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CLIMATE CHANGE AND CLIMATE FINANCE IN THE BANKING INDUSTRY





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INTRODUCTION

1. The climate change legislation context

In the COP 26 in Glasgow (November 2021, <https://ukcop26.org/>), the adhering countries confirmed the pursuit of the goal of limiting global warming to 1.5 ° C compared to pre-industrial levels and the achievement of net emissions equal to zero by 2050 (*net-zero* strategy).

The issue of climate change and the reduction of global emissions is under the lens of the stakeholders of the financial sector but also of governments and regulators.

European Union has adopted important measures to direct financial flows towards sustainable investments through the:

- Action Plan: Financing Sustainable Growth¹ (March 2018)
- Green Deal² (December 2019)

These measures support the three pillars of sustainability (ESG disclosures) in risk management practices, promoting corporate disclosure transparency and correct medium-long term strategies.

Europe has pursued transparency mainly with various regulatory interventions including:

¹ <https://eurlex.europa.eu/legalcontent/EN/TXT/HTML/?uri=CELEX:52018DC0097&from=it>

² https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_it

- Regulation (EU) 2019/2088³ (EU (Sustainable Finance Disclosure Regulation) entered into force in the March 2021
- Regulation (EU) 2020/852⁴ (Taxonomy Regulation)

The first regulatory act is aimed at minimizing greenwashing by requiring complete disclosure in terms of sustainable products and investment procedures.

The second provision introduced a common classification framework for economic activities that contribute to the transition from a carbon-intensive to a low-emission economy.

In such context, the financial sector needs to make careful analyses of the climate and environmental risks evaluating its exposure in the medium and long term as well the sector himself and the asset exposed.

To determine how the effects of the climate change will affect the financial sector, the European Central Banking (ECB) proposed the:

- Guide on Climate-related and Environmental Risks Risk⁵ (November 2020)

Banks needs to “*define and implement the strategy to tackle climate change and creates a more suitable context in which operates*”.

Such assessment can be strengthened through scenario analysis: the *Task Force on Climate-related Financial Disclosure*⁶ (TCFD) recommends the use of a scenario analysis precisely in order to assess the connected risks.

The two types of main risk (physic and transition) are evaluated through the scenario analysis tool with the purpose of “*measuring the adequacy of climate strategy and support the communication*”⁷.

³ <https://eur-lex.europa.eu/legal-content/IT/ALL/?uri=CELEX:32019R2088>.

⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0852&qid=1666954575650>.

⁵ <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks-58213f6564.it.pdf>.

⁶ <https://www.fsb-tcfd.org/>.

⁷ The UN has also drawn up the Principle for Responsible Investment (PRI) which, however, are voluntary standards whose adoption is left to the sensitivity of companies.

The TCFD, established by the Financial Stability Board, constitutes the world benchmark and this research wants to address the sustainability reports of the listed banks on the FTSE All-share index of the Borsa Italiana through three hypotheses.

The hypothesis tends to verify the environment disclosures of the banks reporting as follow:

- a. *how* and whether physical risk (acute and chronic) is reported;
- b. *how* and whether transition risk (legal, technology, market and reputational) is reported;
- c. *how* and whether scenario analysis is conducted.

The technical aspects of climate changes: a brief reminder

Climate change is caused by the increase in the concentration of greenhouse gases in the atmosphere that allow incoming solar radiation to pass but hinder infrared radiation from the Earth.

The increase in the concentration of greenhouse gases determines the increase in the average global temperature of the planet, with devastating effects on the entire climate system.

The greenhouse effect was first described by Fourier in 1827, the details were worked out by John Tyndall in the 1860, and in 1896 Svante Arrhenius calculated that burning fossil fuels would increase the concentration of carbon dioxide in the atmosphere and that this would increase the greenhouse effect and warm the planet⁸.

As a matter of science, climate change depends on data availability and represents a “*multifaceted, non-linear and complex phenomenon of our time*”.

The Intergovernmental Panel on Climate Change (IPCC), the international organization body that evaluates the scientific aspects of climate change, concluded that it is anthropogenic (*human induced*); the IPCC sequence of key findings can be schematized as follows⁹

⁸ Carbon dioxide is by far the most important substance in changing the Earth's energy balance.

⁹ Notes and lessons of Oxford Climate Society.

- IPCC (1990) “*Broad overview of climate change science, discussion of uncertainties and evidence for warming*”;
- IPCC (1995) “*The balance of evidence suggests a discernible human influence on global climate*”;
- IPCC (2001) “*Most of the warming of the past 50 years is likely (>66%) to be attributable to human*”;
- IPCC (2007) “*Warming is unequivocal, and most of the warming of the past 50 years is very likely (90%) due to increase in greenhouse gases*”;
- IPCC (2013) “*It is extremely likely that human activities caused more than half the observed increase in global average surface temperature from 1951–2010*”;

This risk to which the traditional time series is not applicable analysis due to a lack of data at a global level, requires urgent and immediately actions by governments, regulators and people as well as new types of topic analysis.

The research

The research applies *text data mining* and *supervised technique* to extract knowledge and constitutes a mixed method of research: application of quantitative techniques to qualitative data.

It is made up of 4 Chapters:

- an Introduction
- the first chapter is a literature review: “*Scenario Analysis and Climate Change: a Literature Review via Text Analytics*” presented to *International Conference on Sustainability Analysis (ICSA)*, Sapienza University of Rome Department of Social Sciences and Economics, Rome 14–15 July 2022
- the second chapter is made up from the corpus analysis of the sustainability banks reports listed on the FTSE All-share of the Borsa Italiana for the period range 2020–2019 and was introduced with the title “*Our Common Future: Climate Change, Climate-related Financial Disclosures, Transition Risk, Physical Risk and Scenario*”

Analysis in Banking Sector” at the 15th ANNUAL CONFERENCE OF THE EUROMED ACADEMY OF BUSINESS “Sustainable Business Concepts and Practices” University of Palermo, September 21st – 23rd, 2022, Palermo, Italy

- the third chapter is made up from the analysis of the sustainability bank reports listed on the FTSE All-share of Borsa Italiana for the period 2021–2020
- the fourth chapter is a short methodological note with suggestions for new research trajectories

To the research it was not possible to apply Machine Learning techniques due to the small size of the available corpus ¹⁰.

The attachments of this work consist of:

- Annex 1 – Corpus of Sustainability Reports year 2021–2020 (after pre-processing and lexicalisation)
- Annex 2 – Corpus of Sustainability Reports year 2020–2019 (after pre-processing and lexicalisation)
- Annex 3 – Active Forms Matrix year 2021–2020
- Annex 4 – Active Forms Matrix year 2020–2019

The other tables/matrices that the Iramuteq software (www.iramuteq.org) elaborates have not been included by choice in order to save paper¹¹ in the final printing phase, they are available on request at the e-mail address d.aversa@outlook.it.

¹⁰ Research has mainly focused on the risk and not on the opportunities offered by climate change.

¹¹ Ecological choice.

CHAPTER I

SCENARIO ANALYSIS AND CLIMATE CHANGE: A LITERATURE REVIEW VIA TEXT ANALYTICS

ABSTRACT: Climate change affect bank sector and financial organizatins and in order to tackle the global challenge and limit the impacts are used scenario analyses providing *forward looking* measures and narratives of future state of the word to companies and stakeholders in this specific sector. This work aims to provide an indipendent and rigorous literature review on the topic of scenario analysis and climate change analyzing a large set of referred papers included in economic journals on the Web of Science Clarivate Analytics datasource.

The work utilises 416 abstracts and relative titles in the field of economics applying text analytics for qualitative variable and carrying out descriptive statistics and lessicometric measures, similarities analisys and clustering with hiearchical method of Reinert to extract knowledge. In addition, *qualitative content analys* enables the return of a comprehensive and complete universe of meaning together with the analysis of co-occurences.

Content analysis reveals three main clusters of classification and four unknown patterns: area of models, risks, emissions and energy, and carbon pricing, showing the research directions and its limits. through an overview with extensive reference bibliography. In the research, the prevalent use of quantitative instruments and its limitations emerges, while qualitative instruments are residual for climate change assessment, also the centrality of transition risk over adaptation measures and the combination of different types of instruments with reference to carbon pricing.

Scenario analysis is a topic relative recent in finance and management research and its underinvestigated by the academy. The analysis combine quantitative and qualitative research (*mixed approach*) applying *data mining for text* combined with the use of the supervised technique it extracts information moving from a frequency to a relational approach.

KEYWORDS: Scenario analysis, climate change, text analytics, multivariate analysis, quantitative and qualitative research, mixed approach.

In the contest of recovery post pandemic, climate change (IPCC¹² and UNFCCC¹³) is an interconnected (Pörtner, *et al.* 2022) and global issue (Stranadko, 2022), a planetary process in which its elements interact in “*non-linear and complex*”¹⁴ way requiring a *system thinking approach* (Johnson, Papi-Thornton & Stauch, 2019) to address the solutions. As a matter of emergency, a problem of immense risk (Stern & Stiglitz, 2022), uncertainty (Taylor, 2022; Chenet, Ryan-Collins & van Lerven, 2021; Eory, Butler & Moran, 2018) financial risk and stability (Ebner, 2018), this not-linear¹⁵ and not incremental global process entails the evaluation of risks and opportunities (Rising, 2022) asking for solutions through innovation and technology and better information. The climate emergency (CE) derives from the “*depletion of natural resources and increased emissions*” (Ramani, 2020) causing “*negative consequences such as flooding, drought and extreme weather events*” (Nunn, *et al.* 2019). The interconnectivity “*beyond the causal relationship of human activities*”¹⁶ has pushed the United Nations Sustainable Development Goals (UN SDGs) to highlight the nexus between the SDG 13 on climate change and its relation to any other SDG in a complex way.

Climate change is anthropogenic, it is a change in the state of climate, and could be better expressed as “*a change in the mean and (or)*

¹² <https://www.ipcc.ch/report/ar6/wg2/> and (Howarth & Viner, 2022).

¹³ <https://unfccc.int/>.

¹⁴ This means that “*an event of one element can involve numerous others*”.

¹⁵ “*The key distinguish feature of the non-linear relationship together with globalisation determines the greater interdependence of different systems*” (Arnold & Wade, 2015).

¹⁶ Oxford Climate Emergency Programme, University of Oxford.

variability of the properties of this state” measured in multidecadal period (GARP, 2022). The Framework Convention on Climate Change (UNFCCC), in its Article 1, defines climate change as: “*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*”.

Scenario analysis (TCFD, 2017, 2021¹⁷) is a planning tool, a narrative on “*potential future state of the world*” and a conditional prediction that appeared academically in 1950 and requires some decisions about the setting of *parameters* and (or) *assumptions*, the choice of *analytical tools* and *outputs*. The use is for strategy and stakeholder communication to investor and regulators, it responds to both related physical impacts of climate change (physical risks) and the zero-carbon economic transition (transition risks) the two main types of risk that describe climate change

Scenario analysis varies quite significantly between both risks and also for this we use “*global reference scenarios*”¹⁸ that is, “*agreed and widely used projections of future emissions*” sometimes with socio-economic narratives attached. The most universal scenarios are from the IPCC¹⁹ (The Intergovernmental Panel on Climate Change) and include “*representative concentration pathways*”²⁰ also named “RCPs” (van Vuuren, 2011) and “*shared socioeconomic platforms*” (SSPs) incorporating socio-economic projections up to 2100 (Riahi, *et al.* 2017), “*they are used to derive GHG emissions scenarios with different climate policies*” (Rogelj, *et al.* 2018). Other important providers of reference scenario are the International Energy Agency (IEA), Greenpeace, IRENA, and the Network for Greening Financial System (NGFS).

¹⁷ <https://www.tcfhub.org/>.

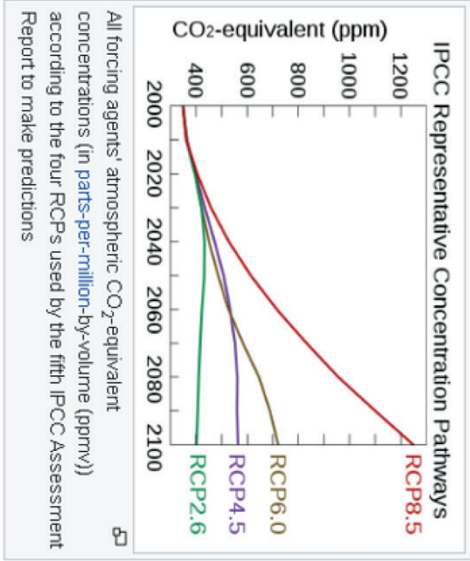
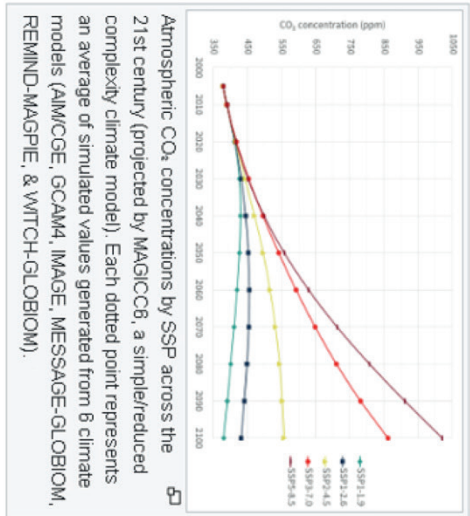
¹⁸ Global references scenario are a set of standard and cross-comparable scenarios.

¹⁹ The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change (<https://www.ipcc.ch/>).

²⁰ RCPs is a “*greenhouse gas concentration (not emissions) trajectory adopted by the IPCC*” (Van Vuuren, 2011).

Transition risk scenario analysis can make use of integrated assessment models (IAM's), "*economic models that also include representations of societal and environmental phenomena and sector-specific decarbonization pathways*" (GARP, 2022), physical risk scenario analysis instead uses physical climate models, but it also benefits from resilience planning. Additionally, the Task Force on Climate-related Financial Disclosure (TCFD) recommended scenario analysis as a way to "*enhance critical strategic thinking*" for companies using *plausible, distinctive, consistent, relevant, and challenging* scenarios. From a "nice to have" instrument to a best practice, scenario analysis is increasingly being implemented by, and even mandated by, regulators. These latter adopted *stress test*²¹ in the wake of financial crisis of 2008 and they model "*the reaction of both a financial system as a whole and an individual institutions' balance sheet to a hypothetical shock*" relying on scenario analysis (Ebner, 2018).

²¹ Various central banks, including the ECB, do stress tests with varying degrees of granularity and distinct climate and political scenarios.

Table 2 · Representative Concentration Pathways (RCPs)**Table 3 · Shared Socioeconomic Pathways (SSPs) of Carbon Dioxide**

1. Introduction and methodology

The literature review is based on a monolingual (english) *corpus* consisting of 416 texts corresponding to as many abstracts extracted from Web of Science Clarivate Analytics in the period between the years 2015 and 2022. The query theme consists of two keys “*scenario analysis*” and “*climate change*” related to the economic journals in the mentioned data source.

The contents were saved in text format (UTF–8 coding) for automatic analysis. Each text was accompanied by the text partition key variables indicated below:

- a) Identifier: ****number
- b) author: *author_author name
- c) year: *year_number
- d) source: *source_journal name

Example of a trace:

****0007 *author_clark *year_2019 *source_journalofappliedcorporatefinance

The corpus preparation took place with a cleaning phase in the pre–processing and once the parsing was completed, it was analysed following this steps:

- a. calculation of the main lexicometric measures for validation;
- b. study of the corpus vocabulary;
- c. similarity and co–occurrence analysis (maximum tree graph construction and identification of semantic regions of meaning);
- d. application of Reinert’s classification technique for the identification of semantic clusters and discussion of the groups identified;
- e. use of the qualitative content analysis technique.

It is specified that it is not convenient to carry out analyses of lexical specificities and correspondences since the high number of sources and the relative brevity of the texts in the corpus make cross–analysis of the