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"LOW-CARBON TRANSITION FOR ITALIAN CHINESE COMPANIES: IMPACT OF TRANSITION RISKS OF NORMATIVE ORIGIN ON THEIR OPERATIONS AND GOVERNANCE"

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ABSTRACT

Transition risks of normative origin are a subset of the climate-related transitions risks, the research on climate-related risks however is largely focused on their impact on finance. Italy and China share strong relational and economic ties: companies operating in both markets that are subject to the sustainable reporting requirements in both jurisdictions could be subject to the misalignment in reporting practices and standards, unavailability of data, and misalignment of carbon taxes regulations. Sustainable reporting is a practice that is becoming more common, especially in Europe, but that is taking foot also in China. It consists in the disclosure of financial and non-financial information, which could be also financially material for the reporting entity and materially impacting its stakeholders. The study of how exposed to transition risks of normative origin are Italian businesses which have a subsidiary in China is an unexplored and new topic. Moreover, it is significant in today's context. To forecast what are the risks stemming from the differences in the sustainability reporting laws and carbon laws between China and Italy will be highly beneficial for businesses. If able to identify those differences, they will avoid a series of cascading effects that derive from the unawareness of the peculiarities in the respective laws and help reduce the risk of greenwashing.

This thesis is a study of how Italian-Chinese companies are exposed to distinguished transition risks as a consequence of the change in their operation and separate sets of sustainability-related policy and legislation. For this dissertation the Company law of the People's Republic of China, the Securities Law of the People's Republic of China and the draft Guidelines n.14 on reporting of sustainable information published by the China Securities Regulatory Commission will be compared with the Directives that have been published in Europe on the same subject. The misalignment in the requirements by the laws will be used as a driver to explain the origin of transition risks of normative nature. More specifically, comparative climate change policy and laws will be identified and the origin of climate-related transition risks will be explored. A comparative analysis of sustainability reporting laws in China, Europe and Italy will be carried out. Lastly a questionnaire has been distributed to Italian companies which have subsidiaries in China to establish a mechanism to measure the impact which is due to the exposure of transition risks of normative origin.

Key words: Laws and Regulations in China and Italy; Sustainability Reporting; Laws; Comparative Study; Transition risks; Climate Change.

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ABBREVIATION

AR: Assessment Report
BAU: Business as Usual.
CBAM: Carbon Border Adjustment Mechanism.
CGT: Common Ground Taxonomy.
CSDDD: Corporate Sustainability Due Diligence Directive.
CSRD: Corporate Sustainability Reporting Directive.
EDG: European Green Deal
EFRAG: European Financial Reporting Advisory Group.
EIBG: European Investment Banking Group.
ESG: Environmental, Social and Governance.
ESR: Effort Sharing Regulation.
ESRS: European Sustainability Reporting Standards.
ETS: Emission Trading Scheme.
EU: European Union.
GHG: Green House Gasses.
GRI: Global Reporting Initiative.
IAMs: Integrated Assessment Models.
IPCC: International Panel on Climate Change.
ISIC: International Standard Industrial Classification.
ISSB: International Sustainability Standards Board.
KPIs : Key Performance Indicators.
LTTG: Long Term Temperature Goal.
MAGICC: Model for the Assessment of Greenhouse gas Induced Climate Change.
MSCI ACWI: Morgan Stanley Capital International All Country World Index.
NDCs: Nationally Determined Contributions
NFRD : Non-Financial Reporting Directive.
NGFS: Network for Greening the Financial System.
NZBA: Net Zero Banking Alliance.
PC: Performance Categories.
PRC: People’s Republic of China.
RCPs: Representative Concentration Pathways.
SSP: Socio Economic Pathways.
TCFD: Task Force of Climate related Disclosures.
TFEU: Treaty on the Functioning of the European Union.
UNEP: United Nations Environment Program.
UNFCCC: United Nation Framework Convention on Climate Change.
XBRL: eXtensible Business Reporting.

INTRODUCTION

The low-carbon transition refers to the economic and social transformation that began when the international community recognized the significant impact of climate change on our lives. This awareness prompted the international community to convene and establish a set of objectives that must be accomplished in order to prevent the occurrence of catastrophic disasters that would have adverse effects on our economy and result in bad consequences for our lives. As a result of the agreements and establishment of specific goals, the economy had to shift towards a more environmentally friendly approach to conducting business. This transition is generating disruptions of different type, which in turn gave rise to what are known as climate-related transition risks. These dangers might vary in nature and have varying implications. Current research has primarily concentrated on physical climate risks and the financial implications of transition risks. The objective of this dissertation is to examine the normative transition risks that arise from the policy misalignment in sustainability reporting requirements between China and Italy. Specifically, I will discuss the effects that Italian undertakings have on their Chinese subsidiaries, where they exert control over their activities. The objective of this research is to determine whether there are significant transition risks of normative origin faced by individuals or organizations due to the differences in sustainability reporting requirements between European and Italian legislation on one hand, and Chinese legislation on the other hand. To achieve this objective, the dissertation will be organized into the following sections. The initial chapter will concentrate on the progression of climate change and the reasons behind the involvement of the world community. It will provide a concise scientific explanation of the causes of climate change and an outline of the threats associated with it. The second chapter will specifically address the nature and genesis of transition risk. It will cover the various areas that are impacted by these risks and explore the components that contribute to these risks. Furthermore, this classification will identify the constituents of normative transition hazards. The third chapter will focus on a comparative analysis of the sustainability laws in China, Italy, and Europe. This analysis will specifically examine the policy instruments employed to regulate sustainability disclosures and imports, and assess their influence on the exposure to transition risks. The last chapter will focus on a survey that will be utilized to analyze data and determine the appropriate methods for measuring the effects of various transition risks.

CHAPTER 1: THE TRANSITION TO A LOW CARBON ECONOMY

1.1 Climate Change today

The present discussion on climate change has been thoroughly analyzed in academia and society, with a comprehensive grasp of the underlying scientific concepts, the identified causes, and the proven consequences of not taking action. However, despite the indisputable reality that our progress has been characterized by the extraction of fossil fuels as the main driver of imbalances in the Earth's atmosphere, their continued use worsens the problem of climate change. The historical account of fossil fuels can be described as a combination of success and hardship. It is important to acknowledge that one's activities have played a crucial role in driving progress and development. However, it is also worth mentioning that these accomplishments have come at a cost. While not an immediate result, its consequences will impact future generations. The present scientific discussion on climate change has highlighted the crucial need of following the carbon budget to effectively achieve the climate goals outlined in international agreements. Nevertheless, the data, although unambiguous, does not support this tendency. I firmly believe that the procedures involved in shifting towards a low carbon economy will ultimately redirect the discussion away from financial profits and towards the influence and consequences.

1.1.1 The greenhouse gas effect

The shift towards a low-carbon economy has garnered attention as a result of the alarming progression of climate change. The earliest indications of climate change may be traced back to 1896, when Swedish scientist Svante Arrhenius conducted research that first proposed the idea that altering the levels of carbon dioxide in the atmosphere might significantly impact surface temperature due to the greenhouse effect. Despite the growing awareness of the potential negative impacts of fossil fuels in the 18th century, their efficient yet detrimental use continued to thrive. In fact, the production and utilization of fossil fuels experienced a significant surge during the 18th and 19th centuries.[1] The production of fossil fuels themselves is not necessarily harmful, or to better say the greenhouse effect itself is not harmful, without it the earth will be too cold to live on.[2] What has been harmful was the greater concentration of greenhouse gasses due to the over exploitation of fossil fuels which in turn released

[1] Melanie Ades et al., "State of the Climate in 2018," *Bulletin of the American Meteorological Society* 100, no. 9 (September 2019): Si-S306, https://doi.org/10.1175/2019bamsstateoftheclimate.1.
[2] Donald J. Wuebbles and Atul K. Jain, "Concerns about Climate Change and the Role of Fossil Fuel Use," *Fuel Processing Technology* 71, no. 1–3 (June 2001): 99–119, https://doi.org/10.1016/s0378-3820(01)00139-4.

greater amount of carbon dioxide than the earth could process.[3] The primary inquiry to consider is the rationale behind labeling this economic shift as a "low-carbon" transition. The solution lies in the scientific evidence that supports the conclusions drawn from years of research on climate change. Let's begin with the balance that was mentioned earlier. The climate system of the Earth maintains equilibrium, meaning that the Earth system is in balance when the solar energy absorbed is equal to the radiation emitted by the Earth and the atmosphere. The factor that can undermine this balance is called radiative forcing agent [4]. There are different elements that can be categorized as a radiative forcing agent but the ones that are deemed the most impactful ones are the greenhouse gasses. They have been found to be the likely cause of the change in the radiate force more than any other factor it being natural or anthropogenic.[5] To provide scientific insight, the direct impacts of greenhouse gases are caused by the absorption properties of the gas molecules, which produce heat infrared light. What determines the strength of the greenhouse warming is the is the change in the flux of the thermal infrared radiation at the tropopause that expresses the radiative force of the system.[6] Indirect radiative effects occur as a result of the interaction between greenhouse gases and chemical reactions in the atmosphere. Ozone is crucial in this process since it serves as a significant absorber of infrared radiation. The net impact of ozone on climate is determined by the equilibrium between the radiative processes involved.[7] At altitudes above 30,000 metres, the presence of additional ozone leads to a reduction in surface temperature. This is because the ozone absorbs additional solar radiation, preventing it from reaching the troposphere and causing harm to the surface.[8] Thus, it is crucial to emphasize that the overall impact of climate change is determined by both the direct influence of greenhouse gases and the indirect consequences resulting from the interaction of these gases with other molecules in the atmosphere. Furthermore, the equilibrium of the radiative force is intricately linked to the strength of the six radiative agents: carbon dioxide, methane, tropospheric ozone, stratospheric ozone, aerosol-radiation interactions, and aerosol-cloud interactions.[9] This balance has been alternated by human activities and the results can be seen in the externalities of climate change.

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[3] Wuebbles and Jain.

[4] K.P. Shine et al., "Climate Change; the IPCC Scientific Assessment," *Assessment Report* 1 (1990), https://pure.mpg.de/rest/items/item_3475154/component/file_3475155/content.

[5] Shine et al.

[6] V. Ramanathan et al., "Climate-chemical Interactions and Effects of Changing Atmospheric Trace Gases," *Reviews of Geophysics* 25, no. 7 (August 1987): 1441–82, https://doi.org/10.1029/rg025i007p01441.

[7] Shine et al., "Climate Change; the IPCC Scientific Assessment."

[8] Andrew A. Lacis, Donald J. Wuebbles, and Jennifer A. Logan, "Radiative Forcing of Climate by Changes in the Vertical Distribution of Ozone," *Journal of Geophysical Research* 95, no. D7 (June 1990): 9971–81, https://doi.org/10.1029/jd095id07p09971.

[9] Nicolas Bellouin et al., "Radiative Forcing of Climate Change from the Copernicus Reanalysis of Atmospheric Composition," *Earth System Science Data* 12, no. 3 (July 2020): 1649–77, https://doi.org/10.5194/essd-12-1649-2020.

From 1750 to 2018 the human race has increased the emissions of carbon dioxide by 47% and methane by 157%. [10] Nevertheless, one may inquire about the connection between radiative forcing, climate change, and the advancement of humanity. The function and intensity of fossil fuel usage during human development may be answered straightforwardly. In the upcoming chapter, the history and development of fossil fuels will be elucidated.

1.1.2 The development of fossil fuels

Fossil fuels development was fundamental for the industrialized world that we know. It brought great economic wealth, mainly for the global north, and allowed the stated to develop technology and mechanisms that would work on the refined final products from fossil fuels. The calculations point in the direction of fossil fuels is the main driver of increased concentrations of carbon dioxide in the atmosphere.[11] Indicative of this statement is the percentage concentration with which carbon dioxide increased in the recent years. For over one thousand year the carbon dioxide emissions fluctuated at 10 ppm (parts per million, molar) remaining constant at 280 ppm, in the recent years this value increased to 360 in 2001, increasing by 30%.[12] Considering that the number in 2020 was 407 ppm, the value of carbon dioxide is rising considerably. The cause of this increase can be attributed to fossil fuel production, deforestation and biomass burning, with fossil fuels having the higher stake in it. Another issue is methane, which is less present than carbon dioxide but has a Global Warming Potential that is 50 times more effective as a greenhouse gas that carbon dioxide.[13] If we look at the consumption of fossil fuels in the past 20 years it has been rising globally. It went from a total consumption of 94K TWh in 2000 to 137K TWh in 2022.[14] This indicates that the production and consumption of fossil fuels have not shown any signs of stopping, or at least in the previous 20 years, they have experienced a significant upward trend. When categorizing the fossil fuels described earlier based on their intensity, we discover that oil ranks first, followed by coal, and gas comes in third place. The distribution is uneven. When comparing the consumption levels of the two states being studied in this master thesis, China's consumption in 2022 is 36,000 terawatt-hours (TWh), whereas Italy's consumption is just 1,500 TWh. Additionally, it should be noted that Italy reached its highest point in 2005 with a consumption of 2,000 terawatt-hours (TWh). Upon examining those figures, one may experience a sense of astonishment, nevertheless, it is crucial to

[10] Ades et al., “State of the Climate in 2018.”
[11] Wuebbles and Jain, “Concerns about Climate Change and the Role of Fossil Fuel Use.”
[12] Wuebbles and Jain.
[13] Edward J. Dlugokencky et al., “Continuing Decline in the Growth Rate of the Atmospheric Methane Burden,” *Nature* 393, no. 6684 (June 1998): 447–50, https://doi.org/10.1038/30934.
[14] Hannah Ritchie, Pablo Rosado, and Max Roser, “Fossil Fuels,” January 2024, https://ourworldindata.org/fossil-fuels.

distinguish between the two countries. On one hand, we have China, a country that has had significant economic expansion over the past two decades, primarily driven by the use of fossil fuels. Additionally, China is home to a population of 1.5 billion people. On the contrary, Italy has successfully achieved economic stability and has already transitioned from the extensive utilization of fossil fuels. Additionally, Italy has a population of 58 million individuals. Hence, we are confronted with two distinct systems, and it would be unjust to solely evaluate the energy intensity of fossil fuels.

1.1.3 The current carbon budget

As it has been seen, there is still a high consumption of fossil fuels, the question is whether we can allow this consumption or if we are using resources that we cannot afford to use. A study from 2015, pointed out that to achieve the climate target of 2°C by 2050, one third of all oil-reserves, almost half of the methane gas reserves and 80% of at the time coal reserves need to stay under the ground.[15] This is alarming if compared with renewed data from 2021 which stated that to have a probability of 50% to keep the global warming under 1.5°C by 2050 we need to keep unextracted around 60 percent of oil and fossil methane gas and 90 percent of coal.[16] Those are however speculations of what should be likely to happen if we are considering a carbon budget of 580Gt CO2 in a time span that goes from 2018 to 2100.[17] The carbon budget refers to the maximum quantity of carbon dioxide (CO2) that should be emitted worldwide within a specific timeframe in order to prevent the global temperature from exceeding a 1.5°C increase. Nevertheless, the IPCC has conducted two calculations. There are two scenarios: one with a carbon budget that has been mentioned before, which has a 50% probability of keeping temperatures stable at 1.5°C, and another scenario with a carbon budget of around 480Gt of CO2, which increases the possibilities to approximately 66%.[18] The current state of the carbon budget being used annually is up by 1.1% if we compare 2022 to 2023, with emissions in 2023 reaching 36.8 billion tonnes of CO2.[19] These numbers are even more significant when comparing them with the report published by the International Energy Agency (IEA). According to the paper, the Stated Policy Scenarios (STEPS) indicate that there will be a peak in demand for fossil fuels before 2030. This will result in a decrease of the customary 80% demand that has remained constant for

[15] P Ekins and R Lowe, "Uncertainties in the Outlook for Oil and Gas - UCL Discovery," n.d., https://discovery.ucl.ac.uk/id/eprint/1418473/.
[16] Dan Welsby et al., "Unextractable Fossil Fuels in a 1.5 °C World," *Nature* 597, no. 7875 (September 2021): 230–34, https://doi.org/10.1038/s41586-021-03821-8.
[17] Joeri Rogelj et al., "Scenarios towards Limiting Global Mean Temperature Increase below 1.5 °C," *Nature Climate Change* 8, no. 4 (March 2018): 325–32, https://doi.org/10.1038/s41558-018-0091-3.
[18] Rogelj et al.Rogelj et al.
[19] Jv, "Https://Globalcarbonbudget.Org," n.d., https://globalcarbonbudget.org/fossil-co2-emissions-at-record-high-in-2023/#:~:text=The%20annual%20Global%20Carbon%20Budget,%2C%20up%201.1%25%20from%202022.

many years by 7%, reaching a new level of 73%.[20] The report plainly said that if the current demand for coal, oil, and gas continues to increase, we would be far from achieving the climate targets in the near future. This is a cause for concern. The necessity for transitioning to a low-carbon economy is evident. An economy that prioritizes the flourishing of human existence while ensuring the preservation and sustainability of the Earth's ecology. The Earth, functioning as an ecosystem, will endure regardless of the difficulties it faces. This shift towards sustainability has been considered a means to prevent humanity's own demise. The following paragraph will examine the fundamental aspects of the initial phase of the transition towards a low-carbon economy.

1.2 International legal and policy foundations of climate transition: Paris Agreement, IPCC Reports, and Financial Stability Board.

The worldwide legal and policy frameworks for climate transitions are very recent. The scientific evidence supporting climate change is a precursor to policy advancements. Driven by scientific knowledge and the observable shifts in climate, the global community resolved to collaborate and establish an international framework that would provide nations with a cohesive set of instructions on how to reduce the impact of climate change. This text will discuss the primary international treaties that establish the legal foundation for the climate transition, the scientific evidence provided by panels of international experts, and the other stakeholders that influence the development of climate transition policies.

The Paris agreement is the second international pact designed to address the issue of climate change. Not just at the regional and national levels, but also on a worldwide scale. This was the inaugural endeavor of supranational organizations to address a significant problem and reach a consensus on a shared objective. The objective is to establish a long-term target of limiting the rise in world average temperature to less than 2°C. The EU Council was the first to establish a target for global temperature not to exceed 2°C in the context of climate-related goals. This target was informed by the Second Assessment Report published by the IPCC.[21] The IPCC reports are fundamental to the formulation of climate change policies and scientific advancements. Currently, there have been six Assessment Reports (AR) published. In the second Annual Report of 1995, which is significant for

[20] "Executive Summary – World Energy Outlook 2023 – Analysis - IEA," n.d., 202, https://www.iea.org/reports/world-energy-outlook-2023/executive-summary.
[21] Bill Hare et al., "Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming," *Regional Environmental Change* 11, no. S1 (January 2011): 1–13, https://doi.org/10.1007/s10113-010-0195-4.

understanding the meaning of Article 2 of the United Nations Convention on Climate Change (UNFCCC), two crucial variables were identified in respect to the interaction between humans and the environment. One of the main factors was that human activities associated with the combustion of fossil fuels were causing fluctuations in atmospheric temperature. Furthermore, it is obvious that certain communities are already experiencing the tangible threats associated with climate change. The objective of Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) was to stabilize the concentrations of greenhouse gases in the atmosphere at a level that would avoid harmful human-induced interference with the climate system.[22] This convention laid the groundwork for two subsequent international treaties, namely the Kyoto Protocol and the Paris Agreement. The legal and policy basis for the climate transition can be traced back to Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) and the subsequent measures taken under the Paris Agreement.

Prior to the Paris Agreement of 2015, there existed previous treaties, agreements, and international studies that paved the way for the contemporary comprehension of climate transition. One of the most significant examples is the assessment reports of the Intergovernmental Panel on Climate Change (IPCC), which came before the United Nations Framework Convention on Climate Change (UNFCCC). The inaugural AR in 1990 was collaboratively authored by the World Meteorological Organization (WMO) and the United Nations Environmental Program (UNEP). Previous scientific publications have shown the phenomenon of radiative forcing and the detrimental effects of human activities, particularly the use of fossil fuels, on the delicate equilibrium of the atmosphere. The AR of 1990 was a document that expressed to the international community the concerns about the human-caused greenhouse impacts, albeit there was some uncertainty involved. In 1990, policymakers were already acknowledging some challenges, including the efficacy of reaction groups, specifically governments, in preventing climate change, as well as the uncertainties surrounding the costs, impacts on economic growth, and other social or economic consequences.[23] Due to this in the report is explicitly addresses the need of a *"programme for the development and implementation of global comprehensive and phased action for the resolution of the global warming problem under a flexible and progressive view"*.[24] Therefore, the first AR might be one of the reasons for the birth of the UNFCCC. The subsequent AR, like the second one, are all equally

[22] "United Nations Framework Convention on Climate Change," *UN Climate Change Annual Report 2018*, 2018, https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf.
[23] Intergovernmental Panel On Climate Change, *Climate Change*, 1992.
[24] Change.

important.

Prior to the adoption of the Paris Agreement, another global treaty that was initiated as a result of the United Nations Framework Convention on Climate Change (UNFCCC) and the Second Assessment Report (AR2) of the Intergovernmental Panel on Climate Change (IPCC) was the Kyoto Protocol. Simply put, it implemented the United Nations Framework Convention on Climate Change by requiring developed nations to align their greenhouse gas emissions with the targets they have set.[25] However, it burdened only developed countries with the need to set emission reduction targets leaving out of the responsibility all the other developing countries such as China and India.[26] Prior to this moment, the notion of "common but differentiated responsibility and respective capabilities" outlined in Article 3 of the UNFCCC was not legally enforceable for industrialized nations. Therefore, this development represents progress. The Kyoto convention not only imposed a greater responsibility on the concept, but also obligated the countries to adhere to the protocol. Currently, the agreement has 192 participating nations and has established carbon reduction targets for 37 developed countries. Furthermore, it implemented three market-oriented mechanisms: the International Emission Trading, the Clean Development Mechanism, and the Joint Implementation. [27] The Kyoto protocol signed the beginning of a new chapter for the internationalization and the awareness related to the need of a transition to a low carbon economy.

Given the global focus on climate legislation, the European Union also made efforts to establish itself as a leader in climate-related initiatives. To avoid regression, the EU Council deliberated on climate change policies following the release of the AR1 by the IPCC, in preparation for upcoming negotiations under the UNFCCC. This led to the decision to maintain greenhouse gas (GHG) emissions at the same levels as in 1990 by the year 2000.[28] The EU's role as a leader in climate policy formulation has been successful. Following the Kyoto I agreement, the European Union proceeded to establish the European Climate Change Program (ECCP) in order to implement the regulations outlined in the Kyoto protocol. Directive 2003/87/EC was created to amend Council Directive 96/61/EC and establish a system called Emission Trading Scheme (ETS) for trading greenhouse gas emission allowances within the community. The European Parliament and Council officially approved it on October 13, 2003.

[25] UNFCCC, “What Is the Kyoto Protocol?,” n.d., https://unfccc.int/kyoto_protocol.
[26] Annalisa Savaresi, “The Paris Agreement: A New Beginning?,” *Journal of Energy & Natural Resources Law* 34, no. 1 (January 2016): 16–26, https://doi.org/10.1080/02646811.2016.1133983.
[27] UNFCCC, “What Is the Kyoto Protocol?”
[28] European Council, “Dublin European Council, 25-26 June 1990, Presidency Conclusions” (European Council, June 26, 1990), https://www.consilium.europa.eu/media/20562/1990_june_-dublin__eng.pdf.

This stage was referred to as Kyoto I. Between the Kyoto Protocol and the Paris Agreement, there were three Assessment Reports (AR) conducted by the Intergovernmental Panel on Climate Change (IPCC), as well as the Doha amendment to the Kyoto Protocol, which is commonly referred to as Kyoto II. The purpose of the Doha amendment, which will subsequently lead to the creation of Kyoto II, was to strengthen the promises made for the second phase spanning from 2013 to 2020. The Copenhagen Convention played a significant role in the historical relationship between Kyoto and Paris. The primary factor contributing to the mitigation of global climate change is the variation in the capabilities of different states to address the associated issues. The problem with the Copenhagen Convention was the incapacity to carry out the negotiation and the presentation of a discouraging document.[29]

Whereas AR3 and AR4 by the IPCC are equally important, this paragraph will focus on AR5, which previewed what issues were going to be addressed in the Paris Agreement. It was found that the anthropogenic emissions have continued to increase from 1970 to 2010 with larger increases between 2000 and 2010, this was despite the growing number of mitigation strategies[30]. Despite its seemingly insignificant nature, there exists a direct association between human-caused emissions released into the atmosphere and the phenomenon of climate change. In order to mitigate climate change, it is necessary to achieve a significant and continuous decrease in greenhouse gas (GHG) emissions, while also implementing measures to adapt to extreme weather events associated with climate change. The primary issue with climate change risks and impact is their lack of regionalization. The impact of greenhouse gas (GHG) emissions on the Earth's radiative forcing is not influenced by the location of these emissions. However, the effect indirectly affects other regions of the world. The AR5 emphasizes the unequal allocation of climate change risks and consequences, which has an impact on countries of all developmental stages. The principles of decision-making on climate change policy are rooted in the concepts of sustainable development and equality. Notably, the design of climate change initiatives is influenced by individuals' perspectives. Their perception of dangers and uncertainties. Ultimately, the fundamental principle behind climate change is collectivism. As stated earlier, greenhouse gas (GHG) emissions do not have a localized impact and instead mix globally over time. Mitigation efforts cannot be effectively addressed by individual agents alone, as the emissions of one agent might affect others regardless of their location.

[29] Savaresi, "The Paris Agreement: A New Beginning?"
[30] IPCC, "Climate Change 2014 Synthesis Report: Summary for Policymakers" (Intergovernmental Panel on Climate Change, 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf.

The preface of the AR5 and the failure of the Copenhagen Accords built up to the Paris Agreement of 2015. The legal novelty in the Paris Agreement was the interlocking sets of articles which arrays its peculiar legally binding mitigation ambition architecture.[31] However, to call the Paris Agreement "binding" might be an overstatement. The articles in question are Art. 2.1(a), which sets Long-Term Temperature Goal (LTTG) and Art. 4.1 in which the long term mitigation goals are concretized.[32] Those need to be compared with the Nationally Determined Contributions (NDCs) which require signatories to show a tangible, effective and measurable action in tackling GHG emissions. Moreover, in the technical architecture of the Paris Agreement Art. 4.3 expresses the ambitious character of the treaty, it states that each party to the is required to *"represent a progression beyond the party's then currently nationally determined contributions".*[33]

The path that leads to the formalization of the agreement was not an easy one. It came from the failures of the Copenhagen Convention, the political instability of the Kyoto protocol and the fragility of the UNFCCC. However, against the odds, the effort of the ministers of the parties to the agreement managed to produce what we have nowadays. Creating an agreement that broke the "global warming gridlock".[34] It created a mechanism which is far from a bottom-up approach but is also distant from the Copenhagen ideas of a strong top-down mechanism. It is based on the bottom-up mechanism of "naming and shaming".[35] Developed a system that enables party signatories to make voluntary commitments, which can then be internationally compared and evaluated, thus subjecting them to worldwide scrutiny. Nevertheless, there are some responsibilities, some of which are more stringent, while others are designed to facilitate globally coordinated efforts. The objective of this global collaborative effort is outlined in Article 4.1 of the agreement, which calls for a worldwide commitment to achieve the highest level of greenhouse gas emissions at the earliest practicable time. The significance of the extent to which greenhouse gas emissions reach should not be interpreted as negative. The tipping point for the use of greenhouse gases is the point at which their use starts to drop. This decrease continues until a threshold is reached when it no longer affects the balance of radiative forcing in the Earth's system.

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[31] Marie Mace, "Mitigation Commitments under the Paris Agreement and the Way Forward," *Climate Law* 6, no. 1–2 (May 2016): 21–39, https://doi.org/10.1163/18786561-00601002.

[32] Carl Schleussner et al., "Science and Policy Characteristics of the Paris Agreement Temperature Goal," *Nature Climate Change* 6, no. 9 (July 2016): 827–35, https://doi.org/10.1038/nclimate3096.

[33] UN, "Adoption of the Paris Agreement" (UNFCCC, 2016), https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/FCCC_CP_2015_10_Add.1.pdf.

[34] David G. Victor, *Global Warming Gridlock* (Cambridge University Press, 2011).

[35] Robert Falkner, "The Paris Agreement and the New Logic of International Climate Politics," *International Affairs* 92, no. 5 (August 2016): 1107–25, https://doi.org/10.1111/1468-2346.12708.

The Paris Agreement laid the basis for international cooperation, creating an unitary framework with periodical reviews and the ratcheting-up of ambitions, under a new base for what we can call an "hybrid" architecture.[36] The approach taken in the Paris Agreement entails that UNFCCC Parties unilaterally declare the action they are willing to undertake, turning on its head the top-down approach embedded in the Kyoto Protocol.[37] Transforming the UNFCCC into a custodian, coordinating and enabling the evaluation of these obligations. This decentralized approach provides countries with substantial autonomy in determining their strategies for tackling climate change. The Paris Agreement allows for a certain degree of flexibility, but it also establishes specific time targets that must be reviewed and updated every 5 years. According to Article 4.9, the parties are required to submit their Nationally Determined Contributions (NDCs) every 5 years. The introduction of the global stocktake was crucial in aligning the Paris Agreement with the scientific community, as it filled the scientific gap that was previously missing. The stocktake enables the evaluation of aspiration levels over time, providing a quantifiable and verifiable measure. This strategy enabled the avoidance of the contentious issue of internationally mandated reductions in emissions. In the Kyoto protocol, these reductions were a source of disagreement due to conflicting interests. Instead, the parties to the accord were given the authority to select their individual contributions to the collective effort of mitigating emissions.[38] Overall, the Paris Agreement set the basis to accelerate the mitigation, adaptation and fight against climate change, building an international system of climate accountability. The first stocktake after the 2015 Paris Agreement has been during COP28, in December 2023 and the results have been alarming. Unsurprisingly, the NDCs were not aligned with what was planned during the 2015 accords. To explicitly cite the stocktake document *"Against forecasts made prior to its adoption, the Paris Agreement has led to contributions that significantly reduce forecasts of future warming, yet the world is not on track to meet the long-term goals of the Paris Agreement."*.[39]

This shows that whereas the Paris Agreement contributed to the decrease of the emission targets, a bottom-up approach based on the principle of "naming and shaming" might not be the best option to solve the problem of climate change. It leaves a high degree of flexibility which leaves to the signatories of the treaty space

[36] Daniel Bodansky, "The Durban Platform: Issues and Options for a 2015 Agreement," December 2012, 201, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2270336.
[37] Savaresi, "The Paris Agreement: A New Beginning?"
[38] Falkner, "The Paris Agreement and the New Logic of International Climate Politics."
[39] Secretariat UNFCCC, "Technical Dialogue of the First Global Stocktake. Synthesis Report by the Co-Facilitators on the Technical Dialogue.," 2023, https://unfccc.int/documents/631600.

for non-compliance with no severe consequences, creating a free rider problem. Whereas the Paris Agreement might have not been the perfect solution to tackle the problem of climate change, it created a "two-level game" logic which brings together domestic climate politics and strategic interaction between countries.[40] In the absence of the Paris Agreement, there would have been a mechanism to compel nations to collectively work towards achieving climate objectives. Regrettably, the distinctiveness of climate change stems from its lack of centralization and its ability to occur independently of the specific geographical region where greenhouse gases (GHG) are released. Thus, if countries were allowed to make their own policy decisions about climate, there would likely be a significant lack of congruence and coherence in their individual national agendas. The Paris Agreement established a hybrid framework of international governance that combines both bottom-up and top-down approaches. While it may not be flawless, it has played a crucial role in fostering a shared trajectory. The Paris Agreement serves as the fundamental framework for future climate transition policies. In the following paragraphs, we will delve into the evolution of these policies, with a special focus on those implemented in Europe.

Following the implementation of the Paris Agreement, there has been a surge of interest in developing national policy solutions to effectively address climate change and expedite the transition to a sustainable climate. Within this particular setting, the European Union (EU) is striving to achieve the highest level of success, comparable to winning the gold medal. Following the implementation of the Paris Agreement, the European Union has introduced a range of regulations and directives to set clear guidelines for the transition towards a low-carbon economy. The European Green Deal (EGD) has been the main focus of Paramount. Introduced in 2019, the Green Deal is the European Union's comprehensive plan to steer its shift towards a carbon-neutral economy by 2050. The objective is to revolutionize the European economy in several sectors such as energy, transport, agriculture, and construction. This will be achieved by encouraging resource efficiency and ensuring a fair and comprehensive transition.[41] With the Green Deal the EU hoped to start a "snowball effect" which allowed countries to align to the Paris goals and the ones that are set by the EU.[42] Overall, it can be conceptualized as a *"roadmap of key policies for the EU's*

[40] Robert O. Keohane and Michael Oppenheimer, "Paris: Beyond the Climate Dead End through Pledge and Review?," 2016, https://www.ssoar.info/ssoar/handle/document/50553.
[41] "The European Green Deal," July 2021, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.
[42] Jon Birger Skjærseth, "Implementing EU Climate and Energy Policies in Poland: Policy Feedback and Reform," *Environmental Politics* 27, no. 3 (January 2018): 498–518, https://doi.org/10.1080/09644016.2018.1429046.

climate agenda".[43] The implementation of the Corporate Sustainability Reporting Directive (CSRD) and the proposed Corporate Social Due Diligence Directive (CSDDD) have hindered progress in the climate transition as of 2023. Although the CSRD wording has been accepted and ratified in nations like France, other countries like Germany have shown reluctance to conform to this new guideline. This could be attributed to the Green Deal's challenge to the established order of the member nations. The disparity between the policies of the European Union and the climate or energy priorities of the Member States might create a "misfit" that exerts pressure on the Member States to alter the existing state of affairs.[44] Therefore, only the thought of the opportunities that the low-carbon transition will advance, not always is an indicator that MS will change their status quo.[4546] Germany exemplifies how the lack of congruence in policy objectives can impede the progress of transitioning to a low-carbon economy. Although the rules derived from the Green Deal may not align with the policy objectives of individual EU countries, the complementary "domestic politics" approach suggests that over time, national policies tend to adjust to meet the needs of the EU without feeling threatened by the status quo.[47]

The Green Deal underpinned the creation of several policy instruments to address the transition to a low-carbon economy. Those have been the consequence of three main headline targets which are: a GHG emission reduction from 1990 levels, the share of renewable energy in final energy consumption and improvement in energy efficiency.[48] Following there are the main policy instruments that have been developed from the headline targets.

The Strengthened Emissions Reduction Targets: The EU is committed to ambitious greenhouse gas (GHG) emissions reduction targets. In 2021, it enshrined into law a legally binding target of reducing net GHG emissions by at least 55% by 2030 compared to 1990 levels. This is known as the 'Fit for 55' package. The EU is currently in the process of further strengthening its emissions reduction targets to

[43] Dipartimento Di Scienze Politiche E Sociali, Area Min. 14 - Scienze Politiche E Sociali, and M. Siddi, "The European Green Deal: Asseasing Its Current State and Future Implementation," 2020, https://iris.unica.it/handle/11584/313484.

[44] Skjærseth, "Implementing EU Climate and Energy Policies in Poland: Policy Feedback and Reform."

[45] Christoph Knill and Andrea Lenschow, *Implementing EU Environmental Policy* (Manchester University Press, 2000). *Implementing EU Environmental Policy*

[46] Christoph Knill, *The Europeanisation of National Administrations* (Cambridge University Press, 2001).

[47] Lorenzo Di Lucia and Annica Kronsell, "The Willing, the Unwilling and the Unable – Explaining Implementation of the EU Biofuels Directive," *Journal of European Public Policy* 17, no. 4 (June 2010): 545–63, https://doi.org/10.1080/13501761003673559; Lars Borrass, Metodi Sotirov, and Georg Winkel, "Policy Change and Europeanization: Implementing the European Union's Habitats Directive in Germany and the United Kingdom," *Environmental Politics* 24, no. 5 (April 2015): 788–809, https://doi.org/10.1080/09644016.2015.1027056.

[48] Di Scienze Politiche E Sociali, Sociali, and Siddi, "The European Green Deal: Asseasing Its Current State and Future Implementation."

align with the Paris Agreement's goals.[49]

The EU Emissions Trading System (ETS): The cornerstone of EU climate policy, the ETS operates on a 'cap and trade' principle.[50] It sets a declining cap on overall emissions from covered sectors (power generation, energy-intensive industry, aviation within Europe) and allows companies to buy and sell emissions allowances. This incentivizes emissions reductions in a cost-effective manner. The ETS is currently being revised as part of the 'Fit for 55' package, with proposals to expand its scope and phase out free allowances more quickly.

Effort Sharing Regulation (ESR): The ESR complements the ETS (Emission Trading Scheme) established in 2005. The ESR sets binding annual greenhouse gas emission targets for Member States in sectors not covered by the ETS, such as transport, buildings, agriculture, and waste. This ensures responsibility is shared across all sectors and countries.[51]

The CBAM (Carbon Border Adjustment Mechanism) is designed to address the risk of 'carbon leakage' (shifting production to countries with less stringent climate policies). It will apply a charge on the carbon content of certain imported goods, levelling the playing field and preventing the undermining of EU climate action.[52]

Sustainable Finance Framework: The EU has developed a comprehensive strategy to reorient capital flows towards sustainable investments, ensuring that the financial system supports the Green Deal's objectives. This includes measures such as the EU Taxonomy Regulation, providing a classification system for green economic activities, disclosure requirements for financial products, and the development of EU green bonds.[53] Within the sustainable financing framework of the European Green Deal (EGD), there are many tools that will facilitate the achievement of the goal of reaching net zero emissions by 2050. The overall funding given amounts to 1 trillion euros, with around half of it being paid directly by the EU, while the other portion will be a combination of public and private financing. This is because the EU is

[49] "The European Green Deal."
[50] "European Climate Policy - History and State of Play | Climate Policy Info Hub," n.d., http://climatepolicyinfohub.eu/european-climate-policy-history-and-state-play.html#footnote1_knjygij.
[51] "Effort Sharing 2021-2030: Targets and Flexibilities," n.d., https://climate.ec.europa.eu/eu-action/effort-sharing-member-states-emission-targets/effort-sharing-2021-2030-targets-and-flexibilities_en.
[52] "Carbon Border Adjustment Mechanism," n.d., https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en#:~:text=Why%20CBAM%3F-,CBAM,production%20in%20non%2DEU%20countries.
[53] "Sustainable Finance Package 2023," n.d., https://finance.ec.europa.eu/publications/sustainable-finance-package-2023_en.

unable to fully support the transition.[54] Therefore about 503 billion euros will be provided by the EU budget, while the rest will be released through the Invest EU mechanism. This mechanism will be triggered by the EU budget and is guaranteed by the European Investment Bank Group (EIBG) and national promotional banks and international financial institutions, mobilizing a total investment of 279 billion euros. The rest will be provided by the just transition mechanism and the national co-financing structural funds.[55]

The European Green Deal is a flexible and developing framework, characterized by continuous policy modifications and the emergence of new legislative initiatives. The success of this endeavor depends on the efficient execution of these tools, along with significant expenditures in environmentally friendly technologies, infrastructure, and the retraining of employees. Although the European Union is encountering difficulties in attaining its lofty climate objectives, the Green Deal demonstrates a resolute dedication to reducing carbon emissions and a readiness to assume a leading position in worldwide efforts to combat climate change.

The emergence of the Paris Agreement Goals, the establishment of the European Green Deal (EGD), and the recommendations put forth by the Intergovernmental Panel on Climate Change (IPCC) have paved the way for a transformation in the financial sector, recognizing the significance of climate change and its effects on businesses. Consequently, climate threats emerged. The entities responsible for formulating the strategies to tackle risks associated with climate change include organizations like the Financial Stability Board.

The FSB is an international body that monitors and makes recommendations about the global financial system.[56] Is the one in charge to assess the systemic risks in the financial sector, therefore is aware of the risks that climate change is building and has already built upon global finance. In 2021 the FSB in its roadmap for addressing climate change financial risks outlined 4 key areas where actions should be taken, namely firm level disclosures, data, vulnerability analysis and regulatory and supervisory practices and tools.[57] The realization that action was needed culminated in the final work by the and FSB's task force, the Task Force on Climate Related

[54] "Overview of Sustainable Finance," n.d., https://finance.ec.europa.eu/sustainable-finance/overview-sustainable-finance_en.
[55] C. Fetting, "The European Green Deal," *ESDN Report*, December 2020, https://www.esdn.eu/fileadmin/ESDN_Reports/ESDN_Report_2_2020.pdf.
[56] "About the FSB," n.d., https://www.fsb.org/about/.
[57] Financial Stability Board, "FSB Roadmap for Addressing Financial Risks from Climate Change Progress Report," *2023 Progress Report*, July 2023, https://www.fsb.org/wp-content/uploads/P130723.pdf.

Disclosures (TCFD). Which now has been incorporated in the International Sustainability Standards Board (ISSB). The milestone consisted in the publication of the first set of sustainability disclosure standards, the IFRS S1 and IFRS S2. The standardization of the disclosure of climate-related data is a fundamental step to facilitate the achievement of the climate goals. However, there is a need to gather this climate data, which in most cases is hard to retrieve. Therefore, the work of the FSB has been to continue to strive to find a better mechanism to facilitate and to provide open access to climate-related data.[58] In their "work programme for 2024" the FSB under the category of climate risks mentioned three pathways that plans to better study. To report the progress made in the achievement of consistent climate-related financial disclosures. The analysis of the relevance of transition plans and planning by financial and non-financial firms for financial stability. Lastly, to take a stock of regulatory and supervisory initiatives related to the identification and assessment of nature related financial risks.[59] Overall, in an assessment by the FSB in 2023, which analysed the climate scenarios of various jurisdiction, it was found that there is a misalignment between the terms and scopes of definition when it comes to the definition and identification of transition risks drivers in the financial authorities of different jurisdictions. Moreover, the novelty of the topic was confirmed by the limitation in the availability to find data and in the methodological issues.[60]

Since the late 1990s, the scientific community has been increasingly drawing attention to the impact of human activities on climate change throughout the course of its historical development. The acts involved the widespread utilization of fossil fuels, leading to a disruption in the equilibrium of the atmospheric radiative force. This disruption caused a rise in global temperature, resulting in the manifestation of climate events that posed a threat to the entire planet. The international community, seeing the imperative of taking action to prevent an irreversible tipping point that would trigger a chain of catastrophic events, resolved to collaborate in search of a solution. The progress made on climate-related measures encountered numerous obstacles and criticisms along its course. The scientific community initiated the process by introducing the first augmented reality (AR) technology through the publication of the initial report by the Intergovernmental Panel on Climate Change (IPCC). The report included, for the first time, a comprehensive analysis of the climatic issues that needed to be examined. The UNFCCC, the inaugural climate

[58] Board.Board.
[59] Financial Stability Board, "FSB Work Programme for 2024," *FSB Work Program*, January 2024, https://www.fsb.org/wp-content/uploads/P240124.pdf.
[60] Financial Stability Board and Network for Greening the Financial System, "Climate Scenario Analysis by Jurisdictions," *Financial Stability Board Publication*, November 2022, https://www.fsb.org/wp-content/uploads/P151122.pdf.

change conference established by the United Nations, provided the solution. By means of this policy instrument, the signatories to the convention have agreed to certain overarching commitments, such as reducing their emissions of greenhouse gases. Nevertheless, as a non-binding commitment, it demonstrated less efficacy than anticipated, yet it established solid groundwork for the subsequent advancement of additional treaties. The policy pertaining to the climate-transition has continued to progress and change, as evidenced by the shortcomings of the Copenhagen accords and the incremental advancements of the Kyoto Protocol. The European Union is leading the way in this policy shift. The Paris agreement, which established a framework, is viewed as effective by some and overly lenient by others. This is because it relies on a "naming and shaming" strategy that faces challenges in enforcing precise targets for its members. In the context of addressing climate change, the focus is on creating effective policy tools. Several factors can be noted. The primary consideration is the equilibrium between global concerns and domestic concerns. There exists a global group that advocates for a reduction in greenhouse gas (GHG) emissions worldwide. Nevertheless, this conflicts with the developmental aspirations of certain nations, leading to a divergence in the objectives of addressing climate change. The second concern pertains to the partially binding nature of the existing climate policy, which heavily relies on the activities of individual nations, save for the European Union (EU) which, by its very nature, has the ability to compel member states to take action. Consequently, there is an inherent issue of individuals acting independently, which could lead to the fragmentation of the climate goals. Additionally, the rest of the international community consists of commercial, public-private, and public bodies that make a significant contribution and provide guidance to citizens and carbon-intensive businesses to align their interests with the global climate objectives.

1.3 Climate and Environmental risks

The international community created current climate-related policies mostly due to the unforeseen threats associated with climate change. Our society still has a limited understanding of the risks associated with climate and the environment. Primarily, prior to exploring the notion of climate or environmental concerns, there exists a significant lack of comprehension among society at large. The distinctions among danger, hazard, and risk. The first concept can be characterized as the state of being exposed to potential injury. Therefore, risks can be classified as situations where there is a potential for harm, but also the possibility of gaining an advantage if successfully conquered. Put simply, this refers to the probability of us causing that

harm. Within the framework of climate change, we face a significant vulnerability to altering the radiative equilibrium of the Earth. This poses a perilous threat to humanity, potentially leading to extinction or catastrophic repercussions.

The sixth IPCC assessment report attempted to close the consistency gap caused by the IPCC's inconsistent and imprecise definitions of risks in earlier reports. "The potential for adverse consequences for human ecological systems, recognizing the diversity of values and objectives associated with such systems"[61] is the IPCC's definition of risk. In regard to both the impacts of climate change and the actions taken by individuals in response to it. The impact on individuals' lives, livelihoods, physical and mental health, financial resources, social and cultural resources, infrastructure, services (including ecosystem services), ecosystems, and species all result in significantly adverse consequences. Regarding the impacts of climate change, risk is perceived as a dynamic and constantly evolving phenomenon. The phenomenon emerges from the interplay of risks linked to climate change, and the magnitude and likelihood of its impacts are uncertain and unforeseen. Conversely, in the context of climate change solutions, risk refers to the potential for the intended measures to not achieve the desired outcome.

Thus, "the potential for adverse consequences" was used by the IPCC to define risk.[62] It is worth mentioning that the concept of climate change risk is perceived neutrally in other fields, such as finance, but it is viewed adversely within the context of the IPCC's perspective. This emphasizes the differences between the issues and the basic principles of risk in the financial and climate change sectors. The threat associated with climate change can only manifest as a harmful externality that has tangible and financial repercussions. The reason for this phenomenon is the influence of climate change on the global environment. The literature from the Intergovernmental Panel on Climate Change (IPCC) clarifies that the extent of this impact varies depending on how climate change affects different aspects. The action may be deemed precarious if the result is unpleasant. On the other hand, if the outcome is positive, it leads to an opportunity. The severity of a certain climate change impact, usually referred to as a "risk," determines the extent of its influence. According to the IPCC, risk is not limited to physical systems alone. Nevertheless, when a threat becomes apparent, it is crucial to take into account not only the possible physical damage but also the consequences for other systems, such as the economic

[61] Andy Resigner, Mark Howden, and Carolina Vera, "The Concept of Risk in the IPCC Sixth Assessment Report: A Summary of Cross-Working Group Discussions," *Guidance for IPCC Authors*, September 2020, https://www.ipcc.ch/site/assets/uploads/2021/02/Risk-guidance-FINAL_15Feb2021.pdf.
[62] Resigner, Howden, and Vera.

and social ones. The upcoming paragraph will provide a clear explanation of how climate change-related difficulties can have a significant impact on financial matters. This implies that a physical hazard resulting from climate change cannot be confined solely to the physical realm; instead, its impacts and consequences must be extended to encompass other realms.

With the new report by the IPCC risk was understood under two new dimensions. It has been applied both to impacts and responses to climate change. Depending on the literature and on how the issue at hand is explained, a risk can be declined into one of the two areas for the following reasons. The dimension of risk contextualized for climate change impacts is centred on the interaction between hazard vulnerability and exposure.[63] The term "hazard" is still used to characterize the climatic driver of a risk in the present definition of a climate risk. The dynamic aspects of risk are acknowledged in the definition. It is acknowledged by this definition that the components of risk are susceptible to changes in the socioeconomic and climatic conditions, which may be intentional, inadvertent, or natural.

However, our understanding of the risks associated with climate change solutions is continuously evolving. This idea does not conform to the "hazard-exposure-vulnerability" model. The three components have no direct or substantial impact on the risk associated with climate change response. In this case, the adverse consequences of a risk may arise from an effort to tackle climate change that either fails to achieve the intended outcome or leads to an undesirable outcome in another area. The concern in this scenario lies not in the actual occurrence of a negative event, but rather in the potential for it to happen. It can be classified as a risk in the literature, even if the adverse consequences have not yet been experienced.

1.3.1 Physical risks

Physical risk is frequently associated with alterations in hazard levels. However, under the framework of "hazard-exposure-vulnerability," it is crucial to also take into account exposure and vulnerability when assessing physical risk. Furthermore, physical hazards can be categorized into immediate, short-term incidents and persistent, long-term alterations in weather and climate. In order to get a comprehensive study and characterization of physical risk, it is essential to take into account all three aspects. Within the realm of exposure and vulnerability, companies face financial repercussions when physical dangers materialize, whereas those that have not yet experienced such risks incur upfront expenses for insurance and other

[63] Intergovernmental Panel On Climate Change, *Climate Change 2022 – Impacts, Adaptation and Vulnerability*, 2023, https://doi.org/10.1017/9781009325844.

investments. Most physical risks arise from environmental factors and the impact of climate change on firms engaged in such operations.

In the Global Risks Report by the by the World Economic Forum[64] the environmental risks were placed amongst the first 4 most likely to severely impact businesses in the next 10 years. Those risks indicate the susceptibility to which a firm is more prone to experiencing. These are severe weather phenomena, significant alterations to Earth's processes, loss of biodiversity, and collapse of ecosystems, as well as shortages of natural resources. These consequences are just four of the numerous material effects associated with climate change. The climate events incur expenses due to their impacts. The majority of these issues are connected to the devastating consequences that climate change has on communities and the challenges faced by insurers in accurately predicting the associated risks. Communities in lower socioeconomic strata are often the most affected by climate change due to their inadequate living conditions, which hinder their ability to prepare for or mitigate its consequences. For insurers, this is solely a financial issue. The primary responsibility of insurers is to assess risk and determine whether it is advantageous or perilous to provide insurance coverage for a company's assets. The assessment of climate change sensitivity and physical risk is based on the level of exposure to a danger. The problem with climate change lies in its low prediction rate, which amplifies the financial risks associated with insuring an asset that may be adversely impacted by a climate-related occurrence.

The value of the asset and the insurers commitment in ensuring an asset vulnerable to climate change brings financial implication in the physical risks assessment. In 2021 extreme weather events caused a total damage of $280 billion, which is an increase of 30% from 2020 and a 70% increase from 2019. Therefore, the mitigation and adaptation to climate change is not only a social matter, but also a financial one. A study published that if no action is taken towards the tackling of climate change the world economy could lose about 18% of its GDP by 2050, with the Asian economies being the ones mostly impacted.[65] Moreover, physical risk, due to the nature of climate related extreme events cover all sectors of the economy, they cannot be regionalized. This means, as it was stated by the FSB, that there could be a significant tail risk in the future. With tail risk is intended the effect of climate change in highly complex global value chains. The transition in global, cannot be regional, the TCFD (Task Force on Climate-related Financial Disclosures) divided physical

[64] "Global Risks Report 2024 | World Economic Forum," January 2024, https://www.weforum.org/publications/global-risks-report-2024/.
[65] Simon Thompson, *Green and Sustainable Finance* (Chartered Banker, 2023).

risks into:

- Acute risks: which have severe, short-term impacts such as floods or hurricanes.
- Chronic risks: those have a more gradual long-term impact such as the rising of the seal levels of surface temperatures.[66]

The consequences of the two dangers are different. During acute risk situations, the primary impact will be on individuals with lower socioeconomic level and, as previously said, it will particularly affect coastal regions. However, the latter is global. While there may be long-term impacts, they are typically more severe and not influenced by socioeconomic level. This would lead to the stranding of a significant asset. Asset stranding occurs when a material asset becomes unusable due to a climate-related occurrence, resulting in a loss on the balance sheet. According to the research, even if global warming is limited to a maximum increase of 2°C over preindustrial levels, around 800 million individuals residing in major low-lying cities such as Amsterdam, Miami, Shanghai, Osaka, and London will experience a substantial disruption to their way of life.[67]

In general, the physical dangers possess a certain level of predictability that is challenging to quantify. Furthermore, the impacts of climate change are global in nature and cannot be limited to a specific geographical region. This increases the vulnerability to climate-related risks for a broader range of individuals and entities. The extensive production of greenhouse gas (GHG) emissions in Europe, for instance, can have serious consequences in India, or vice versa. It is evident that physical risks incur significant costs and have a financial impact on the global value chain. Adaptation efforts may be insufficient to withstand the acute and chronic threats that climate change is imposing on firms' supply chains. In the absence of any efforts to reduce the impact, the financial expenses incurred by companies, countries, and business owners will present a substantial risk to the global economy.

1.3.2 Transition risks

Many corporations assume that the perception of nature or climate related issues is outside their area of concern. It is anticipated that the firm would not be significantly affected by them. Nonetheless, the impacts of climate change and the

[66] Task Force on Climate related Financial Disclosures, "Recommendations of the Task Force on Climate-Related Financial Disclosures," *Final Report*, June 2017, https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf.

[67] "Sea Level Rise and Coastal Flooding - C40 Cities," November 2021, https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/sea-level-rise/.

outcomes of adopting or not adopting a low-carbon economy become evident within the usual lifespan of a corporation. The shift towards a low carbon economy requires the implementation of various measures to reduce greenhouse gas emissions and adapt to the impacts of climate change. This involves making changes to policies, laws, technologies, and markets. The extent of the influence that such risks exert on the corporation is directly linked to the duration that the organization takes to cultivate resilience characteristics. Transition risks encompass various sub-categories, such as legislative, legal, technical, market, liability, and reputational concerns. Each of these hazards poses a potential threat to a company's financial returns or may result in penalties, such as the creation of stranded assets.

This paragraph represents a brief overview of what is the significance of transition risks and why firms should take them into consideration when forecasting their vulnerability towards climate change. The future trend of the global economy will require businesses to shift their Business-As-Usual (BAU) methodologies. There is a higher demand in consumer goods which impact either carbon neutral or carbon negative. Some sectors of the global economy might face a real existential threat unless they transform their BAU and adapt them to the transition risks they are facing. To transition from a BAU to a low-impact mechanism of doing business is challenging. In order to facilitate and give guidance on how to transition, pathways for decarbonization and methods to analyse the effects of those paths were created. In the following paragraph the Representative Concentration Pathways (RCPs) and those developed by the IPCC following the Integrated Assessment Models (IAMs) will be explained in order to better understand what the exposures to hazards are due related to a non-compliance to the low-carbon economy transition.

1.3.2.1 Transition pathways

Understanding the consequences of long-term climate objectives for the necessary near-term transition depends on the use of Integrated Assessment Models, or IAMs. In order to do this, an integrated systems approach that represents all sectors and greenhouse gases is required. IAMs are a rigorous, consistent framework for investigating how complex systems respond. A wide variety of modelling frameworks are covered by them.[68] IAMs are bound to employ simplifying assumptions due to the intricate nature of the systems they analyze. Consequently, it is crucial to interpret the findings while considering these underlying assumptions. IAMs can vary in complexity, ranging from basic economic models that only consider carbon dioxide

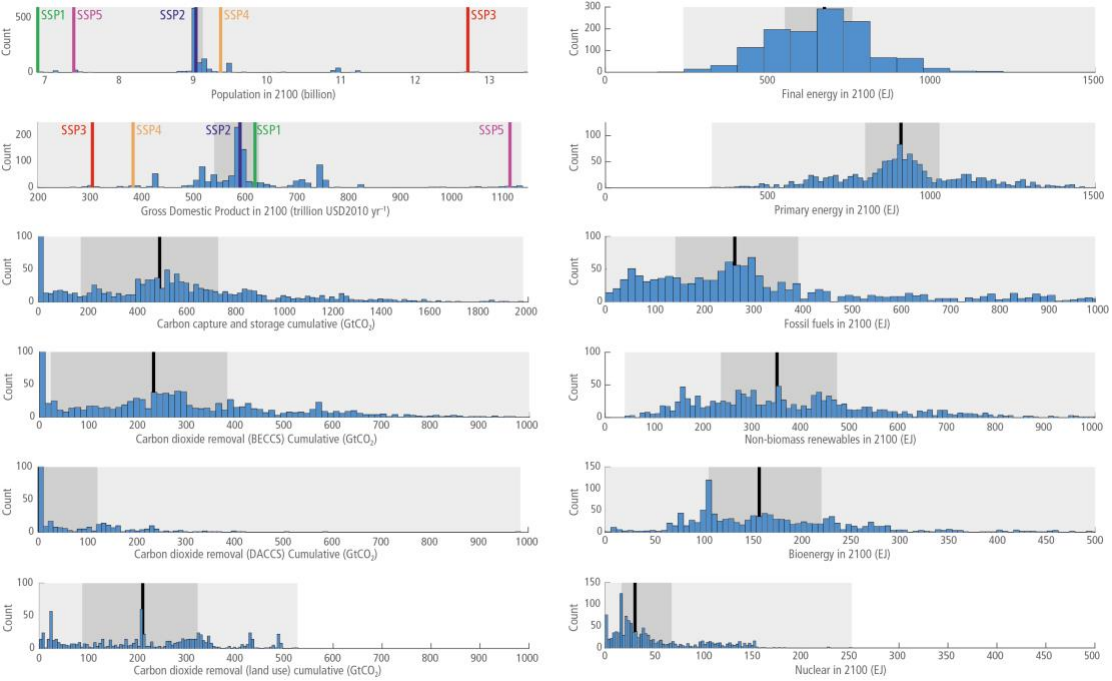
[68] Ilkka Keppo et al., "Exploring the Possibility Space: Taking Stock of the Diverse Capabilities and Gaps in Integrated Assessment Models," *Environmental Research Letters* 16, no. 5 (April 2021): 053006, https://doi.org/10.1088/1748-9326/abe5d8.

emissions to detailed process-based models that encompass all aspects of the global energy system. This includes interactions with land and water, all greenhouse gas emissions, and a simplified representation of the climate system. Typically driven by economic factors, these models can exhibit many characteristics such as exogenous or endogenous technological progress, myopic or perfect foresight, partial, general, or non-equilibrium conditions, and are based on optimization or simulation methods, among other qualities. Various socioeconomic and technical factors and attributes are incorporated into IAMs to accurately depict diverse systems. This knowledge cannot be directly integrated into a model; instead, multiple simplifications and exclusions are made to make it more manageable due to its complexity. Consequently, IAMs possess several advantages and disadvantages that should be taken into account when assessing IAM outcomes.

The characteristics of IAMs can be summed up as follows. To evaluate how the system reacts to various policies or other limitations. They are not forecasts of future events; rather, they offer a response to a hypothetical query. They are employed in the evaluation of carbon's social cost. IAMs are essentially a tool for tracing the process by which an additional ton of emissions influences atmospheric concentrations, which in turn affects precipitation and the average world surface temperature. [69] Environmental issues have long been addressed by IAMs, especially during the IPCC assessment process. IAM-based quantifications, such as the necessary rate of carbon reduction, the number of net zero years, or the rate of technology deployment needed to achieve specific climate outcomes, have influenced many policy conversations. However, here is a debate among scholars over the speed at which technological diffusion happens in IAMs. Gambhir et al. (2019)[70] stated that most models favor large-scale solutions, which leads to a relatively slow phase-out of fossil fuels. Carton (2019)[71] made a similar argument. Despite advancements since AR5, demand-side measures remain trail in detail of representation, even though IAMs are especially good on supply-side representation.[72]

On the contrary, RCPs have been created using IAMs. The authors delineate four distinct trajectories of greenhouse gas (GHG) emissions and atmospheric

[69] J. Rogelj et al., "Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development," 2018, https://publications.pik-potsdam.de/pubman/faces/ViewItemFullPage.jsp?itemId=item_22900_3&view=EXPORT.
[70] Ajay Gambhir et al., "A Review of Criticisms of Integrated Assessment Models and Proposed Approaches to Address These, through the Lens of BECCS," *Energies* 12, no. 9 (May 2019): 1747, https://doi.org/10.3390/en12091747.
[71] Wim Carton, "Carbon Unicorns and Fossil Futures. Whose Emission Reduction Pathways Is the IPCC Performing?," 2020, https://lup.lub.lu.se/record/0daefdce-f850-4f22-a186-bc59d16328d2.
[72] Arnulf Grübler et al., "A Low Energy Demand Scenario for Meeting the 1.5 °C Target and Sustainable Development Goals without Negative Emission Technologies," *Nature Energy* 3, no. 6 (June 2018): 515–27, https://doi.org/10.1038/s41560-018-0172-6.



concentrations, air pollutant emissions, and land use in the 21st century. The scenarios are utilized to assess the costs associated with emission reductions that correspond to certain concentration pathways. The Representative Concentration Pathways (RCPs) consist of four different scenarios: RCP2.6, which involves severe mitigation measures; RCP4.5 and RCP6.0, which are intermediate scenarios; and RCP8.5, which represents a scenario with exceptionally high greenhouse gas (GHG) emissions. "Basis scenarios," or scenarios where no additional measures are taken to restrict emissions, lead to trajectories that lie between RCP6.0 and RCP8.5. RCP2.6 represents a scenario that aims to restrict global warming to a maximum of 2°C over pre-industrial levels. The NGFS (Network for Greening the Financial System) put those scenarios into three pathways. The world can be categorized into three distinct types: orderly, disorderly, and hot house. The orderly paths ensure that the climate goals are achieved, with temperatures not surpassing a 2°C increase by 2100. This implies that businesses and governments undergo a gradual transition without any sudden adjustments. This pathway can be likened to the ones classified by the IPCC as C1, C2, and C3, as seen in Table 1. These are determined depending on the probability of achieving the target. The chaotic scenario corresponds to the goal of not surpassing a 2°C increase by 2100, but it involves a sudden and rapid shift that heightens susceptibility and exposure to climate-related consequences. The chaotic transition is consistent with the IPCC routes C4, C5, and C6 as seen in Table 1. The Hot House World scenario refers to a situation when the climate targets are not achieved, resulting in temperatures rising by more than 3°C. Which corresponds to the IPCC scenarios C7 and C8 as seen in Table 1.

(FIGURE 1) [73]

Category	Description	WGI SSP	WGIII IP/IMP	Scenarios
C1: Limit warming to 1.5°C (>50%) with no or limited overshoot	Reach or exceed 1.5°C during the 21st century with a likelihood of ≤67%, and limit warming to 1.5°C in 2100 with a likelihood >50%. Limited overshoot refers to exceeding 1.5°C by up to about 0.1°C and for up to several decades.	SSP1-1.9	IMP-SP, IMP-LD, IMP-Ren	**97**
C2: Return warming to 1.5°C (>50%) after a high overshoot	Exceed warming of 1.5°C during the 21st century with a likelihood of >67%, and limit warming to 1.5°C in 2100 with a likelihood of >50%. High overshoot refers to temporarily exceeding 1.5°C global warming by 0.1°C–0.3°C for up to several decades.		IMP-Neg [a]	**133**
C3: *Limit warming to 2°C (>67%)*	Limit peak warming to 2°C throughout the 21st century with a likelihood of >67%.	SSP1-2.6	IMP-GS	**311**
C4: Limit warming to 2°C (>50%)	Limit peak warming to 2°C throughout the 21st century with a likelihood of >50%.			**159**
C5: Limit warming to 2.5°C (>50%)	Limit peak warming to 2.5°C throughout the 21st century with a likelihood of >50%.			**212**
C6: Limit warming to 3°C (>50%)	Limit peak warming to 3°C throughout the 21st century with a likelihood of >50%.	SSP2-4.5	ModAct	**97**
C7: Limit warming to 4°C (>50%)	Limit peak warming to 4°C throughout the 21st century with a likelihood of >50%.	SSP3-7.0	CurPol	**164**
C8: Exceed warming of 4°C (≥50%)	Exceed warming of 4°C during the 21st century with a likelihood of ≥50%.	SSP5-8.5		**29**
C1, C2, C3: limit warming to 2°C (>67%) or lower	All scenarios in Categories C1, C2 and C3			**541**

(TABLE 1)

From the RCPs scenarios and the IPCC MAGICC (Model for the Assessment of Greenhouse Gas Induced Climate Change) sectoral socioeconomic scenarios were developed (Figure 1).

The histograms in the graphic display statistics for important categories in the AR6 scenario database. The grey shading represents the ranges of 0–100% (light grey) and 25–75% (dark grey), while the median is indicated by a black line. The axis bounds are maintained to facilitate comparison with other categories, despite the fact that the values with white patches exceed the range of the scenario. There exist five Sectoral Socio-economic Pathways (SSP). In order to align with the systematic transition pathway, the policy pathway that needs to be adhered to is SSP2. The graphs that do not include the SSPs have a black line representing the target for the 2100 goal. The bulk of the climate scenarios for 2100 are in line with the SSP2 forecast, when compared to the other SSPs. The SSP2 mitigation policy pathway involves the implementation of internationally coordinated climate policies that prioritize rapid action and do not include the transfer of emission allowances. Deviation from this policy objective, in accordance with the climatic scenarios, would result in a change in the range of options available, potentially not aligning with the 2°C goals.

[73] "Figure AR6 WG3," n.d., https://www.ipcc.ch/report/ar6/wg3/figures/chapter-3/figure-3-4.

The Integrated Assessment Models (IAMs), Representative Concentration Pathways (RCPs), Model for the Assessment of Greenhouse-gas Induced Climate Change (MAGICC), and Shared Socioeconomic Pathways (SSPs) play a crucial role in directing the global society towards the transition and are essential for evaluating the susceptibilities caused by climate change. Aligning a business's transition strategy with the scientific and policy paths provided by the international community reduces the likelihood of unexpected hazards arising, therefore mitigating transition risks. Nevertheless, devising a mitigation strategy to manage the risks associated with various sources of transition is not a simple task. It is not sufficient to merely consider the transition paths; the organization must also conduct an evaluation of its value chain. The evaluation of the value chain could perhaps be the most difficult stage. To conduct a thorough evaluation of one's value chain, several normative, financial, economic, social, and operational factors need to be taken into account. Transition plans are important because they allow stakeholders to assess a company's progress in reducing carbon emissions and meeting science-based goals. Additionally, these plans provide investors and lenders with vital initial information. Using their review, these parties can assess the extent to which the investee company or borrower is vulnerable to physical and transition risks, asset stranding, carbon lock-in risks, and environmental risks (such as the effects and dependencies of biodiversity), and how these risks translate into financial risks.

1.4 How climate-related issues become financially material

In the context of the transition to a low-carbon economy and the release of sectoral pathways, banks need to address the impacts of climate change under a new perspective. The Global Reporting Initiative (GRI) in its exposure draft of 2020 defined materiality as when *"the organization prioritize reporting on those topics that reflect its most significant impacts on the economy, environment and people, including impacts on human rights"*[74]. However, whether is important to understand what materiality is, it is more complicated to grasp how materiality developed, more specifically the concept of double materiality. For this assessment a paper by the Harvard Business Review by Frieberg et al. was published in 2020 explaining how ESG issues become financially material. Even if the paper concentrates on ESG, which is not a topic of interest for the aim of this master thesis, it provides a useful framework to analyze materiality.[75]

[74] "GRI - Standards," n.d., https://www.globalreporting.org/standards/.
[75] D. Freiberg, J Rogers, and G Serafeim, "How ESG Issues Become Financially Material to Corporations and Their Investors," *Harvard Business Review*, no. Working Paper (2020), https://www.hbs.edu/ris/Publication%20Files/20-056_1c21f28a-12c1-4be6-94eb-020f0bc32971.pdf.

The working paper divides materiality into five distinct categories: status quo, catalyst event, stakeholder reaction, company reaction, regulatory action, and innovation. These are the phases of materiality. This paragraph aims to apply the research conducted by Frieberg et al. to the context of climate change in order to comprehend the financial implications of climate-related concerns. The initial phase is characterized by the status quo, where the issue remains monetarily insignificant. There is a degree of disagreement between the goals of corporations and society that is considered acceptable, and no player in the industry aims to increase profits by causing harmful effects on the outside world. Misalignment occurred either due to adherence to society norms or a lack of accurate understanding of the circumstance. During this stage, both the industry and society fail to recognize the issue of climate change. The effects of a company on the climate and its greenhouse gas emissions are accepted without objection. The stakeholders do not consider the misalignment between a company's actions and the susceptibility of its assets, caused by exposure to climate change dangers, as adverse to their interests. In this instance, the matter is of little financial significance and does not result in any changes in pricing or worth.

The second stage is facilitated by a catalytic event. There are two types of trigger events: when the behaviors of the corporation diverge from what is currently considered socially acceptable. In the second scenario, there is a divergence between society expectations regarding acceptable corporate behavior and the actual behaviors of corporations. In the first scenario, the discrepancy is expanded by the companies, whereas in the second scenario, the gap is enlarged by a change in public expectations. In the first scenario, the companies diverge from standard business practices in order to maximize their profits, resulting in a misalignment between their actions and societal norms. Whether others are effective in obtaining economic rents. This premise, when put into practice, can be likened to the green revolution and the transition from fossil fuels to renewable energies. Certain corporations abstain from implementing transition plans that aim to increase their reliance on fossil fuels, while others have already shifted to alternative sources of energy that are non-fossil fuels. During this phase, societal information may undergo changes as a result of the disclosure of the company's current practices and the revelation of the actual extent of negative externalities. Society had a limited understanding of how fossil fuels in the 1900s disrupted the balance of radiative forces and impacted the climate. However, during the late 1990s and 2000s, there was a growing awareness among people about the adverse consequences resulting from the emission of greenhouse gases into the atmosphere. Frieberg et al. hypothesize that issues are more likely to have financial significance when stakeholders can easily

access information regarding the actual alignment between society and commercial interests. However, in the catalytic phase, the problem remains monetarily insignificant. What is more significant is that companies that deviate and produce more misalignments may outperform other participants in the field.

The third phase entails the exertion of stakeholder pressure. At this juncture, the involvement of non-governmental organizations (NGOs), the media, and other stakeholders becomes significant. They respond to the increasing divergence between the interests of businesses and society. At this stage, it is not appropriate to condemn or stigmatize the entire sector of the economy. Rather, it is only the companies that have contributed to the widening disparity through rent seeking that should be held accountable. The public anger is directed on a specific group of companies, rather than all industries. The financial significance of these difficulties arises only for some organizations when their performance can be identified and demonstrates a difference from the rest of the industry sector. This is the stage of maximum misalignment; the divergent companies cease their ongoing misalignment tactics and anticipate the response from the regulator. The current stage of climate change suggests that the peak for fossil fuel emissions is projected to occur in 2030. Which stakeholders, including financial institutions, governmental entities, and NGOs, have the most responsibility for holding fossil fuel companies accountable. During the phase of stakeholder pressure, companies that are explicitly targeted by public response are likely to face a negative price reaction.

Companies respond to shareholder pressure. The fourth stage is the company's reaction to the demands exerted by the stakeholders. Currently, the corporation is attempting to rebuild the confidence of its stakeholders by taking small measures, with the goal of reducing the expenses associated with externalities caused by misalignment. They want to avoid a more intense reaction from stakeholders or stricter regulations in response to their conduct. At this level, one may observe the interference of politics and regulators, which pose a threat to the separating enterprises. Novel norms and beliefs emerge, with society and stakeholders acutely cognizant of the adverse consequences that arise from the lack of congruence. The proposition made here is that problems are more prone to attain financial significance when organizations are unable to exercise self-regulation. Climate change can serve as a catalyst for self-regulation when stakeholders feel pressure and assets are vulnerable to dangers caused by both chronic and acute climate disasters. Companies strive to decrease the significant misalignment they have identified and steer towards a path where inconsistencies are less noticeable. However, the absence of a regulatory tool means that the degree of misalignment is still severe. A self-regulatory instrument that firms might employ to align themselves with

climate goals is the Net Zero Banking Alliance (NZBA), an organization that provides voluntary recommendations to assist banks in transitioning to a low-carbon economy.[76] The price reaction and valuation for this stage affects the whole industry or sector, causing negative stock reactions. Only those with a better performance might escape the negative consequence of misalignment and experience positive price reactions.

The final stage occurs when the difficulties reach a level of financial significance that affects the entire industry sector. It occurs when there is a combination of regulatory response and innovation. The primary determinants are the implementation of regulations that reduce misalignment and restore equilibrium. Technological innovation that causes disruption and alters the system. At this stage, the misalignment reaches a state of stasis, which is caused by the equilibrium that was established by the restrictions. The valuation of the industry is influenced by the performance of companies in the sector on financially significant issues, leading to a competitive environment.

Financial materiality it is not only a process which is based on the behavior of the firms, it comprises of the reactions of the system to the actions that the firms. Whether they align with the current societal interest and their stakeholders understanding of the negative externalities caused by the actions of the industry. However, with climate change another dimension comes into play and is the one of impact. In the pathways developed by Frieberg et al. only the societal, stakeholder and regulatory dimensions were considered and not the impact one. Impact is crucial when one develops an understanding of the effects that climate has on the performance of companies. It is not only the misalignment awareness and response or the industry discrepancies to make an issue financially material, but also the vulnerability and the exposure to hazards that the industry has on itself and that impact the society. Those risks diverge from those in the balance sheets of companies, but they delve in the material realm of physical objects and assets. The loss is double, both in monetary amounts and physical assets. Due to this difference the European Union developed the notion of “Double Materiality”. When defining double-materiality, the European Financial Reporting Advisory Group (EFRAG) considers both "financial materiality" and "impact materiality," with impact materiality including the following[77]: Finding sustainability issues that are significant in relation to the reporting entity's own operations and values chain (impact materiality) based on the following criteria: (i) the likelihood of actual and potential negative

[76] “Net-Zero Banking Alliance,” n.d., https://www.unepfi.org/net-zero-banking/.

[77] European Financial Reporting Advisory Group, “[Draft] ESRG 1 Double Materiality Conceptual Guidelines for Standard-Setting,” *EFRAG*, January 2022, https://www.efrag.org/Assets/Download?assetUrl=/sites/webpublishing/SiteAssets/Appendix%202.6%20-%20WP%20on%20draft%20ESRG%201.pdf.

impacts on people and the environment, as well as their severity (scale, scope, and remediability); (ii) the size, scope, and likelihood of actual positive impacts on people and the environment associated with the operations and value chains of the companies; and (iii) the urgency derived from planetary boundaries and social or environmental public policy goals.

The inquiry into the process by which an issue attains financial significance is restricted inside the realm of climate change. Restricting the analysis of an asset to its monetary and financial worth hinders the ability to comprehend its whole impact. The notion of "double materiality" was established to assist organizations in conducting a more comprehensive evaluation of their policies and prospects in relation to climate change mitigation. The integration of "financial materiality" and "impact materiality" under the framework of "double materiality" remains a contentious subject. Currently, we have reached the ultimate phase of financial significance, when regulations and protocols have been implemented to address the issue of climate change. By solely considering the alterations in a company's balance sheet resulting from climate-related factors, the evaluation of adverse external effects and weaknesses may be very inaccurate. If the industry or sector being considered includes an evaluation of the potential adverse effects on its value chain and stakeholders, the materiality assessment would extend beyond the financial domain, providing a comprehensive perspective on the most effective strategies for mitigating and adapting to these impacts.

CHAPTER 2: TRANSITION RISKS: COMPONENTS AND THEIR ORIGIN

Transition risks refer to a specific category of risks that arise from climate-related factors and have an impact on the operational and structural aspects of an organization. They are not restricted to internal occurrences; rather, they are distinguished by an exterior impact. The non-linear nature of these externality effects is responsible for their occurrence. The exposure to a transition risk is caused by a multitude of behaviors, which ultimately result in a sequence of dangers. They arise from systemic transformations, alterations in regulation, fluctuations in consumer practices, and other variables that will be addressed in this chapter. Their cross-cutting feature and the fact that they are not isolated dangers are what is important. It is not viable to achieve isolation as a means of mitigating transition risk. There is no single event that can independently trigger a transition risk. It is a consequence of constant enactment of policy actions and operational decisions which do not align with the international climate objectives, sectorial decarbonization pathways and regulations. However, in the life of a company there might be a moment in which a "transition risk trigger event" can ignite chain reaction which will develop in the "straw that broke the camel's back". The "straw that broke the camel's back" is a moment in which the asymmetry between the company's actions and the international decarbonizations objectives are at peak. The asymmetrical peak translates to the highest moment of vulnerability to which a company is exposed to transition risks. This exposure has different impacts. The "transition risk trigger event" can lead the company to significant losses in the balance sheet and operational activities which did not forecast the possible decarbonization pathways related risks. The event's inception may be traced back to a set of activities that are deeply connected to corporate values, stakeholder involvement, policy changes, and technological improvements. Understanding the cause of the cascade event that leads to the creation of transition risks is crucial in the current context of transitioning to a low-carbon economy. This chapter will specifically examine the source and constituents of transition risks to determine the points at which events intersect and how risks arise. Transition risks will arise from four main macro areas of relevance. Climate policy, regulation, and legislation. The advancement of low-carbon technologies. Shifts in consumer behavior and investor attitude. Finally, let's consider the influence of reputation and liabilities.

2.1 Risks from developments in climate policy, legislation, and regulation

Policy, legislation, and regulation form the foundation of a nation's system. They are extremely vulnerable to fluctuations, which are frequently triggered by public opinion and mood. Furthermore, the sort of regime significantly influences the manner in which those changes occur. The successful transition to a low-carbon economy is heavily reliant on the political priorities and plans of a nation. The political agenda exerts influence over the formulation of legislation and the establishment of standards pertaining to sustainability practices. This section will investigate the association between policy, politics, law, and regulation with the low-carbon transition, finding their transition risks origin. Examining the various ways in which different types of governments react to changes in climate policy. Next, when relocating to another country, it is important to consider the potential hazards that may arise due to the differences in tax systems and their lack of alignment. Finally, elucidating the influence of policy mechanisms like the Carbon Border Adjustment Mechanism (CBAM) on the emergence of transition risks.

2.1.1 The connection between transition risks and norms.

The fluctuations in regulatory and political behaviors are unpredictable. The variations in government emotion and political perspectives toward a certain subject have tangible ramifications on the actions of citizens, industries, and investments. Climate change policies are particularly vulnerable to changes in government practices and political ideology. Political and regulatory concerns, while distinct, are intricately interconnected. Volatile changes in the political environment introduce greater uncertainty when making long-term loan and investment choices. Indeed, it is accurate to state that several countries have established goals to tackle the mitigation and adaptation methods associated with climate change within the existing international climate policies. Nevertheless, it is important to note that these goals are not universally applicable nor legally obligatory. They can be influenced by the duration of the government administration. This analysis will examine the relationship between the risks associated with climate change and the societal norms that have emerged as a result of political systems.

Regardless of the type of regime, same risks arise because of the political decisions made by the current leadership. Political risks arising from policy changes are susceptible to fluctuations when there is a change in administration or in the ruling body. The factors that influence these shifts are public opinion, political parties,

governance quality, religion, and legal traditions.[78] To identify the risks due to norm changes that lie within those elements, one need to assess why shifts occur.

Public opinion around climate change is evolving. Studies have demonstrated that when faced with collective hazards, social norms can be modified, resulting in greater collaboration in situations with high levels of risk.[79] Public opinion has a significant role in influencing behaviors. In the context of the low-carbon transition, there is a growing need to move from fossil fuels to renewable energy sources. This is driven by the perceived harm and high danger that fossil fuels represent to the environment. As a result, politicians modify their agenda by aligning their policies with a government that is more conscious of climate issues. Simultaneously, this change in norms might encourage modifications in conduct that conform to perceived societal expectations, ultimately encouraging collaboration and reducing risks.[80] This climate-related policy risk, which is associated with the modification of norms resulting from a shift in public opinion, can be categorized as a sub-transition risk that is predominantly social and driven by grassroots movements. It also indirectly affects how corporations, which are impacted by these changes in regulations, respond to the demands of public opinion and whether they can adjust to the new climate policies. Public opinion is the foundation of a democracy, and political parties will adhere to the demands and preferences of the public opinion. They serve as the means by which the standards are introduced, which will have an effect on the risks associated with climate-related policies, which in turn will affect the firms and industrial sectors. While the other factors are directly linked to the public's attitude on climate change, risks arising from legal traditions can be considered a subset of normative risks.

Research has explored the relationship between legal traditions and economic outcomes, highlighting how endogenous legal traditions can shape economic development.[81] They not only have the ability to influence economic development, but they may also affect the paths of transition. The ability of legal traditions to adjust to evolving political situations can likewise influence the progress of financial development and the efficacy of governance.[82] Moreover, the influence of legal

[78] Thomas J. Leeper and Rune Slothuus, "Political Parties, Motivated Reasoning, and Public Opinion Formation," *Political Psychology* 35, no. S1 (January 2014): 129–56, https://doi.org/10.1111/pops.12164.
[79] Áron Székely et al., "Evidence from a Long-Term Experiment That Collective Risks Change Social Norms and Promote Cooperation," *Nature Communications* 12, no. 1 (September 2021), https://doi.org/10.1038/s41467-021-25734-w.
[80] Carl A. Latkin et al., "Social Norms, Social Networks, and HIV Risk Behavior among Injection Drug Users," *AIDS and Behavior* 14, no. 5 (May 2009): 1159–68, https://doi.org/10.1007/s10461-009-9576-4.
[81] Carmine Guerriero, "Endogenous Legal Traditions and Economic Outcomes," *Social Science Research Network*, January 2012, https://doi.org/10.2139/ssrn.2097706.
[82] Hatra Voghouei, M. Azail, and Siong Hook Law, "The Effect of Dynamic Legal Tradition on Financial Development: Panel Data Evidence," *European Journal of Law and Economics* 35, no. 1 (November 2010): 109–36, https://doi.org/10.1007/s10657-010-9191-x.

traditions on administrative adjudication impacts the judgments and determinations made by administrative tribunals.[83] Furthermore, legal traditions have the potential to impact the caliber of institutions, governance structures, and the overarching legal framework of a nation. The impact of legal traditions on economic roles, property rights, and governance can have long-lasting consequences for community norms and behavior.[84] Therefore, while considering transition risks, it is necessary to examine the differences in legal traditions in order to determine if a particular state may undergo a policy change as a result of climate change. They fit as well as a subset of climate-related normative threats.

Political risks are connected to market risks, such as changing in consumer behavior.[85] A growing political risk in the financial sector is the potential for increased support for alternative and more extreme political approaches to climate change as the physical problems associated with it become more evident. Regulatory risks, a subset of political risks, have a direct impact on the value of loans, investments, and overall operations of financial institutions. The degree of impact that regulation, due to political changes stemming from climate change awareness, has on finance is given by two factors: the level of strictness of the laws and the capacity of the credit institution to align with the regulator's objectives. Asymmetry between the two impacts the capital flows on which economies thrive. The business model of a credit institution should integrate ESG risks as part of the institution-wide risk management framework, in accordance with paragraph 152 of the EBA guidelines on Internal governance.[86] The central banks are aligned with the current government objectives on the decarbonization strategies. This has a real impact on how the low-carbon transition works. Re-orienting capital flows towards sustainable investments is one of the long-term objectives of the current transition. The result is that the credit institution's policies are not aligned with the new requirements of central banks, which are due to a change brought by regulators. The effect of this asymmetry is the exposure to a transition risk which consequently can disrupt the business model. While the expansion of climate legislation may have adverse consequences for the financial industry, it also presents potential advantages. The enforcement of legislation designed to advance sustainability and facilitate the

[83] Monika Stachowiak-Kudła and Janusz Kudła, "Path Dependence in Administrative Adjudication: The Role Played by Legal Tradition," *Constitutional Political Economy* 33, no. 3 (October 2021): 301–25, https://doi.org/10.1007/s10602-021-09352-8.
[84] Carmine Guerriero, "A Novel Dataset on Legal Traditions, Their Determinants, and Their Economic Role in 155 Transplants," *Data in Brief* 8 (September 2016): 394–98, https://doi.org/10.1016/j.dib.2016.05.049.
[85] Thompson, *Green and Sustainable Finance*.
[86] EBA. (2024). Draft Guidelines on the management of ESG risks. In CONSULTATION PAPER. https://www.eba.europa.eu/sites/default/files/2024-01/c94fd865-6990-4ba8-b74e-6d8ef73d8ea5/Consultation%20papaer%20on%20draft%20Guidelines%20on%20ESG%20risks%20management.pdf

revelation of climate-related hazards could offer opportunities for financial institutions and professionals in sustainable finance. An analysis conducted by Vivid Economics and the Principles for Responsible Investment reveals that certain companies within the MSCI ACWI index would experience negative impacts if climate policies and regulations aligned with the objectives of the Paris Agreement were implemented. Conversely, the top 100 companies would witness a significant 33% rise in their profits.[87]

There is a correlation between transition risks and norms, and this correlation includes political sub-risks that have substantial societal repercussions. The specific form of government does not result in a significant variance in the method in which the system assimilates normative, political, and policy risks. This is because the system adapts to the unique form of government. According to the characteristics of those dangers, they are more likely to arise from lower levels than from higher levels. Although this is the case, they have a huge impact on both the market and the government.

2.1.2 The alignment of EU Taxonomy and Chinese Taxonomy as measures for assessing the exposure to transition risks

The European Taxonomy is a strategic tool used to assess exposure to transition risks. An activity is considered sustainable if it meets four overarching conditions and has six environmental aims. The four conditions are as follows: firstly, making a significant contribution to at least one environmental objective; secondly, avoiding any significant harm to other environmental objectives; thirdly, adhering to the minimum safeguard requirements; and finally, meeting the technical screening criteria outlined in the taxonomy delegated acts. The first condition encompasses six environmental objectives: climate change adaptation, climate change mitigation, sustainable use and protection of water and marine resources, transition to a circular economy, prevention and pollution control, and protection and restoration of biodiversity and ecosystems. China does not have a specific legal definition that falls under the rigorous classification of a "taxonomy" like the one used in the European Union (EU). China has not yet implemented a sovereign green bond, unlike the EU. Although China's green credit standards include certain measures, they do not have defined thresholds. Similarly, the green bond legislation in China lacks specific measurements or benchmarks. The term "taxonomy" commonly refers to the 2015 green bond catalogue produced by the People's Bank of China in the context of China's green finance.[88] In recent years, China has actively engaged in international

[87] Thompson.
[88] https://www.oecd-ilibrary.org/sites/5abe80e9-en/index.html?itemId=/content/component/5abe80e9-en

cooperation and collaborated with the European Union (EU) to build a Common Ground Taxonomy (CGT) for the purpose of mitigating climate change. This study identified the objectives of the Chinese taxonomy. The areas of focus include climate change response, pollution control for environmental betterment, ecological conservation, and more efficient resource usage in circular economy waste recycling and pollution prevention.[89] The two taxonomies are applicable to distinct user groups. The EU taxonomy is intended for any user who meets the criteria outlined in the Corporate Sustainability Reporting Directive (CSDR), while the Chinese taxonomy is obligatory for all green bond issuers. The Chinese taxonomy implemented in 2021 follows a hierarchical structure with four levels. It encompasses six distinct groups and encompasses a total of 204 specific activities. The six categories include the energy-saving and environmental protection industry, the clean production industry, the clean energy industry, the ecology and environment-related business, the sustainable improvement of infrastructure, and the green services sector. The notion of a universal taxonomy on sustainable activities entails the creation of a mutually agreed upon comprehension and categorization system for economic activities that promote sustainability. The purpose of this taxonomy is to establish a uniform framework that promotes consensus and coordination on sustainable development objectives and methods among different stakeholders.[90] During the initial version of the Common Ground Taxonomy, it was necessary to establish shared principles or areas of agreement upon which to base the development of the text. The climate change mitigation activities outlined in the China Taxonomy were extracted and the International Standard Industrial Classification of All Economic Activities (ISIC) was utilized to establish a shared understanding of sector-specific activities. During the drafting process, certain sections of the text were derived from both taxonomies. The purpose of mitigating climate change was incorporated in the CGT, along with the eligibility requirement of making a significant contribution. The purpose of combating climate change is derived from the Chinese taxonomy, which includes four top-level sectors together with their related industrial codes and standards. The choice was based on the fact that the climate change objective was more comprehensively addressed by both taxonomies. An alignment of priority was demonstrated across six ISIC sectors: agriculture, forestry, and fishery; manufacturing; electricity, gas, steam, and air conditioning supply; water supply; sewerage, waste management, and remediation operations; construction; and transportation and storage. In summary, a shared classification system for sustainable activities acts as a cohesive structure that

89 https://finance.ec.europa.eu/system/files/2022-06/220603-international-platform-sustainable-finance-common-ground-taxonomy-instruction-report_en.pdf

90 Caterina Lucarelli et al., "Classification of Sustainable Activities: EU Taxonomy and Scientific Literature," *Sustainability* 12, no. 16 (August 2020): 6460, https://doi.org/10.3390/su12166460.

encourages openness, uniformity, and cooperation in the pursuit of sustainability objectives. This taxonomy facilitates the alignment of sustainability activities across different sectors and locations, promoting a unified understanding and vocabulary. It plays a crucial role in fostering a more sustainable and resilient future.

The CGT serves as a crucial mechanism for harmonizing the policies of the European Union and China in determining the parameters of a sustainable endeavor. However, if the definition is provided, hazards can also be standardized. The CGT can serve as a metric for assessing the level of vulnerability to transition risks. By analyzing an activity using taxonomies, one can take advantage of the opportunity to mitigate transition risks. Each classification has distinct applications. Banks can utilize the EU taxonomy to find sustainable investments. By aligning with the taxonomy criteria, firms can reduce their exposure to transition risks associated with regulatory modifications and market changes.[91] Furthermore, including the taxonomy into risk assessment techniques enables a more efficient understanding of their susceptibility to climate-related dangers. Companies can demonstrate their commitment to sustainable practices and transparency by disclosing that their operations are in line with the taxonomy.[92] An exposure to a hazard can also materialize due to bad decision making. Through the adherence to the taxonomy criteria's an organization can proactively take decisions to handle transition risks.[93] The taxonomy serves as a framework for reporting a company's sustainable activities. This is closely related to the act of revealing information. Reporting and disclosing a sector operation in accordance with the taxonomy criteria reduces the vulnerability to liability and damage to reputation. Finally, the EU taxonomy can be utilized to alleviate cascading risks. They are referring to the interrelated and potentially magnifying effects that can result from the transition to more sustainable practices. These risks might appear in several areas, affecting the stability of finances, the dynamics of the market, and the sustainability of the environment. The idea of cascading risks emphasizes the intricate and interconnected structure of the transition process, emphasizing the necessity for comprehensive methods to control risks. In order to mitigate the potential risks associated with transitioning, a company must thoroughly evaluate the intricacies of incorporating climate change into its corporate innovation strategy. This evaluation should take into account the requirement to strike

[91] Franziska Schuetze and Jan Stede, "EU Sustainable Finance Taxonomy – What Is Its Role on the Road towards Climate Neutrality?," *Social Science Research Network*, January 2020, https://doi.org/10.2139/ssrn.3749900.
[92] Thomas Stridsland, Søren Løkke, and Hans Sanderson, "Time to Move from Accounting to Decision Support? Considerations for Improved Emission Disclosure Enhancing the Green Transition," *Preprints.Org*, February 2023, https://doi.org/10.20944/preprints202302.0169.v1.
[93] Jean-François Mercure, "Toward Risk-Opportunity Assessment in Climate-Friendly Finance," *One Earth* 1, no. 4 (December 2019): 395–98, https://doi.org/10.1016/j.oneear.2019.11.007.

a balance between short-term financial performance and long-term sustainability objectives. Companies have issues stemming from cross-cutting risks encompassing market competitiveness, regulatory compliance, and stakeholder expectations.[94]

Alternatively, the Chinese taxonomy may serves as a regulatory tool to regulate the domestic Chinese green bond market. When applied to real-world scenarios, the Chinese taxonomy for assessing transition risks closely resembles the European taxonomy. Due to the nature and goal of the Chinese taxonomy, there have been various modifications in the assessment of risks. Initially, the Chinese classification system places emphasis on the green bond market. The growing association between the green bond market and the government bond market is a clear indication of how the former impacts the national progress towards achieving sustainability. It signifies a heightened flow of information and the spread of risk between various markets.[95] Furthermore, due to its exclusive impact on the financial industry, the scope of the issue is restricted. There is no specific categorization for a sustainable activity, but rather a set of criteria that must be met in order to qualify for green bond issuance. This results in increased vulnerability to potential dangers caused by unforeseen changes in the activity of specific sectors, in response to climate change events. The term "China green taxonomy" pertains to the provision of financial services for economic activity.[96] The designation of an economic activity as sustainable itself is not the focus. The absence of documentation might increase the vulnerability of sectors to risks resulting from a lack of preparedness in adopting sustainable practices.

The implementation of the CGT would lead to a comprehensive comprehension of the requirements that firms need to fulfill in order to mitigate the risks associated with misalignment, as defined by the concept of "sustainable activity". Developing a common definition involves establishing specific parameters and indicators to be followed. This ultimately leads to a comprehensive analysis of the risks and weaknesses faced by Chinese companies seeking to enter the EU market, as well as EU companies seeking to enter the Chinese market. The CGT serves as a framework for defining guidelines and is a pioneer in promoting international cooperation to align nations with diverse economic, political, and social systems in transitioning to a low-carbon economy. To align the taxonomies and create a common one would

[94] Stefano Giglio, Bryan T. Kelly, and Johannes Stroebel, "Climate Finance," *Annual Review of Financial Economics* 13, no. 1 (November 2021): 15–36, https://doi.org/10.1146/annurev-financial-102620-103311.
[95] Xinmiao Zhou, Hongyuan Lu, and Shengchao Ye, "The Information Transmission and Risk Contagion Effect between Green Bond Market and Government Bond Market in China," *Frontiers in Environmental Science* 11 (March 2023), https://doi.org/10.3389/fenvs.2023.1091203.
[96] https://finance.ec.europa.eu/system/files/2022-06/220603-international-platform-sustainable-finance-common-ground-taxonomy-instruction-report_en.pdf

translate in an international understanding and definition of sustainable activity. A common definition can provide mitigation towards the operational risks of a company when structuring its business. Italian Chinese companies need a common understanding of what is considered sustainable both in Italy and China. It would decrease the chances of occurring in regulatory and normative risks, which stem often from the different requirements of legislative nature.

2.1.3 Overview of transition risks of normative nature in China and Italy with a focus on the CBAM.

The Carbon Border Adjustment method (CBAM) is a method devised by the European Union to impose an additional tax on imported goods from foreign countries. This tax is determined by the emission intensity of certain products. In essence, the CBAM imposes a carbon price on imported goods. The carbon tax paid on the imported goods increases proportionally with the GHG emissions of that specific product, relative to the best available technology (BAT) in the same industry. It guarantees that the carbon price of imported goods matches the carbon price of domestically produced goods. The MS will release and update CBAM certificates, with the carbon price being determined by the weekly average auction price of the EU Emission Trading System (ETS).

Researchers says that the CBAM could increase to increase trade costs, affecting the competitiveness of foreign suppliers of carbon-intensive goods.[97] The introduction of the CBAM could also have other type of externalities such as changes in the market environment which would influence the economic activities of whole sectors of the economy. The mechanism aims to address carbon leakage by imposing charges on imports based on their emission content, potentially affecting the economic efficiency of trading partners.[98] For instance, let's consider the solar panel industry, which is currently predominantly controlled by China. China accounts for more than 80% of the global supply of solar panels. The implementation of the CBAM would not only result in higher import expenses for Chinese enterprises but also potentially lead to a market realignment. A disparity in carbon pricing between Chinese and European products could result in a halt to imports from China to Europe. This would entail not just a detriment for the Chinese, but would also have repercussions for the European enterprises that currently depend on the importation of solar panels from China. Internal carbon pricing is a useful tool for firms to plan for different scenarios, predict

[97] Byeongho Lim et al., "Pitfalls of the EU's Carbon Border Adjustment Mechanism," *Energies* 14, no. 21 (November 2021): 7303, https://doi.org/10.3390/en14217303.
[98] Iva Guterres, "Enforcing Environmental Policy – the Role of the European Union," *UNIO* 8, no. 1 (December 2022): 32–52, https://doi.org/10.21814/unio.8.1.4522.

outcomes, analyze sensitivity, and evaluate investments. It helps organizations make educated decisions that are in line with their sustainability goals.[99] The European hyper regulation on the cost of carbon due to the transition to a low-carbon economy could open the path to a new series of risks.

The primary inherent risk arises from the discrepancy between the legislation governing internal carbon pricing in Europe and China. These two systems are highly distinct. Europe has implemented a well-organized carbon market system, known as the ETS, since 2014. This has enabled and continues to enable sectors to progressively reduce their carbon emissions. However, this not only impacts European countries, but also all the participants in their value chain, the majority of which are located in China. In contrast, China lacks a well-organized carbon market that effectively monitors carbon prices and imposes restrictions on enterprises. In order to assess these risks, it is necessary to compare the internal carbon schemes of China and the EU. Any differences between the two schemes could lead to a vulnerability in relation to the implementation of the CBAM and the exposure to misalignment risks. If the Chinese domestic carbon tax policies are more stringent than the European ones, this would result in a competitive disadvantage for European enterprises. China has initiated eight regional carbon market pilots in Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei, Chongqing, and Fujian since 2013.[100] On July, 16th 2021 the pilots went national and China launched the carbon market in the whole nation.[101] Moreover, China has grown to be the second largest carbon market after Europe due to the high presence of high emitting industries.[102] Both the EU carbon market and the Chinese carbon pilot encompass substantial emission sectors such as industry and power. Nevertheless, significant disparities exist between the two markets as a result of distinct development procedures. The main differentiation resides in the method of allocating carbon allowances. In the EU-ETS, the auction technique is employed and the European Commission determines the allocations for each member. On the other hand, the Chinese market uses a free allocation methodology, which makes it vulnerable to having an excess of allowances. Both markets are experiencing an oversupply of carbon allowances, resulting in a breakdown of carbon pricing. This issue is particularly impacting the Chinese market, since credits can only be traded through

[99] Nuno Bento, Gianfranco Gianfrate, and Joseph E. Aldy, "National Climate Policies and Corporate Internal Carbon Pricing," *The Energy Journal* 42, no. 5 (September 2021): 89–100, https://doi.org/10.5547/01956574.42.5.nben.
[100] Ren Cong and Acy Lo, "Emission Trading and Carbon Market Performance in Shenzhen, China," *Applied Energy* 193 (May 2017): 414–25, https://doi.org/10.1016/j.apenergy.2017.02.037.
[101] Xiaoya Wang, "The Impact of China's Entry into the Carbon Trading Market on European Carbon Prices," *BCP Business & Management* 34 (December 2022): 1542–50, https://doi.org/10.54691/bcpbm.v34i.3210.
[102] Haixu Yu et al., "Carbon Market Volatility Analysis Based on Structural Breaks: Evidence from EU-ETS and China," *Frontiers in Environmental Science* 10 (September 2022), https://doi.org/10.3389/fenvs.2022.973855.

immediate transactions. The limitation leads to a constrained variety of financial products and trading activity in comparison to those found in the EU-ETS. The volatility in the carbon markets is influenced not only by the quantity and nature of allowances, but also by political and climate changes.

Transition risks arising from the misalignment produced by the Carbon Border Adjustment Mechanism (CBAM) can be classified as follows. There are several risks that arise from the disparity in policy. There is now no standardized global policy regarding the carbon market, and there is no official agreement in place to govern the emission trading schemes between China and Europe. To accurately evaluate this ambiguity, one should rely on the number of collaboratively redacted documents on carbon pricing that have been created by the EU and China. The second risk arises from the repercussions of varying implementations of norms. The divergent application of an ETS in carbon markets leads to an imbalance in the allowances. The EU ETS imposes more stringent criteria for the distribution of allowances, whereas the Chinese system, which allows for free allocation, is more likely to result in a surplus. The implementation of the CBAM has significantly influenced the conduct of firms due to the substantial impact of carbon price volatility on them. Several indicators can be used to comprehend and evaluate this particular risk, including the carbon price, the probability of volatility, and the susceptibility to changes caused by other systemic shifts. When evaluating the risks associated with volatility and policy changes owing to the implementation of the Carbon Border Adjustment Mechanism (CBAM), it is important to evaluate a range of external factors, including both nationally established allowances and the choices made by companies operating in the carbon market. External factors, such as technological advancements and changes in consumer behavior, can affect how an industry or sector manages its carbon footprint and if it raises its vulnerability to significant risks associated with transitioning to a more sustainable model.

2.2 Risks from the adoption of new low-carbon technologies.

Low-carbon technologies encompass creative methods that promote energy efficiency, diminish emissions, and facilitate the shift towards greener energy sources. Given the current circumstances of shifting towards an economy with reduced carbon emissions and meeting the climate objectives outlined in the Paris Agreement. Integrating low-carbon technologies is an essential component of an industry's transition plan. Nevertheless, the implementation of those technologies is not simple. The issues lie in the use, development, efficiency, operationalization, and susceptibility of these technologies. Multiple studies emphasize the significance of renewable energy

technology in attaining this objective. This becomes particularly critical, especially in industries with large levels of emissions, such as concrete/construction, steel, shipping, and automobile. There are two aspects of innovation related to low-carbon technologies. The utilization of technology to reduce, convert, and enhance energy usage, as well as the application of technology to capture greenhouse gas emissions. Carbon Capture and Storage (CCS) and Carbon Dioxide Removal (CDR) technologies are both considered potential solutions for reducing the current levels of greenhouse gas (GHG) emissions in the environment. On the contrary, we encounter devices that utilize wind energy, solar energy, nuclear energy, or biomass. The implementation of new technologies that are crucial for the low-carbon transition carries inherent risks. Renewable energy technologies are essential for achieving sustainable development. [103] These technologies not only provide clean energy but also contribute to economic growth and environmental protection. Additionally, renewable energy technologies can stimulate the development of related industries, further enhancing their impact. [104] The risks related to the adoption of new low-carbon technologies do not end at the technical area. They have consequence on the market performance, investor sentiment, consumer behavior and the assets of the industry.

2.2.1 The adoption of low-carbon technologies and their impact on companies' strategies and business models.

Industries and segments of the economy must adjust to emerging demands. These needs are indicated by a change in consumer behavior towards the need for a more environmentally-friendly economy, as well as government acts that mandate enterprises to progress in their plans to transition to low-carbon practices. The new regulations primarily entail the imperative to decrease emissions and alter the energy source utilized by enterprises for the production and operation of their establishments.

The change in the source of energy might have severe impacts on the business strategy of an industry. The financial balance sheet of the company for example is the one that might be impacted first. The financial risk of shifting the energy supply from fossil fuel to renewable is a significant factor that drives risk perception. [105] Financial risks encompass an assessment of both credit risks and market risks associated with an investment and its potential future benefits. When evaluating the impact associated with the risk of implementing low-carbon technology, it is necessary to examine two

[103] Poul Alberg Østergaard et al., "Sustainable Development Using Renewable Energy Technology," *Renewable Energy* 146 (February 2020): 2430–37, https://doi.org/10.1016/j.renene.2019.08.094.
[104] En Zhao et al., "Assessing the Economic Impact of Renewable Energy from a Technology Perspective," *Advances in Economics and Management Research* 1, no. 1 (May 2022): 35, https://doi.org/10.56028/aemr.1.1.35.
[105] Gireesh Shrimali, "Financial Performance of Renewable and Fossil Power Sources in India," *Sustainability* 13, no. 5 (February 2021): 2573, https://doi.org/10.3390/su13052573.

distinct aspects. One side encompasses low-carbon technologies that pertain to energy production, including solar, wind, biomass, and nuclear. In addition to being a financial burden on a company's balance sheet, expenses also include various other risks, including susceptibility to climate change events, uncertainty arising from weather fluctuations, and vulnerabilities connected to security, biodiversity, and dependence on external variables. On the contrary, we encounter low-carbon technologies that primarily serve as offsets. These technologies are employed by firms to reduce their emissions. While the operational risks of these entities are relatively low, they nevertheless face risks related to their technology progress and implementation costs.

The financial risks associated with the development of low-carbon technologies can be listed as follows. Counterparty risks, they are associated with the financial stability and reliability of counterparties involved in renewable energy projects, such as investors, lenders, and off-takers.[106] Grid risks relate to the integration of renewable energy into existing energy grids, including challenges in grid stability, power quality issues, and operational constraints.[107] Financial sector risks specific to the financial sector, such as uncertainties in financing renewable energy projects, market volatility, and regulatory changes impacting financial institutions.[108] Financial development risks arise from the influence of financial development on investments and projects related to renewable energy. These risks include the availability of financial resources, the appeal of investments, and the prioritization of financial innovation.[109] Additionally, there are environmental hazards as well as policy and regulatory uncertainties. The former are a result of the impact that climate change has on the progress of specific renewable energy initiatives. Both solar panels and wind turbines are vulnerable to weather occurrences, which leads to potential financial risks and heightened susceptibility to certain climate dangers. Investing in renewable energy projects carries a risk associated with the financial performance and return on investment. This risk is determined by elements such as project costs, revenue stream, and the stability of renewable energy initiatives.[110] Then there are market and operational risks which have an impact on the price of energy and the day-to-day operations. Lastly there are technological risks. Those are related to the adoption of new renewable energy technologies, including technological obsolescence, performance variability, and innovation challenges.[111]

[106] Shrimali.
[107] Shrimali.
[108] Shrimali.
[109] Xinxin Wang et al., "The Global Impact of Financial Development on Renewable Energy in a Panel Structural Vector Autoregression Analysis," *Sustainable Development* 31, no. 3 (November 2022): 1364–83, https://doi.org/10.1002/sd.2453.
[110] Aminu Bature et al., "An Investigation into the Effects of Risks and Risk Management of Bioenergy Projects," *E3S Web of Conferences* 61 (January 2018): 00006, https://doi.org/10.1051/e3sconf/20186100006.
[111] Bature et al.

Those are the risks that need to be considered by the company to assess the impacts of the development of a project that involves the introduction of low-carbon technologies. When considering climate change, it is crucial to evaluate not only the internal hazards that a company faces, but also the risks that arise from not adapting to market requirements.

The adoption of low-carbon technologies has a more significant impact on a sector than on an individual enterprise. There are inherent dangers associated with the rivalry within the sector. The competitions dangers arise from certain companies in the sector adopting new low-carbon technologies, which may leave other industries lagging behind. The risk associated with the development of low-carbon technology is characterized by its innovative nature. It presupposes that the top-performing entity in a certain industry is the one that establishes the benchmark for others to strive towards. Those who possess the ability to adapt and internally tackle all the aforementioned risks associated with changing their energy supply will prosper, while others will falter. The competition risk is closely connected to the market failure risk caused by the expensive transition to a low-emission technology or energy source. Market failure is not the sole cause, as there is also a risk of stranded assets. The failure to adopt low-carbon technologies could result in the company or industry sector becoming stranded. A stranded asset is an asset that becomes obsolete or loses economic value before its intended economic life ends owing to external circumstances such as technology developments, regulatory changes, or market movements.[112] Furthermore, the utilization of low-carbon technologies has a direct influence on the risk associated with carbon pricing. By implementing a gradual introduction of low-carbon technologies, the carbon pricing will fall. Conversely, this will lead to a rise in internal carbon pricing.

2.2.2 Overview of a global perspective on technology risk in a transition context.

An international outlook on technology risk in a transitional setting entails comprehending the difficulties and advantages linked to technological changes that aim for sustainability. The use of renewable energy sources and sustainable technology entails some risks that must be mitigated to achieve a seamless and prosperous transition. Technological transitions are complex processes that entail the evolution and reconfiguration of various aspects, such as technological advancements, changes in control mechanisms, and shifts in meaning.[113] These transitions can lead to regime

[112] Frederick Van Der Ploeg and Armon Rezai, "Stranded Assets in the Transition to a Carbon-Free Economy," *Annual Review of Resource Economics* 12, no. 1 (October 2020): 281–98, https://doi.org/10.1146/annurev-resource-110519-040938.

[113] Frank W. Geels, "Technological Transitions as Evolutionary Reconfiguration Processes: A Multi-Level Perspective and a Case-Study," *Research Policy* 31, no. 8–9 (December 2002): 1257–74,

resistance against low-carbon shifts, introducing politics and power dynamics into the transition process.[114] Understanding the dynamics of regime resistance is crucial for policymakers and scholars to navigate the challenges of transitioning to low-carbon technologies. Moreover, the integration of clean energy technologies in emerging economies, such as India, China, and Brazil, highlights the importance of successful technology transitions in diverse global contexts.[115]

The transition from a high-carbon to a low-carbon world will require the extensive implementation of diverse products and services that utilize existing technology. These will span across sectors such as energy, transportation, petrochemicals, construction, agriculture, food production, fashion, and consumer goods. This transformation will have a profound impact not just on manufacturers of high-carbon products but also on their entire distribution networks. Although the global progress towards achieving a sustainable, low-carbon society may appear to be sluggish, there are certain instances of this shift that might be very disruptive and prompt.[116] Such abrupt changes can arise from regulatory measures like the prohibition of new petrol or diesel-powered car sales by 2035 (as seen in the EU), resulting in notable impacts on automobile manufacturers and their supply networks as well as other sectors within the automotive industry value chain.

2.3 Risks from changing consumer behavior and investor sentiment.

Consumers change their behaviors by reacting to different economic stimuli or to changes within the perception by society of different sensitive issues. In the recent years the sentiment towards the issue of climate change has grown, making it an important element of the decision making of consumers. The propaganda and the science backing the problem of climate change, the push by the governments to enact policies and rules to facilitate the transition to a low-carbon economy changed also the preference of the civil society. There are drivers which can be associated to the change of consumer behavior in the context of climate change. Some research argues that the middle class has a predisposition to buy "green appliances", it is a reaction to emphasizing the role of environmental consciousness and sustainability

https://doi.org/10.1016/s0048-7333(02)00062-8.

[114] Frank W. Geels, "Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective," *Theory, Culture & Society* 31, no. 5 (June 2014): 21–40, https://doi.org/10.1177/0263276414531627.

[115] Radhika Khosla, Ajinkya Kamat, and V. Narayanamurti, "Successful Clean Energy Technology Transitions in Emerging Economies: Learning from India, China, and Brazil," *Progress in Energy* 2, no. 4 (October 2020): 043002, https://doi.org/10.1088/2516-1083/abb52b.

[116] Dongxiang Cheng and Xiang Zhang, "Overview of Low Carbon Logistics Development in China and Foreign Countries," *IOP Conference Series. Earth and Environmental Science (Online)* 100 (December 2017): 012167, https://doi.org/10.1088/1755-1315/100/1/012167.

considerations.[117] Other researchers believe that there are sustainability drivers which reflect the predisposition of consumers towards a green buying behavior, they highlight the influence of price value and they possess a greater attitude and knowledge about green products.[118] Parallelly to this there is the promotion of a healthy lifestyle which increases the consumer awareness on the sustainable activities that one can carry to achieve the sustainable lifestyle.[119] From those drives there is a development of a series of risks.

The first one is perception risk. Consumers tend to change their behavior when they perceive a risk, studies shows that there is a correlation between the impact of perceived risks and consumer behavior.[120] It is necessary to place this perception risk in the perspective of the transition to a low-carbon economy. The consumer's sense of hazard is derived from the information provided about the present climate conditions. The stronger the negative information, the more likely the consumer would correlate it with a bad impact, resulting in a higher level of risk. The perception of hazards within the consumer, which subsequently influences their behavior to become more climate-sensitive or ecologically sensitive, is determined by two variables. The type of information they receive regarding the state of the climate and the verification of its authenticity by reputable institutions, academia, or non-governmental organizations (NGOs) operating in the field. Hence, the perception risks associated with the shift towards a low carbon economy may result in a change in consumer mood, thereby posing a market risk for enterprises that have not yet begun to publicly reveal their actions.

There is a crisis risk. Due to the Covid-19 pandemic research has shown that now consumers are more responsive when an issue is presented as a crisis.[121] The transition to a low carbon economy is directly linked to the climate crisis. Consumers are increasingly cognizant of the repercussions that can arise from underestimating the effects of a crisis. The parallels between the COVID-19 pandemic and climate change

[117] Nombulelo Dilotsotlhe and Helen Inseng Duh, "Drivers of Middle-Class Consumers' Green Appliance Attitude and Purchase Behavior: A Multi-Theory Application," *Social Marketing Quarterly* 27, no. 2 (May 2021): 150–71, https://doi.org/10.1177/15245004211013737.
[118] Sandra S. Graça and Virginie Pioche Kharé, "An Investigation of the Impact of Sustainability Drivers and Transformative Mediators on Green Buying Behavior in the US and Brazil," *Baltic Journal of Management* 18, no. 4 (July 2023): 428–49, https://doi.org/10.1108/bjm-10-2022-0377.
[119] Anniek Boeijinga, Hans Hoeken, and José Sanders, "Health Promotion in the Trucking Setting: Understanding Dutch Truck Drivers' Road to Healthy Lifestyle Changes," *Work-a Journal of Prevention Assessment & Rehabilitation* 55, no. 2 (October 2016): 385–97, https://doi.org/10.3233/wor-162409.
[120] Jia-Ping Tong, "Food Risk Perception and Its Impact on the Consumersr Purchasing Behavior," *Proceedings of the 2018 8th International Conference on Social Science and Education Research (SSER 2018)*, January 2018, https://doi.org/10.2991/sser-18.2018.49.
[121] Nguyen Ngoc Long and Bui Huy Khoi, "An Empirical Study about the Intention to Hoard Food during COVID-19 Pandemic," *Eurasia Journal of Mathematics, Science and Technology Education* 16, no. 7 (April 2020): em1857, https://doi.org/10.29333/ejmste/8207.

are undeniable. They go from the universal nature to the influence on individuals regardless of anger, gender, or socioeconomic status. The perception of a problem as a crisis is determined by the manner in which a government manages the necessary measures to address and resolve the crisis, while avoiding the development of panic.

There are environmental and sustainability risks for companies which develop from the changes in consumer preferences of people. Researchers argue that in exploring the influence of environmental and sustainability drivers on consumer behavior it was found that consumers highlight the growing importance of sustainability considerations in purchasing decisions.[122] The drivers are individuals who are involved in the process of acquiring knowledge and comprehension on the subjects of environmental degradation and climate change. By use of informative campaigns and dissemination of knowledge by other members of the civil society. Companies absorb the impact through their operational and managerial procedures. Companies must adapt their actions and information disclosure practices to address the environmental and sustainability concerns associated with changes in consumer behavior, while also avoiding the deceptive practice of greenwashing.

Lastly there are financial and economic risks. As previously mentioned, they related to the way the consumer changes impact the operations and balance sheet of the industry. The financial risk factors and purchase decisions highlight how financial considerations and economic uncertainties can influence consumer behavior and decision-making processes.[123] If changing in perceptions leads to changes in consumer behavior, this can positively or negatively affect demand for goods and services, impact the value of the organization that provide them, and in turn affect the financial institutions exposed through lending, investment, and other financial activities.[124]

Conversely, there are potential dangers arising from shifts in investor opinion. These factors are similar to those that influence changes in customer behavior, but they primarily impact the company's performance due to the presence of economic incentives. Primarily, these risks significantly influence the market performance of the sector in which the sentiment is changing. When discussing climate change, a change in the beliefs and sentiment of investors can result in a danger of market volatility. This

[122] Shanshan Li et al., "Trends in Food Preferences and Sustainable Behavior during the COVID-19 Lockdown: Evidence from Spanish Consumers," *Foods* 10, no. 8 (August 2021): 1898, https://doi.org/10.3390/foods10081898.
[123] Saumendra Das et al., "Prediction of Life Insurance Premium during Pre-and Post-Covid-19: A Higher-Order Neural Network Approach," *Journal of The Institution of Engineers (India): Series B* 103, no. 5 (August 2022): 1747–73, https://doi.org/10.1007/s40031-022-00771-1.
[124] Thompson, *Green and Sustainable Finance*.

affects asset prices and investment returns which bring erratic market behavior and heightened risk levels.[125] An example of a volatile market is the carbon market through the Emission Trading Scheme. It is a market highly susceptible to the investors sentiment towards the development of carbon intensive industries, whether to decrease the production or increase the production. These decisions are due to externalities which can be of normative, regulatory or social nature. Investors decisions can also contribute to systemic risks in financial markets, they impact asset pricing and overall market stability.[126] Systemic risks in climate change arise from climate events that prompt investors to alter their stance on policy objectives. Consequently, inducing a sudden disturbance in the system. The risk arises from the likelihood that investor mood will be influenced by the climate event, so affecting the investment's objective.

Additionally, there are distinct risks associated with certain companies that arise from investor sentiment. This presents itself when there is negative relationship between investor sentiment and returns of risky companies, the study suggests that sentiment driven decisions may introduce company specific risks that affect stock performance.[127] This particular risk is applicable to companies that have a high carbon footprint, as they are the ones most vulnerable to climate-related threats. In the absence of decarbonization strategies, a sector that emits a high amount of carbon can face sector-specific risks. In this scenario, these risks would include deteriorating relationships with investors and a negative impact on stock performance. Another factor that influences investor sentiment is the release of information. The information dissemination risks research shows that the dissemination of information shapes sentiment driven market behaviors and potential risks.[128] The implementation of new regulations and guidelines, such as the CSRD or the Sustainability Disclosure rules introduced by the Shanghai Stock Exchange (SSE), exemplify the potential impact of information dissemination risks on the operations of an industry. Prior to the implementation of disclosure rules, investors and stakeholders lacked awareness regarding the environmental, climatic, and social aspects of the organization. The necessity for disclosure entails a range of risks associated with the public dissemination of previously confidential material. To be more precise, the information in question was not obligatory to be revealed. It was at the discretion of the corporation to determine if,

[125] Malcolm Baker and Jeffrey Wurgler, "Investor Sentiment in the Stock Market," *Journal of Economic Perspectives* 21, no. 2 (April 2007): 129–51, https://doi.org/10.1257/jep.21.2.129.
[126] Sifan Yu, "The Impact of Investor Sentiment for the U.S. Stock Market Based on Fama-French 3-Factor Model," *E3S Web of Conferences* 275 (January 2021): 01055, https://doi.org/10.1051/e3sconf/202127501055.
[127] Subramanian R. Iyer and Joel T. Harper, "Cash Flow Volatility and Investor Sentiment," *Managerial Finance* 43, no. 2 (February 2017): 178–92, https://doi.org/10.1108/mf-02-2016-0045.
[128] Qingchao Yang, "Summary of the Researches on the Influence of Investor Sentiment on Stock Returns under the Background of Big Data," *SHS Web of Conferences* 151 (January 2022): 01001, https://doi.org/10.1051/shsconf/202215101001.

when, and how to make it known. This dimension allowed investors to trust the company's claims without requiring independent verification. The absence of openness may have resulted in potential hazards associated with the uncertainty surrounding the company's actions and approach towards the transition to a low-carbon economy.

The transition risks associated with the shift in investor sentiment and consumer behavior are non-linear. Their consequences have repercussions on other sections of the firm. view risks can result in market risks, specifically liquidity risk, due to reduced production and consumption of a good. This is influenced by the consumer's view of a company's initiatives towards transitioning to a low-carbon economy. Conversely, the potential for information being revealed negatively affects both investor relations and relationships with banks. This poses a significant financial danger to the company's operations. Prior to the implementation of regulatory disclosure requirements, banks did not see a company's disclosures of their transition initiatives as significant when making investment decisions. However, this has changed and banks now view these disclosures as vital. The risks related to the disclosure of information have a significant impact on other hazards. The inability to secure a loan results in a shortage of available funds, leading to adverse effects on the industrial system. If a certain industry is considered excessively carbon-intensive and it is demonstrated that the methods of reducing carbon emissions are not effective, this indicates that the likelihood of successfully decarbonizing that industry during the transition period is very low. This, in turn, gives rise to risks in both the market and the sector's system, so amplifying volatility. In general, the transition risks associated with changes in consumer perceptions and investor mood are not limited to certain areas. These entities are distinguished by a significant degree of interconnectedness, resulting in a cascading impact.

2.4 Reputational risks vs Liability risks.

Reputational risks occur when firms are linked to high-carbon production and distribution practices and other forms of environmental damage. These factors can be associated with a decline in brand value, a decrease in demand for products and services, a drop in revenue, an increase in crisis management and resolution expenses, and a decrease in appeal to potential consumers, employees, and investors. They can also increase due to wider social sustainability problems, such as the utilization of child or coerced labor. Companies may face reputational and financial hardship if they are perceived to promote organizations and industries that contribute to global warming or other environmental and social damages, regardless of the sustainability of their own

activities. Organizations may face reputational costs if they are accused of greenwashing. Uncovering a corporation's greenwashing practices can result in activist and consumer campaigns targeting the company, leading to a decline in revenue and profitability. Reputational risks are determined not just by the extent to which a sector engages in environmentally friendly practices, but also by the extent to which the sector continues to depend on fossil fuels or activities that produce significant levels of carbon emissions. Despite the recent surge in cash allocated to sustainable and green initiatives within the financial services industry, many financial institutions continue to make significant investments in high-carbon sectors. Since the ratification of the Paris agreement in 2015, a total of 60 international banks have allocated financing over $4.6 trillion to enterprises in the fossil fuels industry.[129] Simultaneously, reputational concerns arise not just from the location of your investments, but also from your efforts to hinder the establishment of sustainable practices. Companies and financial organizations that are seen as actively trying to prevent or postpone legislation or regulation aimed at addressing climatic, environmental, and social challenges may also encounter dangers to their reputation. Hence, any harm to the reputation of a company can have adverse effects on its financial performance, including revenue and profitability. Additionally, it can diminish the overall worth of the organization and reduce its appeal to lenders, investors, and prospective workers.

Conversely, there exist liability hazards, which are also referred to as "litigation risks". These risks are a subset of transition risks since they result from the implementation of more stringent climate and environmental laws and regulations. They generate expenses that can result from legal disputes that are triggered by inadequate environmental management. Lawsuits targeting entities responsible for emitting greenhouse gases and other detrimental pollution. Activists are initiating legal challenges to exert pressure on firms and governments, compelling them to take stronger measures in preventing climate change and safeguarding the environment. Insufficient consideration of climate change and other environmental concerns by firms and investors. Their actions are guided by the notion of "polluter pays," which asserts that individuals who caused pollution in the past should be accountable for their acts and provide compensation to those who were impacted by their polluting policies. The expenses resulting from modifications in legislation, regulation, or public opinion due to a judicial proceeding may extend beyond a financial penalty. They can result in a reassessment of the value of assets and can cause substantial damage or abandonment. Non-compliance with tougher regulations may result in additional long-term costs,

[129] Banking on climate chaos report 2022. https://www.bankingonclimatechaos.org/bankingonclimatechaos2022/, accessed March 10th, 2024.

which can be considered as another externality. Litigation can have wide-ranging repercussions that extend beyond just monetary expenses. Additionally, litigation can serve as a strategic instrument to enhance the visibility of a specific matter, acquire the defendant's confidential documents or information, influence a corporation's social authorization to function, escalate the potential defendant's expenses, or exert pressure on governments to implement pertinent regulations.

The drivers of reputational and liability risks are, in part, influenced by how consumers view the activities that corporations take in response to climate-related issues. This pertains to the company's ability to reveal its actions. Which channels are utilized and what is the level of transparency and resilience of their assertions. Releasing a transition-related claim by a corporation does not always result in a positive externality. Claims connected to transition have a significant influence on consumers' perception of the company. In addition, these allegations are consistently subjected to rigorous examination by non-governmental organizations (NGOs), who are the primary initiators of legal proceedings. Hence, the components of information sharing must be supported by verified data regarding the particular climate action. Insufficient data to support a claim might result in increased vulnerability to reputational and liability issues. This is particularly accurate in the present day, since there is an increased level of consumer consciousness regarding the climate initiatives undertaken by companies.

Reputational and liability risk are heavily dependent on the perception of the organization by stakeholders. The company's perception is shaped by the acts it takes and how it communicates them. Furthermore, it is not solely a matter of how they are revealed, but rather the company's historical background. NGOs, for instance, not only investigate a company's current efforts to address climate change but also scrutinize its past behaviors that may have exacerbated the climate crisis. Liability and reputational concerns are not solely determined by present activities, but are also influenced by prior behaviors. Predicting the future changes and adaptations of regulations before they actually occur involves a forecasting element. This factor reduces the company's vulnerability to the potential damage to its reputation caused by delaying action and the legal dangers associated with non-compliance. Conversely, if a corporation does not have a proactive approach, it is more susceptible to being targeted by lawsuits for its failure to take action.

CHAPTER 3: COMPARATIVE RESEARCH ON EUROPEAN, ITALIAN, AND CHINESE SUSTAINABILITY LAWS

3.1 Overview of the climate and sustainability laws in Europe, Italy and China and their legal foundations.

In the past twenty years, legislation concerning sustainability have developed in Europe, Italy and China, becoming more important due to the global warming emergency. The main purpose has been to create legislative measures that would require corporations, regardless of their size, to disclose their actions and plans related to the shift towards a low-carbon economy. Since 2020, Europe has established a clear definition of sustainable activities through the implementation of the European Taxonomy.[130] This classification of sustainable activities provided a well-defined understanding of the acts that corporations should have performed, or more precisely, the actions that enterprises should have avoided in order to be classified as sustainable. The Non-Financial Reporting Directive (NFRD) came into effect in 2016, pre-dating the establishment of the European Taxonomy on sustainable activities.[131] The EU Parliament Directive 2014/95 requires corporations to produce reports that include details on environmental, social, and employment matters, as well as their dedication to upholding human rights, preventing corruption, and combating bribery. Moreover, it is necessary to disseminate information pertaining to the business model, policies (including the processes of due diligence), the outcomes of those policies, risk management, and key performance indicators (KPIs) associated with the firm. The term "non-financial" faced controversy due to its inclusion of information unrelated to finances, which raised concerns among financial institutions. The knowledge in question, however, is relevant to the financial system itself. Therefore, the term "sustainable information" was considered more preferable than "non-financial information." Hence, the proposal of directive (EU) 2022/2464[132] highlighted the

[130] European Union, "Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the Establishment of Aframework to Facilitate Sustainable Investment, and Amending Regulation (EU) 2019/2088" (Official Journal of the European Union, L 198/13, 2020), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852.

[131] European Union, "Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU as Regards Disclosure of Non-Financial and Diversity Information by Certain Large Undertakings and Groups." (Official Journal of the European Union, L 330/1, 2014), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0095.

[132] European Union., "Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 Amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as Regards Corporate Sustainability Reporting (Corporate Sustainability Reporting Directive)" (Official Journal of the European Union, 2022), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:2022%2F2022/2464.

need to modify several regulations concerning sustainability-related information.[133] The sustainability reporting plan sought to offer benefits to individual citizens, trade unions, and workers' representatives. The issue of which audience sustainability reporting should focus on is divided into two primary user groups. Investors, such as asset managers, and users, such as non-governmental organizations and social partners from civil society entities. The first side prioritizes the implementation of impact and risk assessments across the entire value chain, while the second side highlights the importance of monitoring environmental and social changes. Indeed, the ultimate consumer does not directly utilize reports. Nevertheless, asset managers and investors are increasingly relying on third-party providers to obtain sustainability information. These providers collect data from many sources, including corporate partners.

The legal foundation for the CSRD can be found in Article 50 and Article 114 of the Treaty on the Functioning of the European Union (TFEU).[134] The impetus for the creation of this legislation stemmed from an increasing need for sustainability data from the investment sector. The driving force behind this was the several types of risk associated with climate change and the loss of biodiversity. The regulation applies to big, medium, and small businesses, except microenterprises, that are of public interest in their respective nations.[135] The criteria for categorizing enterprises as large, medium, or small can be found in Article 3 of directive 2013/34/EU. However, there is a discrepancy in the timing of when the need will be enforced. Medium and small firms will be obligated to comply with the rule starting in 2028, whereas large enterprises would be required to do so as early as 2025. The directive's scope extends beyond EU enterprises and includes rules for disclosing sustainability information to third parties outside the EU. Third country undertakings having a net turnover over €150 million from activities conducted within the EU, as well as their subsidiaries with a net turnover exceeding €40 million, are subject to this requirement. The present CSRD wording is anticipated to be incorporated into Italian legislation by July. The Non-Financial Reporting Directive (NFRD) was included into the Italian legal framework with Legislative Decree n.254 of 2016.[136] Two further legislation, namely the Corporate Sustainability Due Diligence Directive (CSDDD) and the Green Claims Directive, are currently awaiting approval from the European Union. The former was deemed necessary due to the challenges faced by large corporations in accessing information

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[133] Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU.
[134] European Union, "Treaty on the Functioning of the European Union, Consolidated Version, OJ C 326, 26.10.2012, p. 47-390," n.d., https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12016E%2FTXT. T
[135] Art. 19(a) Directive 2013/34/EU amended by Directive 2022/2464/EU.
[136] Italian Parliament, "Decreto Legislativo n. 254 Del 16 Dicembre 2016 (Italian Legislative Decree No. 254 of December 16, 2016)." (Gazzetta Ufficiale, n.d.), 254, https://www.gazzettaufficiale.it/eli/id/2017/01/10/17G00002/sg.

across their whole value chain. The rationale for the CSDDD was that the absence of data necessitated a more robust system of due diligence by companies in order to address the data deficiency. There is a clear and significant relationship between conducting thorough research and collecting information at every stage of the industry's value chain. Furthermore, it has been discovered that value chain due diligence serves as a means of identifying risks. Notably, there is a correlation between organizations that enhanced their due diligence methods, their competitive edge, and the prevention of reputational problems. The CSDDD will be closely interconnected with the CSRD, and they will result in a synergy. According to the publication in the European Gazette, the CSRD will be closely connected to the CSDDD, with three key characteristics.[137] The initial step in gathering the information for the Corporate Sustainability and Responsibility Directive (CSRD) involves establishing a procedure that is directly linked to detecting the negative effects in line with the due diligence directive. Furthermore, the CSRD encompasses the final phase of the CSDDD, which pertains to the reporting stage. Furthermore, the CSDDD will require enterprises to have a comprehensive plan that guarantees their business model and strategy align with the objectives of the Paris Agreement. The two policy tools are designed to complement one other. Another instrument will be utilized in synergy with the CSDDD and the CSRD. The Green Claim Directive, which is mostly consumer-oriented, was created in response to the prevalent trend of greenwashing that has been observed in Europe in recent years. The setting of the story is inside the framework of the EU Green accord, serving as a means to highlight and juxtapose misleading environmental assertions. The implementation of the Green Claim directive would require any environmental, climatic, or green-related claims to be substantiated with evidence and independently confirmed by a third-party. The European Union has reached a consensus on a unified document to implement the European Financial Reporting Advisory Group's European Single Reporting System guidelines. The document came through as the Commission Delegated Regulation (EU) 2023/2772 [138], however the effective development of the reporting requirements was put to a halt by a political agreement between the European Parliament and the Council. The agreement provides a two-year delay in the adoption of the sector specific standards and a 25% reduction in the reporting requirements.[139] In the meanwhile EFRAG released which will be the electronic reporting format with which the undertaking will have to report their information. The XBRL (eXtensible

137 https://eur-lex.europa.eu/resource.html?uri=cellar:bc4dcea4-9584-11ec-b4e4-01aa75ed71a1.0001.02/DOC_1&format=PDF

138 European Union, "Commission Delegated Regulation (EU) 2023/2772 of 2023." (Official Journal of the European Union, 2023), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302772 https://ec.europa.eu/commission/presscorner/detail/en/mex_24_707.

139 https://ec.europa.eu/commission/presscorner/detail/en/mex_24_707

Business Reporting Language), the open international standard for digital business reporting has been chosen by EFRAG as the appropriate machine-readable format compliant with the requirements of the CSRD. The motive was that it is globally accepted and used by other nations, such as China, and international organizations[140] to develop digital taxonomies for financial and sustainability-related disclosures.[141]

China has recently begun to establish rules and regulations that mandate the publication of sustainability-related information, as part of its efforts towards the green transition. In 2024, the Shanghai Stock Exchange (SSE), under the instructions of the China Securities Regulatory Commission (CSRC), introduced a set of guidelines that mandated listed businesses to produce a voluntary sustainability report. The recommendations in question are referred to as "Guidelines No. 14 of Shanghai Stock Exchange for Self-Regulation of Listed Companies—Sustainability Report (Trial)". These guidelines were published on April 12th, 2024 with those for the Beijing Stock Exchange (BSE) and the Shenzen Stock Exchange (SZSE). The recommendations are a preliminary version, but a noteworthy advancement in the context of executing the directives outlined in the 20th CPC National Congress concerning the transition of economic and social growth, as well as the strategic advancement of low-carbon development. They became effective on May 1st, 2024 and they will apply to the reporting annual period ending December 31st, 2025. In order to broaden the extent, the subsequent text provides an elucidation of the placement of these recommendations within the legislative framework of China. The Company Law of the People's Republic of China (PRC) is the comprehensive legislation that governs the company system in China, encompassing regulations and rules for firms. The purposes are outlined in Article 1 as follows:

"…regulating the organization and operation of companies, protecting the lawful rights and interests of companies, shareholders, employees, and creditors, improving the modern enterprise system with Chinese characteristics, promoting the entrepreneurial spirit, maintaining the socialist economic order, and promoting the development of the socialist market economy…"

This legal document serves as the basis for the establishment of a company, whether it be a limited liability company, or a joint stock limited company. However, this guideline only applies to corporations that are listed on the stock exchange. This

[140] EBA, EIOPA, IFRS Foundation, GRI, CDP.

[141] European Financial Reporting Advisory Group. (2024). Draft ESRS Set 1 XBRL Taxonomy – Explanatory Note and Basis for Conclusions. https://xbrl.efrag.org/downloads/Draft-ESRS-Set1-XBRL-Taxonomy-Explanatory-Note-and-Basis-for-Conclusions.pdf

demonstrates the correlation with the Securities Law of the People's Republic of China. The rules are closely linked to the disclosure obligations outlined in chapter five of the Securities Law of the PRC. Chapter 5, namely Article 78, explicitly states that:

"…an issuer and other persons with information disclosure obligations as prescribed by laws,
administrative regulations, and the rules of the securities regulatory agency of the State Council shall, in accordance with the law, perform their information disclosure obligations in a timely manner…"

Article 79 specifies the deadlines for submitting the reports required by the law. Which occurs 4 months prior to the conclusion of each fiscal year.[142] It is noteworthy that Article 80 outlines a set of "material" occurrences that a corporation must disclose if they result in a significant disruption to the stock value. There is no reference to alterations in climate, weather, or ecologically linked occurrences, nor modifications resulting from the impacts of those occurrences. The sole provision that can be interpreted as such is Article 80, paragraph 3, which stipulates that if a corporation enters into a substantial contract or gives a substantial guarantee that might have a major influence on the firm's assets, interests, and financial performance, it must be reported. However, in the following article, Article 81, paragraph 9, it is considered significant if the corporation is engaged in significant legal disputes or arbitration. According to Article 85 of the Securities Law of the People's Republic of China, the responsibility for not providing or providing incorrect information lies with the individual who has the obligation to disclose information.

"…the controlling shareholder, actual controller, directors, supervisors, officers, and other directly liable persons of the issuer and the sponsor, underwriting securities company, and their directly liable persons shall be jointly and severally liable in damages with the issuer, unless they are able to prove that they have no fault…"

According to Article 86, the information must be published on the securities trading venue's website and made available for public view at the offices of firms and trading venues for securities. The recommendations for sustainable reporting by the SSE are applicable under chapter 5 of the securities law of the People's Republic of China. Their framework is currently in a preliminary stage, but it provides valuable insights into the future development of sustainability reporting in China.

[142] "Securities Law of the People's Republic of China" (Standing Committee of the National People's Congress, 2019), https://www.pkulaw.com/en_law/1c35c5991418728abdfb.html?keyword=securities%20law.

The *"Guidelines No. 14 of Shanghai Stock Exchange for Self-Regulation of Listed Companies—Sustainability Report (Trial)"* hereinafter referred as "Guidelines", are the first legal document that was published in China to give guidance on how companies listed in the stock exchanges in China should disclose their information. it is a first important step considering the history of the disclosure requirements for Chinese companies. Before this guideline Chinese companies were used to primarily disclose only environmental accounting information through different types of reports, including the social responsibility reports.[143] There is a call for Chinese enterprises to enhance their environmental management practices in order to comply with sustainability objectives.[144] The variations in disclosure procedures are apparent in the specific areas of sustainability reports, where Chinese energy companies place particular emphasis on disclosing information related to investors and employees.[145]

The guidelines show rules to follow when redacting the sustainability report. It stresses the concept of "sustainable development" in Art. 2 of the guidelines.[146] Interestingly enough it seems, that in Art. 5 there is a double materiality element. The article states as follows:

"The disclosure entity shall, in accordance with the characteristics of the industry and operations in which it operates, identify whether each subject has a major impact on the value of the enterprise (hereinafter referred to as financial importance) and whether the performance of an enterprise in the corresponding topic will have a significant impact on economic, social and environmental (herein referred as influence importance), and describe the process of analysing the importance of the subject…"

There are two main types of consequences that might be caused by a business that is required to disclose information. One pertains to the financial consequences on the value of the balance sheet, while the other, by its very nature, has a greater impact on the day-to-day operations. The latter refers to the concept of impact materiality, which

[143] Yanfei Cai, "Study of Carbon Disclosure and Its Differences between Different Countries Based on the Case of Energy Company Shell," *BCP Business & Management* 29 (October 2022): 472–85, https://doi.org/10.54691/bcpbm.v29i.2313.

[144] Kemi C. Yekini et al., "CSR Disclosure and Corporate Sustainability: Evidence from the Shenzhen Stock Exchange," *International Journal of Business Governance and Ethics (Print)* 13, no. 3 (January 2019): 300, https://doi.org/10.1504/ijbge.2019.099370.

[145] Ma Zhong and Mingyue Wang, "Corporate Sustainability Disclosure on Social Media and Its Difference from Sustainability Reports:Evidence from the Energy Sector," *Frontiers in Environmental Science* 11 (March 2023), https://doi.org/10.3389/fenvs.2023.1147191.

[146] China Securities Regulatory Commission, "Notice of Publicly Soliciting Opinions on Guidelines No. 14 of Shanghai Stock Exchange for Self-Regulation of Listed Companies—Sustainability Report (Trail) (Draft for Comment)" (Shanghai Stock Exchange, February 8, 2024), http://www.sse.com.cn/lawandrules/publicadvice/c/c_20240208_5735507.shtml.

is determined by the influence that transition measures have on a company's physical aspects, including assets, environment, and social factors. The Guidelines are founded on a dual materiality idea as opposed to a singular financial one. This enhances the congruence between Chinese stock companies' creation of the sustainability report and the standards of the ESRS. This is further substantiated in Article 11, which stipulates that the revelation of sustainable development subjects should encompass both financial and impact-related aspects. The notion of double materiality, as stated in section 3.3 of Commission Delegated Regulation (EU) 2023/2772, closely resembles the description provided in the Guidelines. The Guidelines consist of four fundamental aspects. Management, planning, assessment of potential risks and opportunities, and measurement of progress towards goals and objectives. Upon analyzing the aforementioned standards outlined in the ESRS 2 for general disclosures, a significant level of similarity is observed. The primary four areas of resemblance include governance, strategy, impact, risk and opportunity management, as well as measurements and targets.

3.2 Comparative study of the risks connected to the differences in sustainability reporting regulations in Europe and China.

This paragraph will analyze and contrast the initial three chapters of the Guidelines with the equivalent disclosure obligations outlined in the ESRS E1. It is important to determine the extent to which the Guidelines were produced in accordance with European standards and where there may be some deviation. The initial disclosure requirements of the ESRS E1 are founded upon the transition strategy aimed at achieving carbon neutrality by 2050. The specific regulation that provides the EU climate reference for this disclosure requirement is Regulation (EU) 2021/1119, Article 2(1). The purpose of this requirement is to assess whether the transition plan implemented by the organization aligns with the objective of limiting global warming to 1.5°C by 2050, as outlined in the Paris Agreement. According to Article 23 of the Guidelines, there is an obligation to reveal the transition strategy. Neither the purpose of this disclosure nor if the strategy should include GHG related data is mentioned. The paper emphasizes the significance of assessing the advancement in dealing with climate-related risks and opportunities, as well as their correlation with business models, strategies, and resource allocation. The primary objective of this article appears to be assessing the preparedness and adaptability of the transition plan in relation to climate change risks and opportunities, rather than providing specific data on the content of the plan as outlined in the ESRS E1 standards. It would be inaccurate to claim that the Guidelines do not include provisions for the disclosure of GHG

emissions. However, they fail to include the requirement of including greenhouse gas (GHG) emissions in the information that must be published in their transition plan.

The Guidelines for the disclosure requirement ESRS E1-2, which pertains to "policies related to climate change mitigation and adaptation", prioritize the assessment of risks and opportunities related to sustainable development. Article 14 of the Guidelines expressly states the requirement to assess the timeframe in which risks and opportunities may occur, and whether this timeframe may be classified as short-term, medium-term, or long-term. Moreover, the standards for revealing data are established based on the degree to which the company's business operations contribute to sustainable development, considering both the level of excellence and the amount of impact. Typically, articles 14 to 19 focus mostly on the relationship between a company's long-term growth and the possible risks and advantages that come with change. Article 18 specifically addresses the requirement to reveal the techniques employed in evaluating and handling climate-related endeavors. The model's capacity to adjust to risks, as explained in Article 17, and the anticipated future impacts of risks and opportunities related to sustainable development on the company's assets, cashflows, and operations, as specified in Article 16. These articles can be seen as comparable to the ESRS E1-2 and ESRS E1-3 in their emphasis on "actions and resources in relation to climate change policies". However, there is a notable discrepancy. The Guidelines give priority to the assessment of effects rather than actions and policies, as stated in the ESRS E1-2 and E1-3. The impact of sustainable development on a firm is of utmost importance, and assessing this impact can lead to successful mitigation. However, hazards can also originate from internal causes that impact the business. A disclosure that overly emphasizes the impact of risks and opportunities on the undertaking, neglects to take into account the broader viewpoint that includes the policies and activities of the enterprise. The result of the conclusion of a previously implemented policy or practice. The latter two elements affect whether the impact is seen as a potential hazard or a favorable circumstance. The risk analysis that is based simply on impact assessment is necessarily constrained in its ability to address information disclosure. Only presents the dangers that arise from rules and activities that have already been put into effect. Within the framework of disclosure requirement ESRS E1-2, a policy involves a comprehensive assessment of the effects, hazards, and possibilities. Illustrating that an impact is a smaller category within policy responses aimed at addressing a particular need for mitigation. Similarly, an action acts as the antecedent to the effect. Lack of understanding of the cause and effect relationship of an event might lead to doubt about the availability of information. Information risk arises from the potential for both the limited availability of information and the discrepancies

generated by different information requests. Gaining access to information is not only challenging, but if its disclosure requires an effect study rather than an analysis of activities and policy decisions, then there is a crucial initial source of information that is absent. Impact-oriented analysis assesses the results and consequences of a policy or action once it has been put into effect. An assessment that considers pre-action and policy decisions is essential for managing transition risks. By analyzing existing policies, regulations, and best practices, organizations can identify areas where action is needed to align with sustainability goals and comply with legal requirements.[147]Analyzing policies and actions allows organizations to prioritize their efforts effectively. By understanding the policy landscape and available actions, organizations can focus on initiatives that have the most significant potential for positive impact.[148] By outlining specific actions and policy changes, organizations can track progress, evaluate the effectiveness of interventions, and make adjustments as needed to achieve sustainability goals.[149] Overall, the articles of the Guidelines are based on an impact disclosure assessment rather than a policy and action one like in the ESRS. This translates in a slight misalignment in what information are to be disclosed, changing the nature of the risks that the undertaking might forecast.

The Guidelines offer rules on the disclosure of environmental and emission related information in chapter three, namely in sections 21 to 28. This chapter includes provisions that mandate the disclosure of the company's actions related to climate change adaptation. There is no reference to the act of reducing or preventing the severity of something, such as damage, harm, or a problem. Furthermore, it necessitates the revelation of greenhouse gas (GHG) emissions, specifically focusing on scope 1 and 2 emissions, whereas the disclosure of scope 3 emissions is optional. Article 24 of the document mandates the disclosure of the usage of carbon credits and encourages the employment of third-party assurance organizations. Article 25 mandates the disclosure of emission information in three distinct categories, while Article 26 mandates the disclosure of the company's boundaries in which greenhouse gas emissions were disclosed. Article 27 mandates the disclosure of all information pertaining to the emission reduction mechanisms employed by the company. This chapter of the Guidelines can be likened to ESRS E1-4, E1-5, E1-6, and E1-7. The mentioned topics are "climate change mitigation and adaptation targets", "energy consumption and mix", "gross scope 1-2-3 and total greenhouse gas (GHG) emissions", and "GHG removals

[147] Eric M. Patashnik and R. Kent Weaver, "Policy Analysis and Political Sustainability," *Policy Studies Journal* 49, no. 4 (May 2020): 1110–34, https://doi.org/10.1111/psj.12391.
[148] María Jesús Muñoz Torres et al., "An Assessment Tool to Integrate Sustainability Principles into the Global Supply Chain," *Sustainability (Basel)* 10, no. 3 (February 2018): 535, https://doi.org/10.3390/su10020535.
[149] Mariano Gallo and Mario Marinelli, "Sustainable Mobility: A Review of Possible Actions and Policies," *Sustainability (Basel)* 12, no. 18 (September 2020): 7499, https://doi.org/10.3390/su12187499.

and GHG mitigation projects funded by carbon credits".

The primary distinction between the criteria in ESRS E1-4 lies in the absence of any reference to the disclosure of mitigation in the Guidelines. The sole responsibility is to disclose the adaptation measures being implemented in regard to sustainable development. While there are no explicit targets mentioned, the measurements of adaptation are categorized into short, medium, and long term. However, there is no particular timescale provided for these categories. Mitigation strategies primarily target the reduction of greenhouse gas emissions in order to proactively prevent additional climate change. On the other hand, adaption measures are specifically designed to tackle the consequences of climate change that are currently taking place. By solely emphasizing adaptation measures, companies may overlook the importance of reducing emissions, which is crucial for long-term climate change mitigation.[150] This unbalanced approach may lead to missed opportunities to reduce the company's carbon footprint and align with the requirements of the ESRS E1 standards. Mitigation measures demonstrate a commitment to reducing the company's environmental impact at its source, while adaptation measures are often seen as responses to the consequences of climate change.[151] Focusing solely on adaptation measures may signal a lack of engagement in sustainable practices and a failure to address the root causes of climate change. Leading to the failure to foreseen systematic vulnerabilities which are the consequences of a free riding risk, due to the lack of sustainable practices which can be only understood through disclosure of mitigation measures. Climate change adaptation and mitigation are interconnected, and implementing both types of measures can lead to more effective and sustainable outcomes.[152] Stakeholders, including investors, customers, and regulatory bodies, increasingly expect companies to address both adaptation and mitigation in their climate change strategies.[153] Failure to address mitigation in disclosure results in a heightened sense of risk over the company's inactivity among stakeholders and investors. The connection lies in a series of risks associated with the availability of credit and liquidity, which are influenced by the bank or investor's opinion of the company's future mitigation activities and its ability to handle unexpected events.

[150] Lin Chen et al., "Strategies to Achieve a Carbon Neutral Society: A Review," *Environmental Chemistry Letters* 20, no. 4 (April 2022): 2277–2310, https://doi.org/10.1007/s10311-022-01435-8.
[151] Laura Cameron et al., "Knowledge and Perceptions of the Health Impacts of Climate Change among Canadians," *Research Square (Research Square)*, December 2021, https://doi.org/10.21203/rs.3.rs-1064960/v1.
[152] Stelios Grafakos et al., "Analytical Framework to Evaluate the Level of Integration of Climate Adaptation and Mitigation in Cities," *Climatic Change* 154, no. 1–2 (March 2019): 87–106, https://doi.org/10.1007/s10584-019-02394-w.
[153] Adrian Brügger, Thomas A. Morton, and Suraje Dessai, "Hand in Hand: Public Endorsement of Climate Change Mitigation and Adaptation," *PLOS ONE* 10, no. 4 (April 2015): e0124843, https://doi.org/10.1371/journal.pone.0124843.

The Guidelines when compared with ESRS E1-5 are slightly aligned. There is mention of disclosure of the undertaking energy consumption and mix. Firstly it can be interpreted by the company as a disclosure of their energy usage is in Art. 25 comma (iii). It states as follows:

"In order to improve the transparency and comparability of greenhouse gas emissions, the disclosure entity may provide different categories of emissions according to the following categories:
(i)…
(ii)…
(iii) sources (combustion, processing, electricity, heating, cooling and steam, etc.)."

Although the text does not explicitly state the specific sort of energy utilized for their commercial operations, it can be inferred that the sources refer to the energy used to operate their facilities. Nevertheless, the understanding of the article is contingent upon the guidelines set by the organization that is obligated to reveal the information. Section II, specifically Article 36, outlines the types of energy that need to be disclosed. However, there is no specific distinction made for sectors with a high climate impact. In contrast, Section 38 of the ESRS E1-5 provides a special method for aggregating energy consumption in these sectors.

ESRS E1-6 deals with the disclosure of GHG emissions and the company's scope 1, 2 and 3 and it is where a greater degree of alignment with the Guidelines can be found. Firstly, as it is written in Art. 26 of the Guidelines, the undertaking carrying the disclosure could chose the type of boundaries with which to calculate its own emissions. However, in Section II "pollution prevention and ecosystem protection" in Art. 30, it seems as the "controlling mechanism" to establish a company's boundaries when calculating its emissions as it is written in the GHG protocol is enforced.[154] It can be understood by the wording of the article:

"Where a disclosure entity or its major controlling subsidiary is included in the list of undertakings disclosing environmental information according to law, it shall disclose the following information:

(i) disclosures, including but not limited to the types, names, total emissions, approved total emission volumes, excess emission rates, environmental performance levels…[ ]"

[154] "Homepage | GHG Protocol," March 2024, https://ghgprotocol.org/.

The phrasing in this article may create the impression that the disclosure entity has an obligation to publicly disclose the greenhouse gas emissions of its subsidiaries over which it has operational control. Although limited, this is supported by the ESRS E1-6 section 46, which also utilizes an operational control mechanism to address the disclosure of the combined greenhouse gas emissions of a company and its subsidiaries. The concept of operational control does not encompass the consideration of equity and financial sharing, which are handled by the GHG protocol. Restricting the disclosure to only one approach, given the significant variation in the sorts of control that a parent firm exercises over its subsidiaries, can lead to an inadequate greenhouse gas inventory. An inadequate and incomplete greenhouse gas (GHG) inventory hinders the comprehension of the vulnerabilities resulting from the emission-intensive operations of corporations. By relying solely on operational control boundaries, companies may overlook significant sources of emissions that fall outside these boundaries, leading to an incomplete assessment of their carbon footprint.[155] This limited scope may result in a failure to capture indirect emissions associated with the company's value chain, such as those from purchased goods and services, transportation, and waste disposal.[156] This may result in an underestimation of the environmental impact of the company, which in turn could affect the decisions regarding activities and policies in sustainable development adaption. By accounting only through controlling mechanism there might be a neglection of the supply chain of a company. Which encompass indirect emissions from sources not owned or controlled by the company, organizations may miss out on valuable insights for reducing emissions and enhancing overall sustainability.[157] Moreover, relying only on operational control could make the undertaking fall in strong reputational and credibility risks. It may result in a lack of transparency and credibility in the company's GHG reporting. Stakeholders, including investors, customers, and regulatory bodies, increasingly expect organizations to provide comprehensive and accurate GHG inventories that reflect the full extent of their environmental impact.[158] One more distinction between the guidelines and ESRS E1-6 is that whereas ESRS E1-6 mandates disclosure for scope 1, 2, and 3 emissions, the guidelines consider the disclosure of scope 3 emissions as optional, but strongly advised. Finally, the Guidelines address the identical standards for GHG mitigation and removal projects

[155] Jennifer D. Morton, "Idaho National Laboratory?S Greenhouse Gas FY08 Baseline," June 2011, https://doi.org/10.2172/1031670.
[156] Matthew Thurston and Matthew J. Eckelman, "Assessing Greenhouse Gas Emissions from University Purchases," *International Journal of Sustainability in Higher Education* 12, no. 3 (July 2011): 225–35, https://doi.org/10.1108/14676371111148018.
[157] Liziane Araújo Da Silva et al., "Trends in Research: Carbon Footprint Reduction in Universities as a Way to Achieve a Green Campus," *International Journal of Sustainability in Higher Education* 24, no. 3 (September 2022): 584–601, https://doi.org/10.1108/ijshe-10-2021-0440.
[158] Xavier Flores-Alsina et al., *Benchmarking Strategies to Control GHG Production and Emissions*, *IWA Publishing eBooks*, 2022, https://doi.org/10.2166/9781789060461{_.

that are funded through carbon credits. More precisely, in Article 24 and Article 27. The company is obligated to provide information regarding their emission reduction targets, the methods they employ, and whether they utilize carbon credits.

In general, the Guidelines demonstrate a considerable level of agreement with the ESRS E1 requirements. It is necessary to identify measures to reduce the impact and analyze the risks and opportunities as part of the disclosure requirements. Furthermore, there is a strong focus on evaluating the effects of sustainable development risks and opportunities, which serves as a valuable tool for comprehending the risks associated with impacts. However, the Guidelines still grant a significant amount of latitude to the organizations that are required to undergo the disclosure process. This might be attributed to the first phases of the document and the necessity for the project to gradually adjust to the system modifications mandated by the transition to a low-carbon economy. The existing draft Guidelines offer only a limited comprehension of the exposure to transition risks associated to climate change and allow for the emergence of indirect risks due to insufficient analysis of information. Examples of adaption measures in connection to sustainable development include addressing scope 3 emissions, exercising operational control, implementing actions and policies. Nevertheless, the act of partially disclosing information could potentially result in greater dangers rather than providing tangible advantages to the entities involved in the disclosure process. When transitioning to a low-carbon economy, conducting only a partial analysis can be more detrimental than not conducting one at all. This is because the risks associated with this shift are interconnected and have wide-ranging effects. Without a comprehensive understanding of the origins of these risks, there is a greater likelihood of making hazardous decisions. Furthermore, the Guidelines do not include a section on "internal carbon pricing" or "anticipated financial effects resulting from significant physical and transitional risks, as well as potential climate-related opportunities." The absence of this provision could have a substantial influence within the setting of the CBAM. The figure below (Table 2) provides a visual representation of the disclosure obligations outlined in the Guidelines and the ESRS E1.

Region	EU	China
Developed by	EFRAG (European Financial Reporting Advisory Group)	China Securities Regulatory Commission (CSRC) and Shanghai Stock Exchange (SSE)
Initial filling year	2024	2026
Breadth	Environmental, Social and Governance, all sustainability.	Environmental, Social, Governance, all sustainability.
Treatment of specific topics	Two general sustainability reporting standards and ten issue specific reporting standards.	No specific standards, just general disclosure requirements.
For whom	All entities subject to the EU CSRD and certain non-eu entities.	Entities listed in the major stock markets of China.
How many fillers	More than 50,000	More than 5,000
Safe harbor provisions for SMEs	Yes, delayed phase in	No provisions for SMEs.
Disclosure	Double materiality (both financial and impact). Specific disclosures are required based on materiality.	Double materiality (both financial and impact)
Emission scopes required	Scope 1,2,3	Scope 1, 2. Scope 3 voluntary.
Scenario analysis	Requires to assess the resilience of business strategy.	Requires to assess the resilience of business strategy. (some missing indicators)
Executive compensation	Requires disclosure of executive compensation linked to climate-realted issues.	No mention of disclosure requirement of executive compensation linked to climate-related issues.

(Table 2).

3.3 Bottlenecks or opportunity? Mandatory sustainability reporting for Italian Chinese companies.

This paragraph will examine the regulations outlined in the CSRD and ESRS E1 regarding transition planning and the obligatory restrictions or potential advantages for Italian Chinese enterprises. The examination of the Guidelines and ESRS E1 reveals a significant risk associated with inconsistencies in the alignment of sustainability reporting regulations. However, in this instance, the issue at hand does not pertain to the regulations in China or Italy. Rather, it concerns the manner in which the regulations of the European Union are implemented in Italy and how the adoption of EU directives in Italy will affect the Chinese businesses. Furthermore, the matter raises concerns about

the compatibility of the current regulations for publicly traded corporations and the lack of regulations for privately held companies, despite the fact that both types of organizations are affected by the sustainability reporting standards in Europe. In order to determine whether cross-border sustainability reporting may lead to obstacles rather than advantages, the initial step is to evaluate the disparities in the regulatory frameworks. One side of the equation involves a strict European framework that is designed to guarantee comprehensive disclosures regarding a company's whole global value chain. The CSRD primarily poses challenges associated with information unavailability, resulting in hazards associated with data collection. However, these situations can be more challenging when the necessary information needs to be collected from a country other than the two involved. Here, the issue bifurcates. The first scenario occurs when the subsidiary company is likewise publicly traded. If the subsidiary company is not the second one. The disparity in information caused by the distinct legislative framework has varying effects on the two types of entity. In the first scenario, the burden is reduced because the listed firm is required to conduct mandatory preparation as outlined in the Guidelines. In this scenario, the potential danger arising from a lack of alignment in information is diminished due to the implementation of a pre-existing reporting procedure.

If the subsidiary firm is not publicly traded, there are important factors that need to be taken into account. As a result of the information needed to comply with European directives, the parent firm will compel the subsidiary to do assessments that were likely not previously contemplated. The assessments will incur expenses, affecting the subsidiary's balance sheet. However, the consequence of requesting non-financial information is not solely linked to the cost. It is linked to the recognition of effects that the company was previously unaware of. One significant challenge is related to the coordination and standardization of data collection and reporting processes across diverse subsidiaries operating in different regions or under varying regulatory frameworks.[159] Another difficulty is associated with the cultural and organizational differences between the partner company and its subsidiaries, which can impact the willingness and ability of subsidiaries to share sensitive climate information.[160] Moreover, the lack of internal expertise and resources within subsidiaries to collect, analyze, and report material climate information can pose a significant obstacle.[161]

[159] Xiande Zhao et al., "The Impact of Internal Integration and Relationship Commitment on External Integration⋆," *Journal of Operations Management* 29, no. 1–2 (May 2010): 17–32, https://doi.org/10.1016/j.jom.2010.04.004.
[160] "Modernizing without Westernizing: Social Ties and Indian Business," March 2014, https://doi.org/10.13007/341.
[161] Anuradhi Dulangi Jayasinghe and Philip Stewart, "Level of Preparedness of the Residential Building Industry in Australia to Climate Change Adaptation: A Case of Residential Building Companies in Brisbane, Queensland," *Mitigation and Adaptation Strategies for Global Change* 27, no. 4 (April 2022),

Additionally, difficulties may arise in ensuring data accuracy, completeness, and confidentiality when sharing material climate information with a partner company.[162] These can result in a range of potential hazards. Concerns around data hazards associated with standardization. Inconsistencies in the data collection process across the entire value chain might result in misinterpretation of the findings, leading to flawed policy decisions. Consequently, the Italian company is vulnerable to market risks due to the absence of data, which makes it impossible to make precise forecasts for decision-making. These decisions subsequently influence the perception of investors and stakeholders, so affecting the risks associated with liquidity, financing, and credit. The cultural variations in the subsidiary are also associated with policy and social risks. These issues are based on the education and training of the management. The need for knowledge could result in disorganized administration and the need to retrain workers. Consequently, this results in operational hazards for the subsidiary's activities. These are the potential hazards associated with the collection of information, as well as the dangers that arise as a result of analyzing the information. These issues are systemic because they originate from activities and policy decisions that are based on the data collected. They have a widespread impact over the entire value chain, rather than just affecting one business. Furthermore, they are interdependent, indicating that one cannot exist without the other. A specific instance would be the modification of a company's policy about climate issues following the discovery of data ambiguity. If the subsidiary does not already have a pre-existing process for acquiring climate data, it is highly probable that the parent business will take action to address this deficiency. The absence of such a method leaves the parent firm vulnerable to risks associated with supply chain information, internal carbon pricing risks resulting from data unavailability, and risks linked to changes in management. The parent firm is susceptible to organizational adjustments that must be implemented to prevent the occurrence of excessive unfavorable external effects. Another consideration to be made is that in the absence of robust legislative frameworks that mandate or incentivize sustainability reporting, companies may face risks related to inadequate disclosure, greenwashing, and reputational damage.[163] Moreover, without clear regulatory guidance, companies may struggle to identify and address material sustainability risks and opportunities, impacting their long-term resilience and competitiveness.[164]

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https://doi.org/10.1007/s11027-022-10004-x.

[162] Katsuyuki Nakano and Masahiko Hirao, "Collaborative Activity with Business Partners for Improvement of Product Environmental Performance Using LCA," *Journal of Cleaner Production* 19, no. 11 (July 2011): 1189–97, https://doi.org/10.1016/j.jclepro.2011.03.007.

[163] John Dumay and Amir Hossain, "Sustainability Risk Disclosure Practices of Listed Companies in Australia," *Australian Accounting Review* 29, no. 2 (May 2018): 343–59, https://doi.org/10.1111/auar.12240. 0

[164] Armando Calabrese et al., "MATERIALITY ANALYSIS IN SUSTAINABILITY REPORTING: A TOOL FOR DIRECTING CORPORATE SUSTAINABILITY TOWARDS EMERGING ECONOMIC, ENVIRONMENTAL AND SOCIAL OPPORTUNITIES," *Technological and Economic Development of Economy* 25, no. 5 (August 2019): 1016–38, https://doi.org/10.3846/tede.2019.10550.

On the other had there are opportunities in carrying an extensive sustainability reporting within the value chain. Strong regulatory frameworks can encourage companies to adopt best practices in sustainability reporting, leading to improved risk management, cost savings, and access to capital.[165] By aligning reporting practices with legislative requirements, companies can demonstrate their commitment to sustainable development, attract socially responsible investors, and strengthen their social license to operate.[166] Furthermore, legislative frameworks that integrate sustainability reporting with broader policy objectives, such as climate action, circular economy, or sustainable development goals, can foster a culture of accountability and drive systemic change across industries.[167] By embedding sustainability considerations into legal requirements, governments can incentivize companies to proactively address environmental and social challenges, seize emerging opportunities, and contribute to the transition towards a more sustainable economy.[168]

Currently, the process of sustainability reporting for Italian company subsidiaries in China is hindered by obstacles rather than presenting favorable circumstances due to the early stage of disclosure standards. While sustainability reporting offers numerous advantages for making informed decisions on climate policy, impact assessment, and mitigation and adaptation techniques, its development also entails notable hazards. Furthermore, the Chinese branches of Italian corporations which are publicly listed in Italy face the need to adapt their sustainability reporting to the European standards. This gap gives rise to a wide range of transition risks, ranging from risks related to standardizing information to risks related to operations and management. The first scenario requires standardizing data collection for two systems that have distinct cultural and operational norms, as well as differing approaches to the value of sustainability practices. In the latter scenario, once standardization is implemented, there is a significant risk of disrupting operational processes. This has a direct effect on the balance sheet and productivity, resulting in market risk. Initially, these obstacles may appear to be bottlenecks, but the more significant concerns arise from a growing misalignment gap. The longer a company delays in aligning with the sustainability

[165] Nurul Jannah Mustafa Khan, Hasani Mohd Ali, and Hazlina Shaik Md Noor Alam, "Addressing Sustainability Challenges as Part of Director's Duty in Malaysia," *International Journal of Law and Management* 65, no. 6 (July 2023): 538–59, https://doi.org/10.1108/ijlma-03-2023-0044.

[166] Katelin Opferkuch et al., "Circular Economy in Corporate Sustainability Reporting: A Review of Organisational Approaches," *Business Strategy and the Environment* 30, no. 8 (July 2021): 4015–36, https://doi.org/10.1002/bse.2854.

[167] Anahita Rashidfarokhi, Saija Toivonen, and Kauko Viitanen, "SUSTAINABILITY REPORTING IN THE NORDIC REAL ESTATE COMPANIES: EMPIRICAL EVIDENCE FROM FINLAND," *International Journal of Strategic Property Management (Spausdinta)* 24, no. 1 (March 2018): 51–63, https://doi.org/10.3846/ijspm.2018.321.

[168] Md. Mahedi Al Masud et al., "Sustainability Impacts of Tidal River Management: Towards a Conceptual Framework," *Ecological Indicators* 85 (February 2018): 451–67, https://doi.org/10.1016/j.ecolind.2017.10.022.

criteria of the CSRD, the greater the future transition risks will be, resulting in increased costs and considerable effect. Overall, companies that are subject to both reporting requirements in Italy and China should keep in mind that compliance with the strictest reporting requirements translates in an abatement of risks. Those risk stem from the asymmetry between the level of reporting that a company is subject to. When assessing the reporting requirements throughout global value chains, the stricter reporting to which the company is subject should be applied.

3.3.1 The impacts from the different application of sustainability disclosure requirements for Italian companies that operate in China and Chinese companies that operate in Italy

The classification of what are the impacts from different sustainability disclosure requirements varies from where the company has its operations. To evaluate such impact there are elements which need to be taken in consideration. The first one is where the company carries its business. A Chinese company carrying its operations in the European Union and an Italian company carrying its operations in China will have to face different transition risks and prepare for different impacts. As it was mentioned in the previous paragraph, the normative risks emerging from sustainability disclosure requirements are cross cutting and cascading in nature. They are not isolated to a single area of the company, but they impact the whole system. The new laws on sustainability reporting established by the EU will have an impact on the operations of Chinese companies carrying business in Europe. This is due to a difference in standard. The Chinese company finds itself to have to comply with a sustainability standard which is not required in China. The non-compliance with those new standards opens the path to a series of impacts. The first one is greenwashing. Prior to the development of the CSRD and the Green Claim Directive companies were likely to report and publish false sustainability performance information. With the development of the CSRD, data needs to be proven and third-party checked. Moreover, due to disclosure of this information to the public, false statements will impact also the perception that the consumers have on the company. There is a competition impact which emerges from the misalignment between the European Sustainability reporting laws and those in China. A Chinese subsidiary of a parent Chinese company will be subject to sustainability requirements that the parent company is not subject to. First of all, it could be likely that the subsidiary company is unready or unprepared, due to the missing guidance from the parent company. The parent company due to the lack of standardized sustainability reporting requirements in China could struggle to adapt to the changes required by the European Laws. This in turn has an influence on how the investors perceive the company. The struggle in the adaptation to sustainability reporting requirements can lead to a change in the

investor sentiment, which in turn can bring to a shortage of liquidity or credit. Not only it impacts the investor sentiment but also the costs. Since there is a discrepancy in the sustainability reporting laws, the Chinese parent company will have to find the relevant data which is required by the reporting requirements. This adaptation entails investing in research and personnel education or hiring. Not only, some information requires the development of new systems for data gathering which before the company might have not considered. Those will have an impact on the balance sheet of the company and on its spending. Those impacts are not isolated to a single area, but they have an effect on the management of the whole company.

A similar reasoning goes for parent Italian companies which have subsidiaries which carry operations in China. For this type of undertaking the reasoning is the opposite the parent company is required to adapt to sustainability disclosure requirements, however the Chinese subsidiary is placed in a system in which the disclosure of suitability information is not yet a core concern. In this case the impacts are similar, but the direction of the effects is different. It is exercise by a top-down approach rather than a bottom-up one. In this case the main difference is that for the Chinese undertaking in Europe adaptation is systematic, whereas for the one in China is isolated. In the latter case it is not the whole sector which is required to disclose data in relation to sustainable practices, but only the specific subsidiary. Investor sentiment is impacted, but in this case the investor as a market indicator has the rest of the sector which is not necessarily required to disclosure. The extent for which investor sentiment can negatively or positively impact the undertaking is given by the maturity of the sector towards sustainability. If a sector in China is mature enough to perceive the discourse of sustainable information as relevant for an investment decision, then the undertaking providing that information as a reaction of the sustainability reporting requirements provided by the parent Italian company will be positively impacted. Conversely, for the Chinese company is Europe investor sentiment has a benchmark, which is given by an already established systemic best practice for disclosure of sustainable information. In this case investor sentiment is driven by the depth and credibility of the information.

Transition risk of normative origin arise from the discrepancies in sustainability reporting requirements. The discrepancies are due to the difference in the laws and in the information requirements needed by the reporting guidelines. The impacts are different on whether the undertaking is a subsidiary of a Chinese company in Europe or a subsidiary of an Italian company in China. The former due to the sustainability reporting requirements needs to adapt its subsidiary to a systemic shift which does not

directly impact the parent company in China. This makes it more challenging to adapt, since the parent company has lower requirements than the subsidiary. The latter instead needs to implement reporting requirements which are more stringent than those required by the system, creating an isolated case for the Chinese subsidiary. Both are exposed to impacts related to investor sentiment, greenwashing, and adaptation cost. In the case of the undertaking in Europe the investor sentiment will be impacted if the information disclosed correlates negatively to the rest of the sector. A negative correlation means that investors will be less likely to invest in the operations of the company. This affects the capacity to attract capital. The difference in disclosure of sustainability related information could lead to greenwashing. For the Chinese undertaking in Europe there might be a difficulty in find reliable information from the parent company to disclose a particular sustainable action. Vice versa for the Italian parent of the Chinese undertaking the lack of requirements in China, might lead to the development of false or misleading information which then if published by the parent Italian company could lead to greenwashing claims. Greenwashing risks and those related to investor sentiment have an impact of the costs in both cases. However, for the Chinese undertaking in Europe those costs are associate with a change in the corporate values starting from the subsidiary and do not necessarily develop through the whole value chain. For the Italian undertaking in China instead those costs develop throughout the whole value chain. However, in terms of operational change, training, and shift of the corporate value, since the adaptation is top-down the costs might be better mitigated. This is assumed if the parent company is already in line with the disclosure requirements provided in Italy.

CHAPTER 4: HOW TO MEASURE IMPACT OF DEFINED TRANSITION RISKS ON ITALIAN-CHINESE COMPANIES?

4.1 Scope of the survey and identification of the representative cohort of Italian Chinese companies.

The poll relies on the public materials from ISSB and EFRAG, including the IFRS S2 and the ESRS E1 and S1. The poll aims to ascertain the level of awareness among Italian Chinese enterprises on the risks arising from policy misalignment between Italy and China, specifically pertaining to normative origin. The goal of this study is to address the paucity of scholarly publications and data that can identify the genesis of climate-related transition risks resulting from a misalignment in reporting standards between Italy and China. The survey assesses the level of preparedness and understanding regarding the disclosure requirements and hazards associated with the development of systems that are prepared to receive disclosure. Moreover the method of research has been thought with the final practical use of being an assessment whether the governance of the company identifies transition risks that need to addressed in order to put into effect the decarbonization strategy. Ultimately this helps identify the company's misalignment from the respective national's decarbonization objectives. The interviewed companies operate within the automotive and manufacturing industry. The survey was conducted online. There was a total of 4 participants, however only 2 of them completed the survey. Consequently, the two incomplete responses will be excluded from the research analysis. Their identities shall remain undisclosed in order to protect their privacy. The survey data reveals certain factors that can contribute to transition risks. These factors are directly connected to the company's operations and its future prosperity. The global economy is currently concerned about developments such as the low carbon economy, the emergence of transition risks, and the definition and identification of these risks. There have been studies which address climate-related risks as drivers which will lead to the next big financial crisis, comparable to the one in 2008.[169] The majority of research on climate-related hazards focuses on the physical risks and their impact on financial performance. This is constraining, as a result of the intersecting and amplifying characteristics of climate hazards. Furthermore, although it is true that physical risks have a significant influence on the balance sheet, their analysis only focuses on the direct consequences and fails to evaluate the broader implications across many levels of the firm. Conversely, the research conducted on the origin of transition risk mostly emphasizes its impact on finance. The survey aims to

[169] Jamie Woolley, "Will Climate Risk Trigger the next Great Financial Crisis?," March 2024, https://greencentralbanking.com/2024/03/28/will-climate-risk-trigger-the-next-great-financial-crisis/?utm_source=linkedin&utm_medium=social&utm_campaign=news.

demonstrate that normative transition risks significantly influence finance, with the underlying cause being normative shifts and the emergence of policy needs. The purpose of the study is to demonstrate that normative risks possess a decentralized nature, which might potentially impact several parts of the firm, including the financial sector.

The poll has been organized according to the ISSB and EFRAG's transparency criteria. Specifically, I am referring to IFRS S2, ESRS E1, and S1. There is a total of 62 questions. The data points were obtained by utilizing the disclosure requirements outlined in the aforementioned publications and are available in Appendix A. The categories are grouped into 10 groups, which are then utilized as performance categories (PC) to evaluate the level of risk exposure. Each category has overarching generic datapoints that are derived from broader inquiries related to a certain performance category. These categories align with the disclosure areas specified by the ESRS E1 and IFRS S2. The following terms are included: "strategy", "impact, risk and opportunity management", "metrics and targets", "energy intensity based on net revenue", "GHG intensity based on net revenue", "governance", "financial position, financial performance and cash flows", "climate resilience", "risk management", and "social". Each of the main inquiries in those performance categories has been designed to ascertain the connection between the disclosure category and the approach employed by the parent firm to conform to the given disclosure categories.

4.2 Assessment of data points in the survey to measure impacts of transition risks on Italian-Chinese companies

PC1. Each category has specific questions that correspond to a risk indicator. The question arises from the term "strategy" and can be divided into two halves, as there are two performance categories that encompass the fields of strategy.

Q1: "Do you have a transition plan for climate change mitigation? Did you include your Chinese subsidiaries in its transition plan for climate change mitigation?"
Q38: "In the report for your Chinese subsidiaries did you describe the climate-related transition risks that could possibly be expected to affect the entity's prospects?"

The first question is to ascertain whether the company has conducted an analysis of the transition risks associated with the implementation of disclosure requirements for their Chinese operations and if they are aware of these risks. The latter is useful for determining if there has already been an evaluation of the susceptibility to vulnerabilities that could impact the subsidiary's operations.

PC2. In the performance category "impact, risks and opportunity management" instead the overarching question is:

Q8: "Did your company carry an identification and assessment of climate-related transition risks and opportunities within the value chain of your Chinese subsidiaries?"

Conducting an identification and assessment of climate-related transition risks implies that the company is knowledgeable about the potential systemic changes that may arise from these risks across its whole value chain.

PC3."Metrics and targets":

Q14: "Did you set GHG emission reduction targets or any other targets to manage material climate-related transition risks for your subsidiaries in China?"

Emission reduction targets serve as a crucial metric for gauging the company's perception of climate-related risks.

PC4. Energy intensity based on net revenue:

Q16: "How likely are you to identify and disclose GHG emissions? GHG emissions within your value chain, particularly the emissions associated with your Chinese associates, joint ventures, unconsolidated subsidiaries and all the other contractual arrangements withing your value chain in China?"
Q22: "Have you considered the effects and impacts of the CBAM on your value chain?"
Q23: "Did your Chinese partners or subsidiaries take measures to mitigate the impacts from the entry into force of the CBAM?"

The purpose of those questions is to determine whether the Chinese subsidiary is prepared and competent to reveal such information. In addition, if the Italian parent firm lacks or has limited access to information, it may face challenges in adapting to the requirements imposed by the CBAM. PC5. "GHG intensity based on net revenue":

PC5. "GHG intensity based on net revenue":

Q24: "Do you have GHG removals or GHG mitigation projects financed through carbon credits in your Chinese subsidiaries?"
Q28: "Do you apply internal carbon pricing schemes?"
Q30: "Did you assess the potential financial effects from material transition risks of your Chinese subsidiaries?"

Utilizing greenhouse gas (GHG) reductions, implementing internal carbon pricing schemes, and evaluating potential financial impacts are measures that indicate vulnerability to reputational damage, investor sentiment, and consumer behavior.

PC6. "Governace":

Q33: "Do you have a body or an individual within your board that is responsible for the oversight of climate-related risks and opportunities?"

Oversight pertains to the impact that decisions will have on performance. The level of risks is determined by the individual's level of knowledge and understanding

of the low-carbon transition, as well as the amount to which their salary is tied to the attainment of climate-related objectives.

PC7. “Financial position, financial performance and cash flows”:

Q46: “How satisfied are you with the availability of reasonable and supportable information on climate-related transition risks in your Chinese value chain?”.

The level of satisfaction, whether high or poor, will directly impact the success of the efforts implemented so far.

PC8. “Climate resilience”:

Q47: “Do you use a climate-related scenario analysis to assess the climate resilience of your Chinese Subsidiaries?”.

Climate-related scenario analysis is a subject of controversy. Nevertheless, possessing one provides a comprehensive comprehension of the course of action to pursue regarding mitigation and adaptation endeavors.

PC9. “Risk management”:

Q49: “What are the inputs and parameters you use to assess transition risks in China?”.

In order to facilitate the collection of data, it is essential to have inputs and parameters that enable the centralization of information disclosure and reporting.

PC11: "Social". This category comprises a set of inquiries pertaining to the company's management and operation of its personnel at its Chinese subsidiaries. Nevertheless, this portion will be examined by comparing it to the discoveries made in the earlier personal computers.

When comparing the performance categories with the Guidelines, there is a significant degree of agreement. However, it is worth noting that there are certain areas that lack sufficient coverage. Specifically, there is a misalignment in disclosure within nearly all of the PCs, except for PC10. The following paragraph will examine the survey findings for each performance category.

4.3 Analysis of the data and in particular of data related to transition risks of normative origin.

4.3.1 PC1: “Strategy”.

There is a disparity between the automobile and manufacturing sectors in the survey response. The automotive responded affirmatively to questions Q1 to Q7. The manufacturing project demonstrates a significant lack of awareness regarding the disclosure standards. The automotive company has implemented a transition plan to mitigate climate change. It considers the investment amount allocated to its Chinese subsidiaries to be highly suitable. The company is aware of the potential greenhouse gas (GHG) emissions that may be locked in and understands how these emissions could impact the targets set for different timeframes: short-term, medium-term, and long-term. Conversely, the manufacturing sector has subpar performance in the "strategy" performance category. Although the automotive industry has a decreased susceptibility to dangers originating from norms, the same cannot be said for manufacturing companies. The absence of a transition plan for your Chinese subsidiary gives rise to a range of concerns about the accessibility of information. The accessibility of information results in suboptimal decisions that pave the way for a cascade of hazards. The primary risk pertains to disclosure. In order to achieve disclosure, it is imperative to have a well-defined pathway for what will be disclosed. Without a transition strategy, a corporation is unable to evaluate what information will be made public. Furthermore, this leads to a lack of data collection, which must be revealed in order to comply with rules. Non-compliance with regulations and liabilities poses a danger of exposure, which can ultimately damage one's reputation. Prior to the emergence of sustainability reporting, the risks were not considered significant as this information was not mandatory. The implementation of new policies and legislation poses a danger to organizations, as it necessitates the collection of more information that was not previously required. This has a direct influence on the operations and systems of these companies. The assembly itself and the modifications in the system necessary to deliver this information have an effect on the financial domain of the organization, resulting in unanticipated expenses and obligations.

4.3.2 PC2: “Impact, risk and opportunity management”

This performance category is considered retroactive in comparison to the first one. The transition strategy is the ultimate outcome of prior study conducted. The data for this performance category exhibits a higher degree of homogeneity. There is only

one inconsistency, specifically with the assessment of risks and opportunities in the value chain of the Chinese companies. We have received a favorable response for the automobile sector, but a bad response for the manufacturing sector. The assessment of the hazards and potential advantages in the Chinese subsidiaries' value chain aligns with the sustainability reporting guidelines issued by the SSE. However, the respondents performed poorly on the remaining aspects of the PC. This indicates a lack of information of the risks and opportunities associated with achieving the 1.5°C goals. The lack of understanding of risks is itself an indication of risk. The absence of an evaluation of the susceptibility of assets to climate-related incidents, as well as the lack of Key Performance Indicators (KPIs) for allocating resources to mitigate and adapt to climate change, creates opportunities for vulnerabilities. Firstly, there is the inherent risk associated with the balance sheet and the potential for stranded assets. Policy inactivity poses risks that can lead to liability and damage to the company's reputation.

4.3.3 PC3: “Metrics and targets”

In this performance category, the survey revealed that the automobile firm demonstrated alignment by establishing measurements and targets to effectively manage climate-related transition risks. Furthermore, they ensured that these targets were grounded in scientific principles. Conversely, the manufacturing sector exhibits a lack of coordination, without any specific goals. Emission reduction targets serve as a measure of a company's future viability. Policy and legislation are increasingly imposing stricter requirements on the long-term, medium-term, and short-term objectives that businesses must meet. The ESRS mandates that subsidiaries must disclose relevant information in the sustainability report at the group level. Answering adversely could have a substantial impact on the investor's perception of reputation and could potentially lead to major liquidity and credit issues.

4.3.4 PC4: “Energy based on net revenue”

This particular portion of the poll is arguably the most captivating. The results demonstrate two distinct techniques to aligning with the CBAM and disclosing GHG emissions. One side of the issue is a strong understanding of the potential consequences that the CBAM and the publication of GHG information may have on external parties. The automobile respondent had a neutral stance towards disclosing GHG statistics under Q16, while the manufacturing company expressed a strong reluctance to do so, stating it was "extremely unlikely". In addition, whereas the automobile industry responded affirmatively to the CBAM-related questions on adaptation, the manufacturing company expressed a negative stance towards aligning with CBAM. The need to align with GHG disclosure should not be delayed due to the

following reasons. The data is necessary to comply with disclosure rules that are becoming increasingly popular. Regardless of their willingness, they will have to make this information public. The absence of preparedness for necessary compliance, rather than noncompliance itself, poses a danger. If this factor holds true in the greenhouse gas (GHG) evaluation of a corporation, it initiates a chain of interconnected consequences. The first factor pertains to the impression of risk associated with the company that revealed the information, in comparison to other companies in the same industry. Subsequently, investor sentiment is influenced, leading to disruptions in the accessibility of funds. The dissemination of public information subsequently leads to customer purchasing choices, which in turn impact the market competitiveness of the brand. Furthermore, there are a range of consequences that occur as a result, including potential legal responsibility and damage to one's reputation, stemming from inadequate adherence to the requirements of disclosure regulations. Additionally, there are hazards associated with CBAM. Failing to address the risks associated with the Carbon Border Adjustment Mechanism (CBAM) entails exposing international trade to hazards that cut across several sectors and jeopardize the value chain. These parameters are necessary for conducting a greenhouse gas (GHG) inventory and calculating emissions for imports in European countries. The absence of understanding regarding the consequences of the Carbon Border Adjustment Mechanism (CBAM) on the imports of the Chinese subsidiary may result in a price hike for the end product, so introducing additional market risks associated with the industry's competitiveness.

4.3.5 PC5: “GHG intensity based on net revenue”

Both participants had a negative response in the performance category. Internal carbon price mechanisms are not being adopted, and there are no initiatives being supported through carbon credits to remove or mitigate greenhouse gas emissions. The absence of an internal carbon pricing plan is what is being highlighted. Within the framework of disclosure rules, the use of internal carbon pricing as a measure of a company's climate performance in respect to its low-carbon economy objective is very indicative. Internal carbon pricing is a tool used by Italian companies to assess the expenses associated with reducing carbon emissions in their Chinese subsidiaries. Furthermore, these movements are not limited to the financial success of companies, but also are influenced by changes in climate policy, consumer behavior, and investor mood. Their perception could be influenced by the company's reputation or the liabilities that arise from a failed forecast of a potential transition risk. Without implementing internal carbon pricing mechanisms, there is a significant vulnerability to risks.

4.3.6 PC6: “Governance”

The governance structure assumes accountability for the actions and omissions of an organization. Furthermore, when it comes to disclosures linked to sustainability, the governing body should have the power to make judgments based on the sustainability performance of the organization. In order to mitigate the risks associated with the board's limited comprehension of sustainability disclosures and mitigation and adaptation plans, it is advisable to appoint an individual specifically responsible for overseeing the transition to a low-carbon economy. The automobile respondent demonstrated a strong level of congruence, with a position on the board that is connected to the transition towards a low-carbon economy and the associated risks. However, the manufacturing respondent does not comply with the ESRS disclosure standards in the governance sector. Curiously, both participants, regardless of whether they have a position on the board or not, said that the individual responsible for that function lacks significant expertise in the areas of low-carbon transition and sustainable reporting.

4.3.7 PC7: “Financial position, financial performance and cash flows”

This performance area includes concerns related to the future modifications in the low-carbon transition strategy of the Chinese subsidiary and the accessibility of reliable information pertaining to climate change. The responses of the participants in PC7 were synchronized. Both parties predict that their approach to the low-carbon transition in China will remain unchanged and express general dissatisfaction with the accessibility of information. Both of those replies are pertinent in the context of comprehending the stance of the Chinese subsidiaries regarding consciousness and adaptability. From one perspective, Italian parent firms consider the plan for low-carbon transition in their Chinese subsidiaries as unchanging and not requiring any adjustments. Furthermore, the discontentment regarding the quantity of pertinent information indicates a lack of awareness and a lack of progress in the methods of data collection. The level of dissatisfaction with this PC is concerning. The foundation of transparency and sustainability reporting relies on the accessibility of information and the transformation in the data collection mechanism. This is linked to the intentions to modify the strategy for climate transition risks. The lack of dynamism observed in the responders indicates a poor level of readiness and preparedness among them. The lack of preparation and preparedness to disclose sustainable information results in the exposing of systemic hazards. These hazards arise as information risks and risks related to policy or action. They exhibit cross-cutting and cascading behavior. Inadequate knowledge might result in erroneous policy decisions and actions that may have adverse consequences for the project. Actions generate

consequences that ultimately damage the balance sheet and financial performance of the organization. Finally, there are risks associated with liability and reputation. Inadequate disclosure resulting from a failure to adapt to current requirements or a lack of information exposes the company to legal responsibility, and misinterpretation by the public can lead to damage to its reputation.

4.3.8 PC8: “Climate resilience”

There was a negative correlation between the respondents in the performance category of climate resilience. The respondents lack climate-related scenarios to evaluate the climate resilience of their Chinese subsidiaries, and the approach they have is not comparable to their operating situations. This suggests a significant level of vulnerability to the risks associated with climate-related occurrences, which encompass not just physical dangers but also have the potential to influence financial and policy choices. Climate resilience is linked to the level of preparedness that an organization possesses while determining how to strategize its actions in response to climate change. The identification of a climate resilience plan pertains to the ability of the project to predict potential consequences and select appropriate climate activities in response. Climate resilience is essential for mitigating the implications of shocks to the physical assets and system of an activity. The physical repercussions have several consequences that can be categorized into risks associated with public opinion, litigation, and investment sentiment.

4.3.9 PC9: “Risk management”

This component of the survey focuses solely on the subject of what factors are used to evaluate the transition risks in China. In the automobile project, the analysis focused on scope 1 and 2 emissions. However, no specific characteristics were discovered for the manufacturing project. Both scenarios suffer from the limitation of selecting characteristics that are insufficient to fully evaluate the magnitude and complexity of transition risks. Transition risks possess both qualitative and quantitative characteristics, and they have a cross-cutting and cascading nature. The assessment of scopes 1 and 2 is restrictive.

4.3.10 PC10: “Social”

Both the automotive and the manufacturing companies answered positively to the questions related to the social impacts of sustainability disclosures. This section shows that there is a higher degree of compliance of the undertakings when it is a matter that impacts the employee operations of a company.

4.4 Relevant findings on measurement of transition risks related impacts

The poll questionnaire reveals that several factors must be taken into account. Within the context of PC1, a company's transition plan strategy has significant effects on its reputation, liability, and profitability. In PC2 and 3, respondents indicated that awareness is a crucial factor to consider when identifying climate-related risks and possibilities. Awareness is generated via the establishment of Key Performance Indicators (KPIs), which can then evaluate the effects. PC4 and PC5 revealed the consequences that arise from international import regulations, such as the CBAM. Considering the global perspective when evaluating the effects of a corporation. The significance of both the international and internal dimensions in relation to the carbon price is crucial for the company to evaluate its market performance. The survey conducted in PC6 revealed a strong association between the nature of the governing body and its influence on the company's operations. The study conducted by PC7 demonstrated a correlation between individuals' contentment and the accessibility of information. PC8 and PC9 demonstrated the interconnections between climate scenarios, climate resilience, parameters, physical impacts, and their subsequent effects on social and economic aspects. PC10 is closely connected with the disclosure standards. The survey indicates that the Chinese branches of Italian companies operating in China have not yet achieved complete compliance with the disclosure obligations that will become compulsory by 2025. The incomplete alignment resulting from the absence of knowledge and a lack of comprehension regarding the parameters to be established, creates a pathway to a range of potential problems. These risks arise due to regulatory changes that impact Italian enterprises and their Chinese operations. In order to establish a precise assessment technique for these risks, further study should be conducted, and the survey should be expanded to include a larger number of respondents. Nevertheless, the measurement using the existing data might be organized according to the factors identified in the performance categories.

The answers provided by the respondents in the performance categories confirm the previously theorized impact of transition risks of normative origin. The answers by the respondents, which can be found in Appendix B, show that in the Chinese subsidiaries of Italian companies are subject to transition risk of normative origin due to the asymmetries in the disclosure of sustainability related information. The impacts that this discrepancies cause are related to the indicators of the performance categories. It is showed by the certain degree of ambiguity and negativity in the PC. The

negativity in the answers shows that there is a high exposure to transition risk of normative origin. This high exposure is the result of the impacts that the PCs have on the operations of the company as a reaction to the application of sustainability reporting requirements to Chinese subsidiaries. The performance categories (PC) can be used as a qualitative evaluation tool for the companies to assess their degree of readiness to sustainability reporting requirements. Through their use in the operations within the value chain the level of exposure and the level of asymmetry to the requirements of the stricter set of reporting requirements can be understood. Therefore, focusing on specific areas which under the performance categories are found to perform poorly. The use of PCs decreases the exposure to transition risks and increases the symmetry with international climate objectives. Moreover, it can provide a better understanding on where to allocate capital to develop a decarbonization strategy, avoiding unnecessary costs.

CHAPTER 5: CONCLUSIONS

The purpose of this research was to develop and understanding of whether Italian-Chinese companies are exposed or not to distinguished transition risks due to their operations and their impact on separate sets of policy and legislation. As a result of climate change, governments have begun to alter their policies in order to transition towards a low carbon economy. This transition, if implemented gradually and in accordance with the sector-specific strategies defined by scientific international organizations such as the IPCC and SBTi, can be considered "orderly". This refers to a state where there is no development of long-lasting and sudden occurrences that will have a detrimental effect on our system. Nevertheless, there are situations that lead to chaotic transitions. In order to prevent chaotic transitions, governments and the international community have initiated the development of rules and requirements for sustainability reporting. Certain communities, such as the European Union (EU), were more expeditious in formulating guidelines. The implementation of the CSRD introduced additional sustainability reporting obligations that also impacted the activities of Italian companies operating in China, resulting in potential risks due to the regulatory shift.

The analysis reveals that these hazards are both cross-cutting and cascading, originating from the formulation of policies, consumer behavior, and public opinion. Governmental climate policies are susceptible to the impact of political sentiment, leading to the formulation of legislation that aims to address public opinion demands. The need to conform to new regulations compels businesses to adjust. The adaptation of the project entails a separate set of risks that are linked to investor attitude and consumer behavior, which in turn impact the availability of capital, liquidity, and market conditions. The research demonstrates the presence of transition risks that arise from normative factors. These risks are a result of policy decisions taken in response to a change in the political sentiment of a community. Furthermore, their nature is characterized by a cascading effect, which implies that it has repercussions in several other aspects of the organization's activities. For instance, the implementation of low-carbon technologies entails credit risks associated with the advancement and utilization of such technology. Normative changes in legislation might give rise to liability and reputation problems. Engaging in activities without following regulations and disregarding public opinion might lead to legal action by non-governmental organizations (NGOs) or a shift in consumer preferences due to

inadequate disclosure. In general, normative transition risks exhibit the following characteristics: They are interconnected, implying that they have effects on other areas that extend beyond the company's standard adjustment. They stem from policies that are formulated in response to the public's desire to alter the existing trajectory of climate change and the international community's shared responsibility mechanism. Italian Chinese enterprises have a significant influence on the operations and value chain of companies that have branches overseas. Furthermore, when considered on a global scale, these barriers hinder the ability for new participants to enter the market, potentially leading to disparities and unequal opportunities in terms of production resources and management of the value chain.

When conducting the comparative study on sustainability legislation, it was discovered that despite the SSE's Guidelines being derived from the CSRD and EFRAG disclosure requirements, there exists a significant lack of harmony between the sustainability disclosure laws of the European Union and China. This highlights another aspect of transition risks that arise from normative factors, namely the creation of a global sustainability disclosure rule that lacks consistency. The normative international hazards arise mostly from the non-compliance with disclosure standards. Hence, an additional factor to evaluate the susceptibility of being affected by normative transition risks is the extent of congruence between the sustainability reporting obligations of the parent country and the host country where the subsidiary operates. Italian Chinese enterprises face risks in their value chain regarding compliance with disclosure requirements set by the Corporate Social Responsibility Directive (CSRD). Based on the research, it is evident that the existing standards set by the CSRD may result in a higher vulnerability to normative hazards and the subsequent problems that arise from them. The disparity in applicability between the SSE Guidelines and the CSRD is the reason for this.

A survey was developed to examine the differences in applicability, using the disclosure standards set by EFRAG and ISSB as a basis. Performance Criteria (PCs) were identified to provide a framework for measuring the impact of normative transition risks. The analysis of performance categories revealed that the disclosure requirements of both the IFRS and EFRAG, when applied to the management practices of Italian companies in their Chinese subsidiaries, expose them to negative consequences due to a lack of awareness. The survey analysis reveals that the performance categories are mostly affected by risks of a normative type. The survey revealed that the areas with the highest level of exposure include internal carbon pricing, climate-related targets, governance, and adaptation to the CBAM. The

performance areas in which respondents provided more negative answers indicate that the lack of data from one of those categories increases the likelihood of normative transition risks for Chinese subsidiaries of Italian enterprises. Moreover, in the process of developing the PCs, it was found that they can be used as an instrument to evaluate what is the level of alignment of the company with the global climate goals and decarbonization pathways.

This dissertation's research demonstrates that Italian companies with subsidiaries in China face significant transition risks. Those risks stem from the changes in operationality due to the different sustainability reporting requirements between Italy and China. On one side there is China with relatively newborn sustainability reporting requirements which are still under draft approval. On the other side we find Europe and Italy with an already structured mechanism of laws and regulations to report sustainability information. When placed in the context of an Italian company that has Chinese subsidiaries the lack of a law which obliges the report of sustainable information for the Chinese companies creates a greater exposure to transition risks. Therefore, the moment that misalignment is found this translates in a transition risk of normative origin for the undertaking.

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APPENDIX A

The survey that I am presenting is based on the documents published by the ISSB and EFRAG, namely the IFRS S2 and the ESRS E1 and S1. The aim of the survey is to understand what the current awareness of Italian Chinese companies of the risks of normative origin is due to policy misalignment between Italy and China.

Demographic questions

- **Name of the company or undertaking you represent.**
- **Name of the Chinese subsidiary or partner.**
- **In what industry does your company operate.**

Disclosure requirements ESRS E1 – Transition plan for climate change mitigation

<u>Strategy</u>

- **Do you have a transition plan for climate change mitigation? Did you include your Chinese subsidiaries in its transition plan for climate change mitigation?**
    - Is the amount of investment and funding given to the transition plan of your Chinese subsidiaries appropriate?
    - Do you know the potential locked-in GHG emissions from your assets and products in China? If yes:
        - Do you know how those might affect your transition risks or how they might jeopardize the achievement of your GHG reduction targets?
    - Is the transition plan for your Chinese subsidiaries embedded and aligned with your business strategy?
- **Are those reduction targets divided in a timeline which is divided in short-, medium- and long-term goals?**
    - Are they measurable?

<u>Impacts risks and opportunity management</u>

- **Did your company carry an identification and assessment of climate-related transition risks and opportunities within the value chain of your Chinese subsidiaries?**
    - Also, those of normative nature?

    - Did you create a forecast of an identification of climate-related transition events for your Chinese subsidiaries with a forecast scenario in line with the 1.5C° goals?
    - Did you create an assessment of how the assets of the Chinese subsidiary and your business activities associate with them might be exposed to these climate-related transition events?
- **What is the percentage of the resources allocated to carry mitigation and adaptation to climate change actions within your Chinese Subsidiaries?**
    - Did you set measurable KPI's?

Metrics and Targets

- **Did you set GHG emission reduction targets or any other targets to manage material climate-related transition risks for your subsidiaries in China?**
    - **Are they science based?**

Energy intensity based on net revenue

- **How likely are you to identify and disclose GHG emissions? GHG emissions within your value chain, particularly the emissions associated with your Chinese associates, joint ventures, unconsolidated subsidiaries and all the other contractual arrangements withing your value chain in China?**
    - Did you disclose scope 1, 2 and 3 emissions of your Chinese subsidiaries?
    - If you did, did you disclose the scope 1, 2 and the scope 3 of the financial investment category? To this information is not to apply the share of equity owned in the Chinese subsidiary to limit the proportion of GHG emissions in the report.

- **Did you have any changes in what constituted your value chain in China?**
    - Do you consider those changes effective?
    - Did you explain the change in the comparability with the previous years?

- **Have you considered the effects and impacts of the CBAM on your value chain?**

- **Did your Chinese partners or subsidiaries take measures to mitigate the impacts from the entry into force of the CBAM?**

GHG Intensity Based on Net Revenue

- **Do you have GHG removals or GHG mitigation projects financed through carbon credits in your Chinese subsidiaries?**
  - Was your carbon credit scheme certified by a third-party?
  - Do you have GHG removals and/or GHG mitigation projects?
  - Do you have them inside or outside your value chain?

- **Do you apply internal carbon pricing schemes?**
  - If yes, do they support your decision making and incentivize the implementation of climate-related policy and targets?

- **Did you assess the potential financial effects from material transition risks of your Chinese subsidiaries?**
  - Did you assess the monetary value of the assets subject to these risks?
  - And the relation with your revenue from those assets

ISSB-IFRS S2 Survey

Governance

- **Do you have a body or an individual within your board that is responsible for the oversight of climate-related risks and opportunities?**
  - If yes, Is the body or individual constantly informed about the climate related actions of the company?
  - Does it take care also of those taken by the Chinese subsidiaries?
  - Did you evaluate the knowledge of the body on the subject of transitioning to a low-carbon economy?
  - Is the remuneration policy of this body based on the performance metrics related to climate-risks?

Strategy

- **In the report for your Chinese subsidiaries did you describe the climate-related transition risks that could possibly be expected to affect the entity's prospects?**
  - Within this identification di you separate climate related physical risks and climate related transition risks?
  - Do you have a temporal frame on when those climate related transition risks could occur?
  - What is your definition for short, medium, and long term in relation to those climate-related transition risks?
    - What is your definition of short-term?

- What is your definition of medium-term?
- What is your definition of long-term?

Financial position, financial performance, and cash flows

- **Do you expect your strategy in China to change in relation to climate change transition risks?**

- **How satisfied are you with the availability of reasonable and supportable information on climate-related transition risks in your Chinese value chain?**

Climate Resilience

- **Do you use a climate-related scenario analysis to assess the climate resilience of your Chinese Subsidiaries?**
- **Is the approach used commeasurable with your circumstances?**

Risk management.

- **What are the inputs and parameters you use to assess transition risks in China?**

Climate related targets

- **For Chinese subsidiaries do you have qualitative and quantitative climate-related targets?**

Brief Survey on ESRS S1

- **For your subsidiaries in China do you have policies for the elimination of discrimination and enhancement of equal opportunities?**
- **Do you have for your subsidiaries in China specific policy commitments related to inclusion or affirmative actions for people from ethnic groups particularly at risk or vulnerable?**
- **Do you engage the workforce of your Chinese subsidiaries directly? What is the frequency of the engagement?**
- **Do you provide contribution or remedy for the workers of your Chinese counterparts in the case there are material negative impacts?**
- **Are you working to prevent, mitigate and remedy the negative material impacts on the workforce of your Chinese subsidiaries?**
- **Did you already carried actions to remedy the climate-related material impacts that affect the workforce of your Chinese subsidiaries?**

- **Do you have for you Chinese subsidiaries courses that train your employees on the safety in the workplace?**
- **Has the company been sanctioned for the violation of safety measures in the workplace?**
- **Do you release courses, or do you educate your distributors or suppliers on social responsibility?**
- **Do you have investments allocated for the renovation and upgrade of the workplace?**
- **What is the percentage of your employees that is part of a syndicate?**
- **In your company evaluation and social reporting do you consider you social responsibility towards strategy, management and identification of the stakeholders?**

APPENDIX B

N. of Questions	Questions	Automotive	Manufacturing
Q1	Do you have a transition plan for climate change mitigation? Did you include your Chinese subsidiaries in its transition plan for climate change mitigation?	Yes	No
Q2	Is the amount of investment and funding given to the transition plan of your Chinese subsidiaries appropriate?	Extremely appropriate	
Q3	Do you know the potential locked-in GHG emissions from your assets and products in China?	Yes	
Q4	Do you know how those might affect your transition risks or how they might jeopardize the achievement of your GHG reduction targets?	Yes	
Q5	Is the transition plan for your Chinese subsidiaries embedded and aligned with your business strategy?	Definitely yes	
Q6	Are those reduction targets divided in a timeline which is divided in short-, medium- and long-term goals?	Yes	No
Q7	Are they measurable?	Yes	
Q8	Did your company carry an identification and assessment of climate-related transition risks and opportunities within the value chain of your Chinese subsidiaries?	Yes	No
Q9	Also the climate-related risks and opportunities of normative nature?	No	
Q10	Did you create a forecast of an identification of climate-related transition events for your Chinese subsidiaries with a forecast scenario in line with the 1.5C° goals?	No	
Q11	Did you create an assessment of how the assets of the Chinese subsidiary and your business activities associate with them might be exposed to these climate-related transition events?	No	
Q12	What is the percentage of the resources allocated to carry mitigation and adaptation to climate change actions within your Chinese Subsidiaries? 0% meaning no resources, 100% meaning all your resources.	10%	0%
Q13	Did you set measurable KPI's?	No	No
Q14	Did you set GHG emission reduction targets or any other targets to manage material climate-related transition risks for your subsidiaries in China?	Yes	No
Q15	Are they science based?	Yes	
Q16	How likely are you to identify and disclose GHG emissions? GHG emissions within your value chain, particularly the emissions associated with your Chinese associates, joint ventures, unconsolidated subsidiaries and all the other contractual arrangements withing your value chain in China?	Neither likely nor unlikely	Extremely unlikely
Q17	Did you disclose scope 1, 2 and 3 emissions of your Chinese subsidiaries?	Yes	No
Q18	If you did, did you disclose the scope 1, 2 and the scope 3 of the financial	No	

	investment category? To this information is not to apply the share of equity owned in the Chinese subsidiary to limit the proportion of GHG emissions in the report.		
Q19	Did you have any changes in what constituted your value chain in China?	Yes	No
Q20	Do you consider those changes effective?	Definitely yes	
Q21	Did you explain the change in the comparability with the previous years?	No	
Q22	Have you considered the effects and impacts of the CBAM on your value chain?	Yes	No
Q23	Did your Chinese partners or subsidiaries take measures to mitigate the impacts from the entry into force of the CBAM?	Yes	No
Q24	Do you have GHG removals or GHG mitigation projects financed through carbon credits in your Chinese subsidiaries?	No	No
Q25	Was your carbon credit scheme certified by a third-party?		
Q26	Do you have GHG removals and/or GHG mitigation projects?		
Q27	Do you have them inside or outside your value chain?		
Q28	Do you apply internal carbon pricing schemes?	No	No
Q29	Do they support your decision making and incentivize the implementation of climate-related policy and targets?		
Q30	Did you assess the potential financial effects from material transition risks of your Chinese subsidiaries?	Yes	No
Q31	Did you assess the monetary value of the assets subject to these risks?	No	
Q32	Did you assess the risk in relation with your revenue from those assets?	No	
Q33	Do you have a body or an individual within your board that is responsible for the oversight of climate-related risks and opportunities?	Yes	No
Q34	Is the body or individual constantly informed about the climate related actions of the company?	Yes	
Q35	Does it take care also of those taken by the Chinese subsidiaries?	Yes	
Q36	Did you evaluate the knowledge of the body on the subject of transitioning to a low-carbon economy?	No	
Q37	Is the remuneration policy of this body based on the performance metrics related to climate-risks?	Yes	
Q38	In the report for your Chinese subsidiaries did you describe the climate-related transition risks that could possibly be expected to affect the entity's prospects?	No	No
Q39	Within this identification di you separate climate related physical risks and climate related transition risks?		
Q40	Do you have a temporal frame on when those climate related transition risks could occur?		
Q41	Do you have a definition for short, medium, and long term in relation to those climate-related transition risks?		
Q42	What is your definition of short-term?		
Q43	What is your definition of medium-term?		
Q44	What is your definition of long-term?		

Q45	Do you expect your strategy in China to change in relation to climate change transition risks?	Definitely not	Definitely not
Q46	How satisfied are you with the availability of reasonable and supportable information on climate-related transition risks in your Chinese value chain?	Somewhat dissatisfied	Extremely dissatisfied
Q47	Do you use a climate-related scenario analysis to assess the climate resilience of your Chinese Subsidiaries?	No	No
Q48	Is the approach used commeasurable with your circumstances?	No	No
Q49	What are the inputs and parameters you use to assess transition risks in China?	Scope 1 and Scope 2 (priority)	We have no inputs and parameters
Q50	For Chinese subsidiaries do you have qualitative and quantitative climate-related targets?	No	No
Q51	For your subsidiaries in China do you have policies for the elimination of discrimination and enhancement of equal opportunities?	Yes	Yes
Q52	Do you have for your subsidiaries in China specific policy commitments related to inclusion or affirmative actions for people from ethnic groups particularly at risk or vulnerable?	Yes	Yes
Q53	Do you engage the workforce of your Chinese subsidiaries directly?	Yes	Yes
Q54	What is the frequency of the engagement?	Extremely appropriate	Somewhat appropriate
Q55	4. How likely is that you provide contribution or remedy for the workers of your Chinese counterparts in the case there are material negative impacts?	Extremely likely	Somewhat likely
Q56	Are you working to prevent, mitigate and remedy the negative material impacts on the workforce of your Chinese subsidiaries?	Yes	Yes
Q57	Did you already carried actions to remedy the climate-related material impacts that affect the workforce of your Chinese subsidiaries?	Yes	Yes
Q58	Do you have for you Chinese subsidiaries courses that train your employees on the safety in the workplace?	Yes	Yes
Q59	Do you release courses, or do you educate your distributors or suppliers on social responsibility?	Yes	No
Q60	Do you have investments allocated for the renovation and upgrade of the workplace?	Yes	Yes
Q61	What is the percentage of your employees that is part of a syndicate?	100%	40%
Q62	In your company evaluation and social reporting do you consider you social responsibility towards strategy, management and identification of the stakeholders?	Yes	Yes