Financial Offer	Value proposition ✓	Value proposition ✓	Products ✓
Positioning	✗	External positioning ✓	Behaviour & expectations ✓
Attributes	Customer relationships ✓	✗	Policy & regulation ✓✓
Distribution channels	Channels ✓	✗	Tools & services ✓
Sustainable value creation			
Approach	Key resources, Key activities ✓✓	Human resources, Internal processes and competencies ✓✓	Education & training ✓
KPIs	✗	External positioning ✓✓	Identity, Clear standards ✓✓

Fig. 1. Re-evaluating framework used in this study with current practices. Source: Author.

are many aspects of value creation to be considered, the levers in this section are only focused on the approach, which is understood by combining key activities and resources and the key performance indicators (KPIs). Although these are not found in previous business models, they need to be included to track progress. Through KPIs, improvements in the business model in the short term can be understood, so that banks can be held accountable for their commitments year by year. These tracked outputs eventually lead to desired sustainable outcomes and the effects of business model decisions (Upward & Jones, 2015). KPIs also provide a tool for transparency, which is vital for sustainability.

In addition, the blocks ‘Revenue streams’ and ‘Cost structure’, which address the value capture area of the model, are not included in the SBMS. Although they are both considered a vital part of the model, they will not be studied because of the lack of transparency and information available.

From the comparison, it can be seen that the business model structure is in line with the developed business models as well as current sustainable market practices. Acknowledging that some levers are more strongly supported by previous models than others. The weakest connection between frameworks is in regard to SDGs. However, as one of the frameworks was created long before the SDGs were even thought of, and owing to the drive set by the UN to increase the use of this framework to align individuals, businesses, institutions, and local and global goals, it has been decided that SDGs will be kept as a key lever in the transformation of banks’ business models towards climate finance. Thus, the target, sustainable value proposition, and sustainable value creation of a bank must be examined to determine its efforts in the area.

4.2. Sustainable business model structure for the banking sector

Eight key levers have been identified for the transformation of banking business models towards a climate-resilient economy to create and capture value in a sustainable way, including its customers and all other stakeholders (Fig. 2).

These levers are divided into three areas: targets, sustainable value

propositions, and sustainable value creation. Importantly, the value capture area of the value extraction mechanism is not present in the SBMS. This is due to the expected lack of transparency and disclosure, where the model would be applied, to be able to fully study its implications. All remaining blocks, as introduced by the SBM, should be examined with three pillars of sustainability in mind: economic, social, and environmental. However, because of the complexity of addressing all pillars at once, this study focuses on addressing the economic and environmental pillars when adapting the business models of banks. In addition, we consider implied social effects within the economic pillar.

A **bank’s target** considers who is the bank doing business for and for whom the financial products are aimed. The most impactful levers in this area are customers and SDGs. Customers are retail and commercial clients for whom financial offers are directed. Customer target groups can be seen in a pyramid, as shown in Fig. 3, which is divided by half into retail and commercial.

The above-mentioned classification is based on traditional bank customer segmentation. However, to simplify the model, the target customer groups were divided into five groups: retail, small and medium-sized enterprises (SMEs), large companies, financial institutions, and investors.

SDGs refer to those which, according to the Paris Agreement framework, are mainly addressed by the bank and help classify the means to identify a bank’s current and potential stakeholders. As the SDG framework is becoming increasingly popular, banks should align their strategy and communication to become involved in the pools per region working on the same SDGs. A clear classification of the SDGs on which a bank is working will facilitate and attract communication with stakeholders. Of all the SDGs, 13, 12, 7, 9, 11 and 17 are the SDGs most related to climate finance.

The **sustainable value proposition** focuses on what a bank can offer. It is important to analyse this through the lenses of.

- A financial offer is a product or service in a specific sector provided for a target customer. The sectors were chosen based on the cluster of categories, made by the UNEP Enquiry: Design of a Sustainable

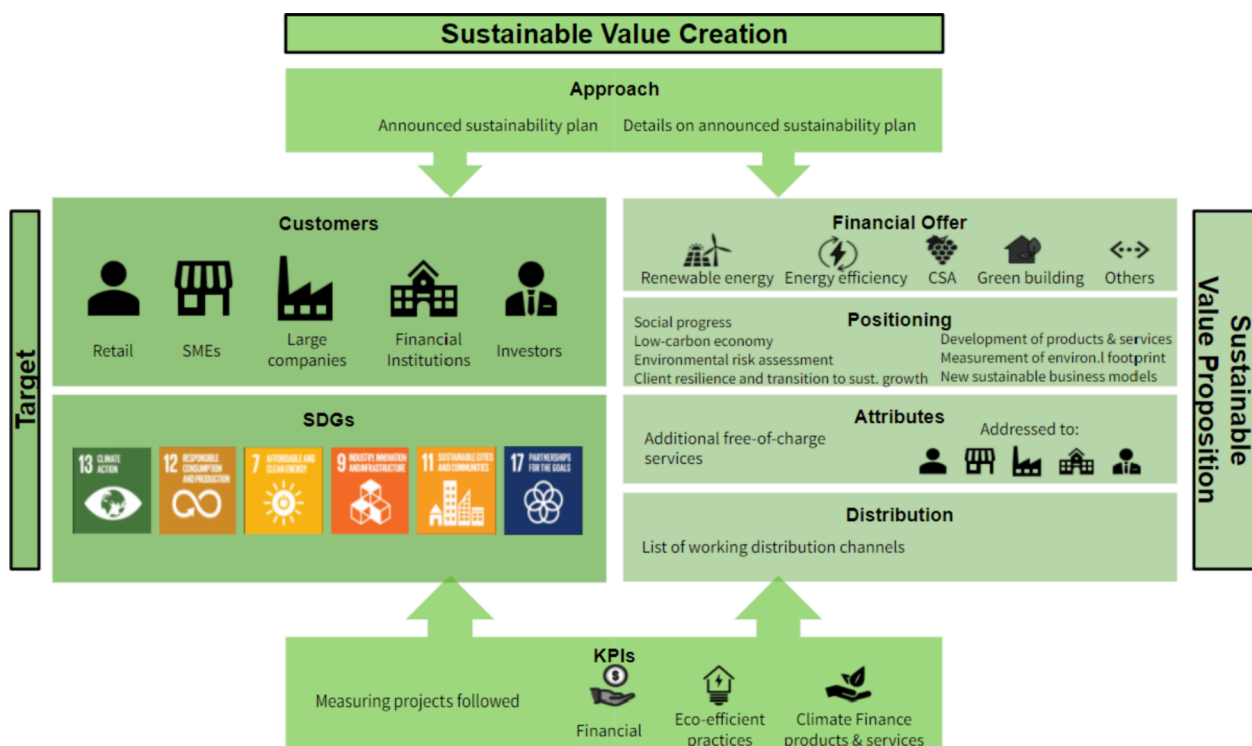


Fig. 2. Business model structure developed for this study. Source: Author.

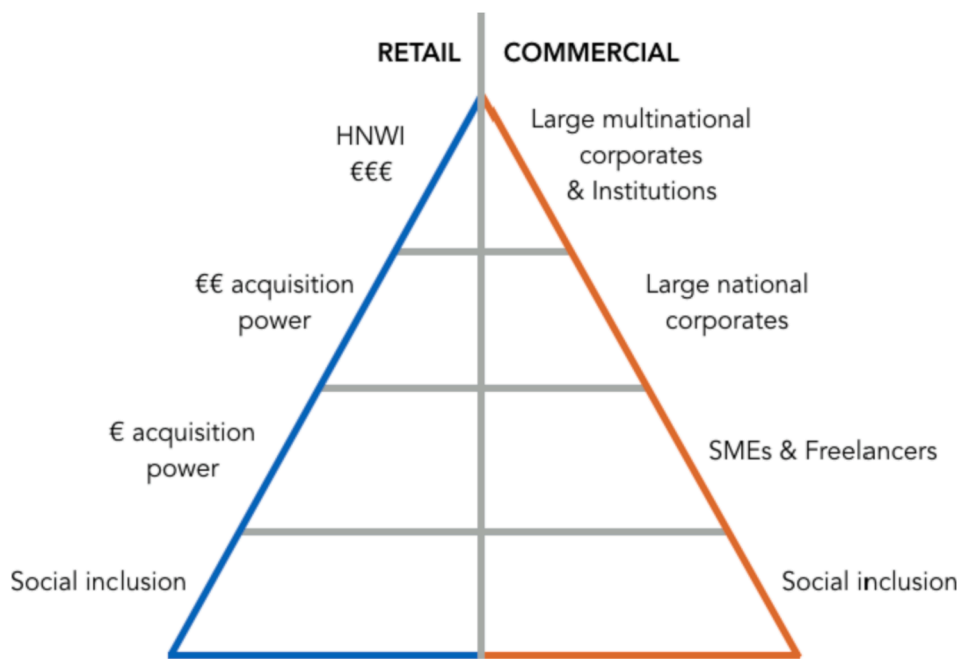


Fig. 3. Traditional bank customer segmentation. Source: Author.

Financial System in line with the environmental and performance specifications looked upon currently when tagging ‘green’ finance. There is no fixed taxonomy, but the cluster gathers areas where there is a consensus. Considering that the banking sector addresses the scope of green finance, these six categories were evaluated. A general study of 30 banks worldwide was performed to identify the most common categories and subcategories. The main categories addressed by banks within climate finance for all the target customers on which this study focuses, and which provided for a target customer are renewable energies, energy efficiency, climate smart agriculture, and green building.

- Positioning refers to the attitude that banks portrait regarding climate finance. Positioning, together with this approach, helps align and all other parts of the model.
- The attributes they possess to ensure their proposal.
- Distribution channels through which products and services are offered to customers and through which stakeholders are informed. The aim of this lever is to identify the necessity of opening new channels and how regular channels can be used for the distribution of new financial offers.

The **sustainable value creation** area considers the carbon-resilient plan defined by each bank. Within all possible levers in this area, the approach and KPIs have been identified as the key:

- The approach refers to the concrete steps taken or willingness to be taken by the banks regarding climate finance, where the focus is currently put, and the chosen combination of key activities and key resources followed by the bank.
- KPIs are key indicators of how climate finance activities, processes, products, and services are progressing, showing what each bank is truly ready to be held accountable for. They can be seen through four lenses: financial KPIs connected to related actions; eco-efficient practices, usually evaluated in ESG analysis; KPIs per product offered; and KPIs per climate finance sector.

5. Case study: Banks’ analysis

In this chapter, the identified business model structure is applied to

the selection of leading global banks in terms of climate finance. Which bank and how each bank works in each of the identified areas are identified. Each bank’s strongest areas have been analysed and highlighted, so that other banks tackling similar areas can work with a starting benchmark.

5.1. Selection of global leading banks in terms of climate finance

A specific criterion was followed to choose which banks to analyse in this study. It consisted of first identifying and categorising how each country addresses climate change, and then selecting the most impactful banks within each country category. Once 40 banks were selected, initial analyses were performed to further understand the market and the possibilities of applying the business model framework.

To select which banks to analyse, a criterion was developed for first classifying countries in relation to climate change. Four main categories were highlighted as most relevant when considering a country’s possible relationship with climate change: most sustainable, most polluting, and most affected by pollution.

Segmentation of countries based on two databases and nine world indices provided different lists per category, mainly depending on the year the report was produced. The indices used in each case are as follows:

- Most sustainable: Top SDG performers, GABV members, Robecosam ESG index, and top sustainable banks;
- Most polluting: Acciona reports, Sustainable Banking Network (SBN) established countries, SBN countries measuring results, World Factbook, and top sustainable banks;
- Most affected by pollution: Countries most affected by single event (1996–2015), countries most affected by climate change owing to basing their economy on agriculture (1996–2015), countries with the most growth potential, SBN established countries, SBN countries measuring results, SBN initiating commitment, and GABV members; and
- Others: SBN established countries, SBN countries measuring results, SBN initiating commitment, SBN emerging, SBN framework implementation, and world finance – most sustainable banks 2014.

For a bigger picture of how countries deal with climate change but not forget the financial factors this study will analyse, the following criteria were applied to create the final list:

- Importance of the country in the continent it belongs to or in a global financial context;
- Population of country; and
- In the case of ‘most affected by pollution’, the index of PM2.5.

Table 2 shows the countries selected, which led to the selection of banks to be analysed.

Banks were selected per country based on their sustainable accreditation and total assets. A list of 40 banks was chosen to be researched with the aim of obtaining a general overview of existing intentions and practices related to climate finance globally. Banks in which information was either not accessible or not in English or Spanish were disregarded. This was the case for many banks whose work took place mainly in the Middle East, in countries such as Qatar or Saudi Arabia, owing to inaccessible data, and other banks from Switzerland, France, or Germany owing to their lack of English reports. All data were gathered from banks’ annual reports, sustainability reports, and websites in 2017.

The aim of this overview is to further understand the market and select five banks, out of the 40 listed, to apply the developed business model framework. Data for each bank were gathered according to the fields listed in Table 3.

By comparing the data and understanding of the market, Santander Bank and BBVA (Spain), HSBC (United Kingdom), ING Group (The Netherlands), and ABN Amro (The Netherlands) were chosen for further analysis for the following reasons:

- having a high international profile, providing worldwide implementation;
- having high business margins and addressing a wide range of sectors to ensure they can be looked upon as future benchmarks;
- addressing both commercial and retail segments to assess all possible customers included in the business model structure;
- the client-focused approach reflects its changing capability and motivation to address climate finance; and
- their management focus on sustainability is either starting to be integrated into the strategy or with an evolving corporate social responsibility department. Banks that have fully integrated sustainability in their strategy are discarded, as the business model structure aims to be useful to those banks transitioning to a more climate-friendly model.
- Sustainability scope focused on green finance, especially regarding energy efficiency, renewable energy, sustainable agriculture, and green buildings, as these are the main areas addressed in the business model structure.

5.2. Banks’ analysis: SBM vs current sustainable practices

The banks selected for the application of the SBMS under these criteria are Santander Bank, HSBC Holdings, ING Group, ABN Amro, and BBVA. An initial framework has been developed to provide a clear overview of each bank, ensuring the bank’s compliance to the described

Table 2 Countries’ selection. Source: Author.

Most sustainable	Most polluting	Most affected by pollution	Others
Germany	Australia	Bangladesh	Argentina
Denmark	Brazil	Honduras	Colombia
The Netherlands	China	Mali	France
United Kingdom	United States	Nicaragua	Spain
Switzerland	India	Pakistan	
		Sudan	

Table 3 Collection of data from 40 selected banks. Source: Author.

Field	KPIs	Segment scope	Sector scope	Sustainability scope
Details	Business margins (intermediation margin, ordinary margin, operating profit)	Commercial (institutional, corporate, SME, social inclusion)	Agro Energy Industry	Renewable energy Energy efficiency Climate Smart Agriculture Green building/ Smart cities
	Cross selling (#prod/client)	Retail (premium, standard, social inclusion)	Services & Commerce	
	Churn rate		Transport	Water management
	Digitalisation margin NPS		Cities & Infrastructure Forestry Waste management	Waste management Transport Social
Field	Sustainable finance management	Green financial offer	SDGs scope	Sustainability ranking
Details	Integrated in the strategy	Assets	SDGs 1–17	Indexes
	CSR department Just marketing/ Greenwashing	Liabilities Services		Ratings

criteria and giving visibility to its general business model before entering into detail its climate finance approach. Next, the SBMS was applied to all five banks, as shown in Fig. 4. A thorough analysis of each lever led to the identification of best practices per lever.

Starting with the business model target, two major customer practices were observed: a general approach for a broad range of customer segments and a specific approach for segments with a good track record. ABN Amro shows a good track record in the first practice with a strong general approach, focusing on its regular strongest client, retail, with a high volume of products/services, while also including many offers to other customers. On the other hand, ING leaves one of its regular strong customers, namely, retail, and focuses all its efforts in a reduced segmentation: large companies where the market is most consolidated. This can be compared with the best-in-class ESG investing strategy. With regard to SDGs, two other practices can be followed: approaching all six climate finance-specific SDGs, as HSBC and BBVA declare to do, which allows them to link SDGs more easily to their objectives and long-term plans; and approaching only specific SDGs, such as Santander Bank, ABN Amro, and ING, which gives them a clearer focus but limits the visibility of their contribution.

For the analysis of the sustainable value proposition, all five banks displayed a clear positioning to tackle climate finance, even though they had different priorities. The 15 most popular products and services with regard to climate finance were found and evaluated from a customer target and a specific sector point of view. BBVA searches for new business models through a low-carbon economy, whereas ABN Amro does so with social progress in mind. All banks have the intention to develop new products and services to broaden their portfolios. Some of these products are more disruptive, whereas others are more similar to traditional ones (Fig. 5). From a global perspective, all five banks show a good practice of being stakeholder-oriented, but little innovation is found in distribution channels.

The sustainable value creation approach taken by banks reveals two main directions: committing to certain objectives and targets in a given timeframe, or committing to yearly targets. Within their activities and processes, each bank defined specific internal areas to address. There is not enough track record to conclude on the best practice under each circumstance, but a set timeframe for the achievement of each

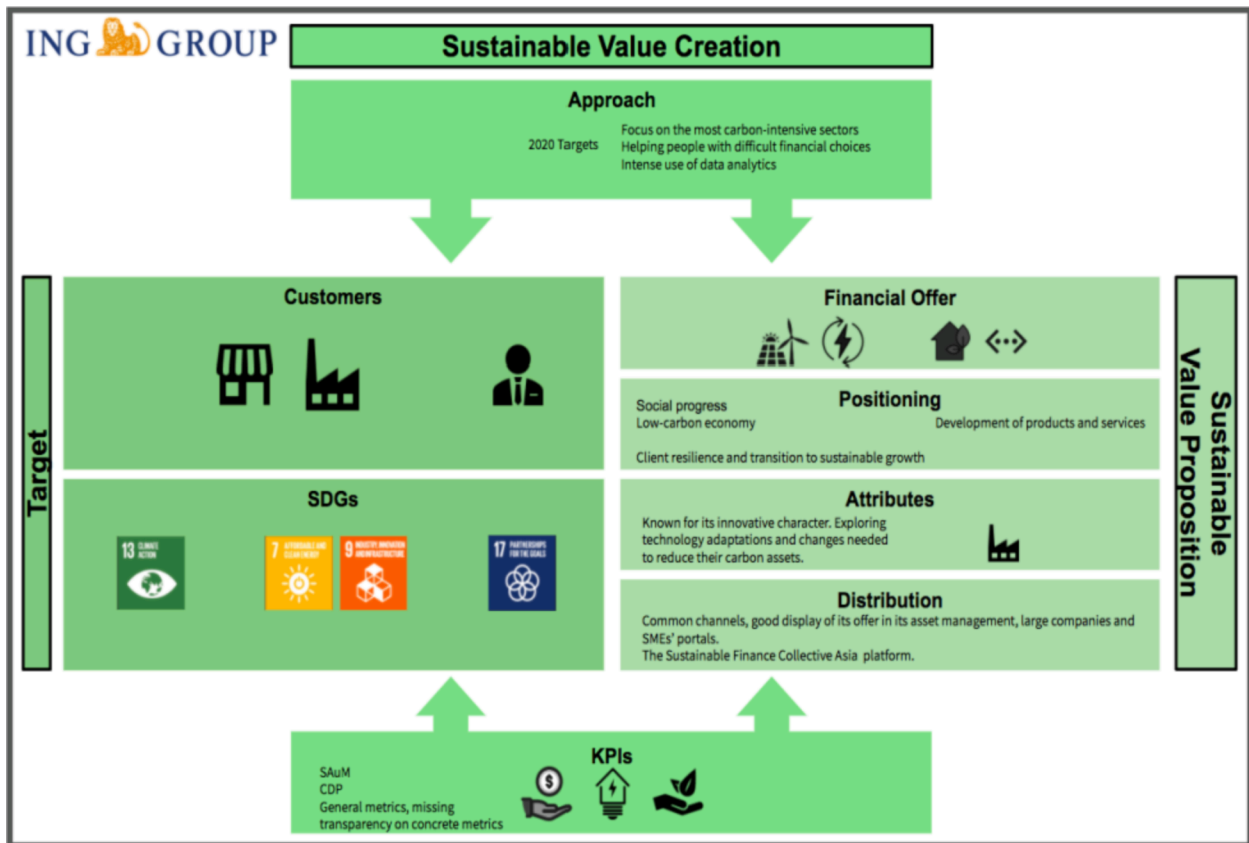


Fig. 4. SBMS applied to the five banks targeted in this study. Source: Author.

	Target					Specific Sector				
	Retail	SMEs	Large companies	Institutions	Investors	Renewable energy	Energy efficiency	Climate Smart Agriculture	Green Building	Others
Financial Offer										
Project Finance										
Mortgage										
Green bond										
Lines of credit										
Revolving credit facility										

Fig. 5. Most popular financial offer when it comes to climate finance per target customer and World Bank recommended sectors. Source: Author.

bank's plan is vital. The developed products, commitments made, and different activities that take place in the context of climate finance must be analysed within a time frame owing to the urgency brought on by climate change.

In reference to the KPIs that track the outputs and outcomes of all the above-mentioned levers, they can be seen through four lenses: (i) general financial KPIs, where no standard or unique connection between these KPIs and climate finance is set; (ii) eco-efficient practices KPIs, where all five banks perform remarkably well by the application and measurement of standardised KPIs with regard to operational footprint, renewable energy, energy efficiency, waste management, water management, and transportation; and (iii) climate finance products and services KPIs, which differ per bank. Many initiatives such as the Montreal Pledge, the Carbon Disclosure Project, or the Platform Carbon Accounting Financials are being implemented to obtain the best climate finance metrics; and (iv) additional climate finance KPIs, where no common practice has been found but recommendations from the Task Force on Climate Financial Disclosure on improving disclosure and transparency are the best adopted to follow in this area, as done by Santander Bank and BBVA.

6. Discussion

The business model structure for climate finance was identified based on Osterwalder and Pigneur's business model canvas (2010). The solution of considering business models as building blocks provided by Osterwalder et al. (2014) is viewed as a template between a firm's strategy and practice, allowing the examination of the value proposition, value creation, value delivery, and value capture, while offering a more systemic perspective and potential interconnections (Norris et al., 2021). The business model canvas can facilitate discussion, debate, and exploration of potential innovations to the underlying business model itself, with users developing a more systemic perspective of an organisation and the potential interconnections from an integrated triple bottom line perspective of value creation (Bocken et al., 2014; Lüdeke-Freund & Dembek, 2017). Hence, it can be quite effective in developing and capturing new ideas for this research (Iheanachor et al., 2021). As our research does not focus on value capture, the study is not affected by the fact that, in practice, environmental and social value can be implicitly overcome behind the canvas' more explicit economic value orientation (Geissdoerfer et al., 2018), which could likely require the development of a different tool (Bocken et al., 2013).

The new framework proposal aims to be useful for any bank looking to expand its business model by transitioning to a carbon-resilient economy.

- Positioning, referring to the attitude banks portrait regarding climate finance, is especially important as it helps identify whether a bank is simply trying to perform 'greenwashing' or if it actually aligns its actions to what it portrays itself to be in the media. Positioning, together with this approach, helps align and all other parts of the model.
- The attributes they possess to ensure their proposal tend to vary significantly depending on the client segment and geographical location. It is mandatory to define attributes with a client-oriented approach and not fall into the trap of reducing costs when expanding by introducing assumptions before testing them in that specific market.
- Customer segmentation and the SDGs, according to the Paris Agreement in 2015, were analysed. The client segments with which client relationships are aimed to be improved by the implementation of climate finance are retail, SMEs, large companies, financial institutions, and investors. Likewise, a selection of those SDGs which are most related to climate finance and can provide the best guidance for the alignment of targets has been made. These SDGs are SDG 13, SDG 12, SDG 7, SDG 9, SDG 11, and SDG 17.

Rauter et al. (2017) argue for the importance of deeper knowledge of the development of business models to allow firms to develop their business models into ones that support sustainable value creation. In this respect, the implementation of SBMs requires more research to gain more insights into the strategies, tactics, and process models involved (Reficco et al., 2018; Caldera et al., 2017; Bocken et al., 2014).

6.1. Implementing the business model structure provides good initial and in-depth insights

The business model structure and its key levers, given the information available, have been identified based on the value-based approach (Osterwalder et al., 2005; Osterwalder et al., 2014; Osterwalder & Pigneur, 2010). Therefore, a non-extensive taxonomy and codification of the documentation have been created for each commercial bank. Yip and Bocken (2018) studied the SBM archetypes in the retail banking industry in Hong Kong. This study provides further details on how banks approach the realisation of these SBM archetypes, as all eight of the SBM archetypes from the original work (Bocken et al., 2014) were found and validated, but the dominant empirical focus is on the energy, manufacturing, and food sectors (van Bommel et al., 2020).

Fig. 2 shows the business model structure at a quick glance and can serve banks to easily check what they are currently doing with regard to each of the levers. While doing this exercise, it will be clear, by the lack of input or difficulties in figuring out what to write down, where the main gaps and challenges the bank needs to overcome.

When this exercise was performed after a thorough analysis of the selected banks, one of the key conclusions gathered was the different focus and, sometimes, incoherences that could be deducted from each bank:

- Santander Bank states its pioneer spirit and continues its diversification strategy per customer segment and region by developing specific new products and services for specific customers and regions. The attributes accompanying the offer are not segmented and focus more on the strength, loyalty, and trust of the bank as a whole. Furthermore, there is a slight inconsistency regarding the SDGs, as the bank mentions tackling SDG 17. *Partnerships*, but not as its main focus, while its reports continually refer to the work put towards different partnerships and collaborations.
- HSBC focuses on developing internal protocols and metrics by creating the HSBC Center of Sustainable Finance. While in the process of research by its institute, it has already adopted global tools such as the Montreal Protocol and the help of the Task Force on Climate-Related Financial Disclosures, showing a strong commitment to the attainment of its climate-related goals. Even though the volume and variety it ranks second among the studied banks, by leaving the responsibility of climate finance in the hands of its centre, rather than to each existing department, sustainability is not integrated in their culture, and the changes are adopted as a long-term trend and opportunity.
- ING has a surprising approach, as its innovative and client-oriented attributes do not address the development of new products for their regular customers, but are based on the development of technology to improve the service of those products that are already on the market and have a track record. Thus, taking a much more conservative approach, it addresses the best market players at sustainability, reinforcing and encouraging their work, but leaves behind those who need initial support to change their business models.
- ABN Amro, being the smallest bank of the studied, shows the highest dedication towards developing products and services in different sectors and offering a dedicated commitment to energy efficiency as its main attribute. The banks' new developments are directly focused on their main clients and, more specifically, on mortgages. Within their main context, the Netherlands is part of the Partnership for

Carbon Accounting Financials and positioned as leaders with regard to mortgages, from its application to evaluation. However, the bank displays little transparency when it comes to its actual metrics and the realisation of its climate finance-related KPIs.

- BBVA commits to climate finance through its Compromiso 2025 plan, betting highly on transition. However, it does so after several years of addressing the market, showing thoughtfulness and a conservative risk profile. The tardiness in formalising its plan is reflected in the measurement of the progress obtained. It uses good indicators, such as the amount of carbon-related assets and energy labels, but fails to implement standardised global tools, such as the Montreal Protocol, Equator Principles, or Carbon Disclosure Project framework.

That said, it is impressive to see the effort, work, and resources that have been mobilised to transform the business model of these banks towards a climate-resilient economy. These sustainable activities can contribute to SBM development and innovation, describing practices not only as the fundamentals of a sustainable transition (Shove et al., 2012), but also as evidence of such a sustainable transition in society and business (Boons, 2016; Shove et al., 2012). In this way, sustainability-related activities are the constituent parts of large-cap firms' sustainability efforts and an important indicator of business model transition. In literature on the potential role of SBMs in wider transitions, the business model approach is particularly useful (Zott & Amit, 2010) because large banks may only start to radically innovate from a smaller scale as a pilot scheme to test radical business models where the risks are more contained (Yip & Bocken, 2018).

6.2. General guidance and best practices per lever have been identified

From the application of the business model structure, a collection of best practices has also been developed as part of the conceptualisation of SBMs (Stubbs & Cocklin, 2008; Khizar et al., 2022). While the question of whether the target customer should be the bank's most or least important client is left for each bank to decide on their approach, it is encouraged to address all six SDGs identified in this study. We expect that the approach of examining sustainable business activities as the constituent parts of SBMs can provide sustainability measures or indicators that assess the outputs and effects of business model decisions on the value being created or destroyed and distributed among stakeholders (Rebai et al., 2016). In this sense, understanding the ways in which businesses can contribute to transitions to sustainable development that are operationalised through the SDGs is essential (de Villiers et al., 2021).

The SDGs global framework as well as the National Contact Points per country can help expand, and then, focus, on the path each bank wants to follow per customer segment and per region. Regarding financial offers, this study identifies products and services in two main categories:

- products and services more easily adaptable and with track records: Project finance, savings accounts, and pension funds; and
- innovative products and services: lending tools, mainly revolving credit facilities, mortgages, advisory services, and partnerships.

The attributes that come with these offers should be partly global and partly specialised. The needed trust and strength can be better portrayed with a global image of the bank, while specialised attributes will encourage businesses and people to take the initial step to transform their models and behaviours. Banks' positioning regarding climate finance also contributes to the encouragement of their clients (Shams et al., 2019) but the offer should be easily available and obtainable.

It is too early to determine whether the best approach is this, but a general consensus can be found for the need of a timeframe with specific numeric targets (Geibler et al., 2019). Analysing the KPIs of all five

banks, a good commitment in regard to their direct emissions due to building, waste, and transport has been found. However, their commitment towards the indirect emissions they aim to reduce, given their current plants, is not clear. By following the Montreal Protocol (HSBC), the Equator Principles (Santander Bank and HSBC), or the Carbon Disclosure Project guidelines (ING Group), the process made with regard to specific investment funds or project finance can be tracked. Nonetheless, out of the 26 indicators studied that relate to climate finance, proper measuring mechanisms have not been set for six, and discrepancies or lack of data transparency can be found in 17. To track these targets, good KPIs must be set and measurement mechanisms must be applied.

6.3. Challenges for the banking sector

While guidance on the transformation of a bank's business model to a sustainable one has been obtained, challenges and future opportunities for reference banks have also been identified.

- There is a need for more innovative products with a client-focused approach that ensures their level of fit by segmenting per customer type and region. These products should be backed up with specialised attributes of the triple dimension of sustainability: economic, social, and environmental (Shams et al., 2019).
- Advisory services regarding how to transform one's business model and regarding the physical and transition risks climate finance entails are needed for all clients. Climate finance values should be embedded in all banks' culture and for employees to be fully trained on the subject (Ritala et al., 2018), although some organisations are more open to change than others (Bouncken et al., 2020).
- Partnerships should be further promoted, as useful results with a good track record have demonstrated so (Upward & Jones, 2015)—for example, the partnerships for project finance and the Partnership for Carbon Accounting Financials metric sharing alliance.
- There is a very little innovation in the distribution channels; thus, there is an opportunity to open new channels to attract a bigger audience (Edvardsson et al., 2000). Common channels should also be updated for the information and acquisition of new products and services to be easily available (Goncearuc et al., 2022).
- Standardised metrics are required. While it is important that each bank determines the best metrics to analyse the progress of each of their products, there are many common points that should follow a standard (Geibler et al., 2019). Such a standard can help to identify where and how the best progress can be obtained. Public bodies contribute to initiatives such as European Taxonomy, but further work is needed (Zhang et al., 2020; Hao et al., 2022).
- The Task Force on Climate-Related Financial Disclosures recommendations after the first analysis of volunteer banks focused on improving the transparency of results and metrics in bank disclosures. The three banks that received this recommendation indeed had a higher transparency of data. Thus, public-driven initiatives present themselves as a successful means of ensuring the transparency of data and metrics.

7. Conclusions

A business model framework was defined to serve as a tool for banks seeking to become catalysers of climate finance. The resulting SBM framework provides good initial and in-depth insights by offering two different perspectives of analyses: (a) a holistic view and (b) detailed key levers and sub-levers to transform the business model of a bank towards a carbon-resilient economy and to achieve share value creation for different stakeholders. The conceptual model is the main contribution of this research, and its application to five reference global banks undergoing a business model transition towards climate finance has led to the understanding that banks with such a profile should be the ones to

catalyse climate finance.

Based on the proposed SBM, a discussion of the gap between sustainability strategy formulation and implementation was developed. Research reveals the new products and services which may help bridge this gap and contribute to a better understanding of the mechanisms underlying the SBM. This, in turn, would ensure sustainable solutions to social and environmental issues. However, the famous concept of greenwashing plays a role in this area, as it questions the real intention and dedication of managers to reduce their direct and indirect emissions.

Based on the practical application of the SBMS to five reference global banks (Section 5), this study shows that the SBM framework can provide a detailed qualitative overview of a particular business through standardised KPIs per product, ongoing challenges to address, and managerial opportunities. Nevertheless, the scarcity of alignment among banks to employ the same measurement mechanisms and the lack of metrics for other products, services, and non-financial attributes bring to light a breach between intention and reality.

As the case study analysed herein is exploratory, future research efforts can be oriented towards incorporating primary sources in the identification and application of SBMS. For advancement in the implementation of climate finance into banks, further study and specification of the SBMS per sector recommended by the World Bank could be performed and the empirical focus of these investigations could be expanded to more countries. The SBMS could be applied to the five selected banks every-three years to reflect the long- and short-term point of view within sustainability, study the developments in the area, and track future challenges to be overcome.

CRedit authorship contribution statement

Mercedes Grijalvo: Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Carmen García-Wang:** Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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