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# Assessing Climate Change Mitigation & Adaptation Efforts In The Italian Industry:



The Results Of An Exploratory Study.

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# CREDITS.

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The editing of the research report “Assessing climate change mitigation and adaptation efforts in the Italian industry: the results of an explorative study” has been coordinated by Prof. Francesco Testa and realized with the contribution of Niccolò Maria Todaro and Dr. Federica Gasbarro. Scientific supervision was provided by Prof. Fabio Iraldo.

Special thanks to Roberta Ianna and the Italian Ministry of the Environment and Protection of Land and Sea for commissioning and supporting the realisation of the report.

## **Citation:**

Please cite as:

Francesco Testa, Niccolò Maria Todaro, Fabio Iraldo, Federica Gasbarro, Roberta Ianna (2017). *Assessing climate change mitigation and adaptation efforts in the Italian industry: the results of an explorative study*. Retrieved from the Italian Ministry of Environment and Protection of Land and Sea website: <http://www.minambiente.it/pagina/marrakech-partnership-global-climate-action>

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# EXECUTIVE SUMMARY.

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The present report details the results of an exploratory study on climate change mitigation and adaptation within the Italian industry, commissioned by the Ministry of Environment and Protection of Land and Sea of Italy and conducted by the Institute of Management of the Sant'Anna School of Advanced Study. The study aimed at providing a comprehensive picture of climate action within the Italian manufacturing sectors, by assessing the business perception of climate issues and the organizational, strategic and competitive dynamics that drive corporate responses to climate change in Italy.

The methodological approach of the study relied on the submission of an extensive questionnaire survey among the Top Management of large- and medium-sized firms operating in a wide array of manufacturing industries. Given the size and scope of the initially selected sample of companies (which amounted to 2,950 firms), the study grounds on a large amount of primary data and therefore provides a reliable and generalizable assessment of the factors that influence organizational decision-making on climate issues within Italian manufacturing firms.

The study adopts a multi-perspective approach in order to examine a comprehensive array of factors, pertaining to different level of analysis (i.e. micro, meso and macro), and investigate their relations with the implementation of climate change mitigation and adaptation measures. At the micro-level, the study focuses on Top Managers' individual and intangible cognitive factors that underpin decision-making processes under uncertainty. At the meso-level, the focus of the analysis shifts on the organizational context, by examining the role of organizational culture and governance structure as drivers of climate action. Finally, at the macro-level, the study assesses the influence of externally induced pressures exerted by the normative, regulatory and competitive environments in which companies operate and interact with diverse stakeholders.

Following, the main sections of the report are outlined and the main results summarized:

**1. Top Managers' awareness and perceptions of climate change** – This section of the report assesses executives' awareness of the climate change phenomenon and their perceived exposure to climate risk, as well as the perceived efficacy of mitigation and adaptation measures in preventing or limiting climate change. The descriptive statistics provided in the chapter highlights a high level of awareness concerning the effect of industrial GHG emissions on the global climatic conditions among Italian managers, as well as medium-to-high level of awareness concerning the potential risk associated to climate change on business and production activities. Surveyed executives are also aware of their exposure to increasing normative risks (such as progressively stringent emissions ceilings) and they appear as concerned about the exposure of public infrastructures (e.g. telecommunications lines, electricity supply etc.) to climate impacts.

Financial risks (such as increasing insurance premiums) also constitute a relevant risk category in a 10 years time-horizon. Despite the high level of awareness of climate change, executives emerge to be confident in the effectiveness of mitigation in limiting the detrimental impacts of GHG emission on the environment, while they are more uncertain concerning the efficacy of adaption in reducing their companies' exposure to climate impacts.

- 2. Assessing the internalization of environmental protection** – The chapter provides a meso-level analysis focusing on the internalization of managerial values in organizational cultures and business strategies. The main results indicate as managerial attitudes towards the protection of environment are mirrored at the organizational level. Italian executives indeed confirm that environmental sustainability is a guiding principle in their companies' strategy planning process and a characteristic feature of their organizational culture. The statistical elaboration of the data (provided in chapter 6.1) confirms this finding, by highlighting as managers' commitment to environmental issues translate, at the organizational level, in a proactive environmental culture.
- 3. Responding to climate change** – This section provides a picture of the state-of-the-art of climate action within the Italian industry, by assessing the level of implementation of mitigation and adaptation initiatives among Italian manufacturing companies. Despite mitigation measures emerge to be generally preferred over adaptation initiatives, property insurance against climate risk is the most widespread climate action among the surveyed companies. On the other hand, energy and resource efficiency measures are generally preferred over other form of climate responses because of their association with cost reductions and because of lower upfront investments.
- 4. Advancing climate action** – The fourth chapter combines the meso- and macro-perspectives in order to investigate motivating factors and hurdles to climate action pertaining both to the organizational context and to the institutional and regulatory environment. At the organizational level, governance structures play a fundamental role. The appointment of a clear and defined leadership on climate issues at the Top Management emerge as a major driver of climate action among the surveyed organizations. Similarly, the "climate leadership" is empowered by the availability of resources (financial, human and technological) devoted to environmental protection. The statistical model presented in chapter 6.1 illustrates how both the availability of resources for environmental protection and the empowerment of managerial figures on climate issues are driven by the organizational culture. At the macro-level, the regulatory environment (represented by national and supranational regulatory authorities) emerges as the most relevant coercive pressure on Italian companies towards the adoption of mitigation and adaptation initiatives. However, an interesting finding of the study is that enhancing organizational capabilities in the environmental domain constitutes a motivation for the adoption of mitigation and adaptation measures, as well as the will to conform to international standards in the environmental management and business continuity field. Finally, according to the statistical elaboration of the data, environmental factors (such as the regulatory and normative pressures and the pressures

exerted by the diverse stakeholders) emerge not only as a major driver of climate action in the Italian industry, but also as a source of influence on the organizational culture.

**5. Developing climate knowledge** – The fifth chapter aims at answering three questions. What kind of climate-related data Italian companies need in order to inform their decision-making processes on climate issues? Do Italian companies possess sufficient data on climate change? Do Italian companies take part in (or are aware of) the Global Climate Action Agenda promoted by the UNFCCC? The results of this section underlines a lack of adequate information on climate impacts among Italian companies. Not surprisingly, information concerning the economic and organizational impacts of climate change emerge as the most important data according to Italian managers, followed by data concerning direct climate impacts (such as water shortages) and health and safety risk associated to global warming. However, Italian managers admits a general and widespread dissatisfaction with the availability of information within their companies. Similarly, only a marginal minority of companies appear to be aware or interested in the international initiatives promoted within the Global Climate Action Agenda.

**6. Policy recommendations** – The final chapter of the report provides the detailed analysis of the findings of the study and derives recommendations addressed to policy-makers and decision-makers inside organizations. At a general level, the following recommendations emerge from the study:

- a. Emphasize the role of direct regulation in driving the technological transition, focusing on companies' innovative and competitive performance;
- b. Climate action should be rewarded (especially adaptation) by means of the development and diffusion of innovative resilience-based insurance and banking products addressed to small and medium-sized firms;
- c. Strengthening executives' empowerment for climate action, by leveraging on the diffusion and valorization of existing voluntary instruments, such as business continuity management standards and environmental management standards;
- d. Supporting a cultural change at industry and organizational level, by means of institutional support and training activities;
- e. Raising public awareness and encouraging carbon disclosure, in order to enhance the demand for climate-friendly products and services while fostering transparency at the supply-side;
- f. Enhancing transparency and communication across the actors of the supply chain, by means of management standards certifications and labelling;
- g. Promoting companies' engagement in multi-stakeholder initiatives in order to promote cooperative approaches to mitigation and adaptation aimed at sharing costs, duties and responsibilities among diverse actors.

# TABLE OF CONTENTS

<b>i. EXECUTIVE SUMMARY</b> .....	3
<b>ii. INTRODUCTION.</b>	
The Role of the Business Sector in Mitigating and Adapting to Climate Change .....	9
<b>iii. METHODOLOGY</b> .....	13
<b>1. AWARENESS AND PERCEPTIONS OF CLIMATE CHANGE.</b>	
Measuring the Antecedents of Climate Action among Italian Companies	
1.1   WHY COGNITION MATTERS? .....	15
1.2   AWARENESS OF CLIMATE IMPACTS.....	16
1.3   PERCEPTIONS OF CLIMATE RISK EXPOSURE.....	18
1.4   PERCEIVED EFFICACY OF MITIGATION AND ADAPTATION EFFORTS.....	20
<b>2. ASSESSING THE INTERNALIZATION OF ENVIRONMENTAL PROTECTION.</b>	
Moving Towards a Climate Strategy?	
2.1   CLIMATE ACTION & BUSINESS STRATEGY: DO THEY MATCH? .....	22
2.2   ENVIRONMENTAL PROTECTION AS A MANAGERIAL VALUE.....	23
2.3   ENVIRONMENTAL PROTECTION AS A DETERMINANT OF BUSINESS STRATEGY.....	24
2.4   THE ECONOMIC VIABILITY OF CLIMATE ACTION.....	25
<b>3. RESPONDING TO CLIMATE CHANGE.</b>	
Mitigation and Adaptation Efforts among Italian Companies.	
3.1   WHAT IS THE STATE-OF-THE-ART? .....	27
3.2   MITIGATION AND ADAPTATION: ASSESSING THE LEVEL OF IMPLEMENTATION.....	28
3.3   CLIMATE ACTION EXPOSED: BUSINESS CASES & BEST PRACTICES.....	30
<b>4. ADVANCING CLIMATE ACTION.</b>	
Assessing Motivating Factors and Hurdles to Climate Action within the Italian Industry.	
4.1   WHEN PUSH COMES TO SHOVE, WHAT MATTERS?.....	31
4.2   LEADERSHIP: DEFINING ROLES & RESPONSIBILITIES.....	32
4.3   EMPOWERMENT: ACCESSING KNOW-HOW, TECHNOLOGIES AND RESOURCES.....	33
4.4   ISOMORPHISM: DISCERNING PRESSURES TOWARDS ACTION.....	35

4.5 | STAKEHOLDERS: IDENTIFYING THE CLIMATE-RELEVANT POWER STRUCTURE.....37

**5. DEVELOPING CLIMATE KNOWLEDGE.**

Assessing the Availability of Information on Climate Impacts among Italian Companies.

5.1 | WHAT KIND OF CLIMATE KNOWLEDGE DO COMPANIES NEED? ..... 40

5.2 | ASSESSING THE NEED FOR CLIMATE-RELEVANT DATA.....41

5.3 | KNOWING THE GLOBAL CLIMATE ACTION AGENDA INITIATIVES.....43

**6. CONCLUSIONS AND POLICY RECOMMENDATIONS.**

6.1 | MODELLING THE ANTECEDENTS OF CLIMATE ACTION.....46

6.2 | ASSESSING RELATIONS AT THE MANAGERIAL, ORGANIZATIONAL  
AND ENVIRONMENTAL LEVEL.....47

6.3 | POLICY RECOMMENDATIONS.....49

# LIST OF FIGURES

<b>Figure 1.</b> “Breakdown of Respondents by Sector” .....	14
<b>Figure 2.</b> “Awareness of Climate Impacts” .....	16
<b>Figure 3.</b> “Perceptions of Climate Risk Exposure” .....	18
<b>Figure 4.</b> “Perceived Efficacy of Mitigation and Adaptation Efforts - Part 1” .....	20
<b>Figure 5.</b> “Perceived Efficacy of Mitigation and Adaptation Efforts - Part 2” .....	21
<b>Figure 6.</b> “Environmental Protection as a Managerial Value” .....	23
<b>Figure 7.</b> “Environmental Protection as a Determinant of Business Strategy” .....	24
<b>Figure 8.</b> “The Economic Viability of Climate Action” .....	25
<b>Figure 9.</b> “Mitigation and Adaptation Practices – Level of Implementation” .....	28
<b>Figure 10.</b> “Mitigation or adaptation measures implemented by the Italian companies” .....	30
<b>Figure 11.</b> “Leadership: defining roles and responsibilities” .....	32
<b>Figure 12.</b> “Empowerment – Climate Change Mitigation” .....	34
<b>Figure 13.</b> “Empowerment – Climate Change Adaptation” .....	34
<b>Figure 14.</b> “Discerning Pressures towards Action” .....	36
<b>Figure 15.</b> “Stakeholders. Identifying the Climate-Relevant Power Structure” .....	38
<b>Figure 16.</b> “The importance of climate-relevant data” .....	41
<b>Figure 17.</b> “The availability of climate-relevant data” .....	42
<b>Figure 18.</b> “Lima-Paris Action Agenda initiatives” .....	45
<b>Figure 19.</b> “Modelling the antecedents of climate action.” .....	47



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# INTRODUCTION.

## The Role of the Business Sector in Mitigating and Adapting to Climate Change

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The Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC), published on 2014, categorically stated that '*Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems*'. For the first time, a comprehensive assessment of sea level rise, and its causes, over the past few decades was provided. It was also able to estimate cumulative CO<sub>2</sub> emissions since pre-industrial times and provide a CO<sub>2</sub> budget for future emissions to limit warming to less than 2 °C. About half of this maximum amount was already emitted by 2011. Thanks to the IPCC, we know that:

- From 1880 to 2012, the average global temperature increased by 0.85 °C.
- Oceans have warmed, the amounts of snow and ice have diminished and the sea level has risen. From 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded due to warming and ice melted. The sea ice extent in the Arctic has shrunk in every successive decade since 1979, with  $1.07 \times 10^6$  km<sup>2</sup> of ice loss per decade.
- Given current concentrations and ongoing emissions of GHGs, it is likely that the end of this century will see a 1–2 °C increase in global mean temperature above the 1990 level (about 1.5–2.5 °C above the pre-industrial level). The world's oceans will warm and ice melt will continue. Average sea level rise is predicted to be 24–30 cm by 2065 and 40–63 cm by 2100 relative to the reference period of 1986–2005. Most aspects of climate change will persist for many centuries, even if emissions are stopped.

As the detrimental role of human activity on the global climate has been acknowledged, political, social and business actors need to direct new efforts towards researching alternative patterns of production and consumption in order to mitigate the negative externalities of human activity. This goal implies, on the one hand, reducing greenhouse gas (GHG) emissions affecting the rate and magnitude of change, while, on the other hand, researching possible ways to adapt to climate change impacts on social and business activities. These two kinds of responses to climate change in terms of mitigation and adaptation actions can be complementary. However, the capacity to mitigate and adapt is dependent on socio-economic and environmental circumstances and on the availability of information and technologies. Hence, climate change represents a major environmental challenge, both in the present and in the future, in particular for policy-making.

In fact, even though the concerns associated to climate change led the international community to establish the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, the first binding agreement on climate action was signed only in 1997 in Kyoto and entered into force between 2008 and 2012. In 2015, a new international agreement was reached in Paris.

The central aim of Paris Agreement is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change.

The Paris Agreement also welcomed the efforts of all non-Party stakeholders to address and respond to climate change, including those of civil society, the private sector, financial institutions, cities and other sub-national authorities, calling them to a Global Climate Action. These stakeholders were requested to scale up their efforts and showcase them via the Non-State Actor Zone for Climate Action platform (link to <http://climateaction.unfccc.int/>).

Within the Global Climate Action, governments are expected to: provide visibility to private initiatives aimed at combating climate change; take part in private initiatives; encourage private actors in adopting mitigation measures or joining existing mitigation programs; implement multilateral actions to achieve governments' mitigation targets; start new initiatives.

The Italian Government ratified the Paris Agreement and it is already actively involved in the Global Climate Action recognizing the importance of the involvement of the civil society and business sector.

The contribution of the private sector is crucial for the program success. Regarding the business sector as an example, on the one hand, companies are directly (e.g. those producing fossil fuel and electricity) and indirectly (e.g. those consuming fossil fuels and electricity) responsible for GHGs emissions, and in certain cases to a greater extent than countries. This further implies that they can play a huge role in mitigation. For example, the mining group Rio Tinto rivals the emissions of New Zealand, while the GHG emissions of ExxonMobil are higher than those of Belgium. On the other hand, companies are affected by the impacts of climate change in terms of ecological changes, e.g. weather and climate events. Extreme weather events directly affect single companies and this could be extremely oppressive in particular for SMEs. For example, in the case of agro-food industry, a company has to face extreme weather events directly damaging its plant or surrounding areas, but has to face also indirect impacts of global precipitation/temperature pattern changing as happened for wheat and maize yields, which production drops of 2% every 10 years.

Therefore, within the Global Climate Action, firms are expected to adapt their business model in order to contribute to the achievement of the target of keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. As a consequence, firms are expected to:

- Change their supply chain towards sustainability;
- Cooperate with multi-stakeholders initiatives aimed at GHGs emissions reduction;
- Define emissions reduction targets by sector within 2050;
- Setting GHGs emissions reduction targets or resilience improvement targets;
- Encompassing climate change in business strategies and governance;
- Supporting the implementation of private and public policies aimed at tackling climate change and supporting the development of markets with low Carbon dioxide (CO<sub>2</sub>) emissions.

In order to inform national policy-making towards supporting private sector's mitigation objectives within a Global Climate Action, the Italian Ministry of the Environment and Protection of Land and Sea, with the support of the Institute of Management of the Sant'Anna School of Advanced Studies, carried out a survey on climate change mitigation and adaptation among Italian companies. The aim of the survey is to understand the business perception of climate change and discover the strategic dynamics that drive companies towards adopting climate change mitigation or adaptation measures in the Italian industry sector.

In particular, the study aims at providing a comprehensive understanding of climate action within the Italian manufacturing and extractive industries, by investigating the managerial, organizational and environmental factors that influence organizational decision-making on climate issues.

The rest of the Report is structured as follows:

- the first chapter of the report focuses on the awareness of climate change and the perceived exposure to climate risks as potential determinants of climate action among companies' managers (CEOs, environmental managers or other members of the top management);
- the second chapter investigates the internalization of managers' pro-environmental values in the organizational culture and the role of environmental sustainability as a feature of companies' business strategy;
- the third chapter deepens our understanding of the current state of mitigation and adaptation in the Italian private sector, the fourth chapter investigates the external barriers and motivations that hinder or encourage climate action in the industrial sector. The fifth chapter assesses the availability of information on climate change among Italian companies and the need for climate-related data;

- the last chapter aims at providing implications and directions for policy making at national and regional level, as well as for decision-making on environmental and climate issues at the organizational level.

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# METHODOLOGY.

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The data showcased in the report were collected between July and September 2016, by means of a questionnaire survey developed by the researchers of the Institute of Management of the Sant'Anna School of Advanced Studies. The survey consisted of 19 multiple-choice questions and 1 open question.. The questionnaire was designed by taking into account the potential problems of common method variance that can affect behavioral research. Several procedural remedies were adopted to reduce bias such as: avoiding vague concepts, complicated syntax and unfamiliar terms in order to minimize item ambiguity; keeping questions simple, specific, and concise; avoiding the use of bipolar numerical scale values and providing verbal labels for the midpoints of scales and guaranteeing respondent anonymity. Moreover, in order to limit respondents dropping out in the final stages of the survey, the questionnaire was divided in two separate sections.

The survey was submitted online to a sample of 2,950 companies operating in the Italian manufacturing industries<sup>1</sup> extracted from the Italian Chamber of Commerce database. These companies, mainly large and medium, represents more than 80% of Italian value of production. An introductory letter asked recipients to forward the survey to a member of the top management appointed to strategy planning or climate change responses. As of October 2016, 620 responses were collected, representing a 21% response rate. In particular, 487 completed surveys were returned for the first section of the survey and 149 for the second section. Hence the final response rate is 16,5% for the first section and 5% for the second section.

Most of the respondents belong to medium or large-sized firms. In particular, 50% of the companies in the final sample employ 50 to 250 employees, while 44% employ more than 250 employees. Small firms (i.e. less than 50 employees) and micro-firms (i.e. less than 10 employees) represent the 6% of the final sample. In terms of turnover, 53% of the firms in the sample report annual revenues of more than €50,000,000, while 41% report earnings in the range between €10,000,000 and €50,000,000. 6% of the final sample report annual revenues of less than €10,000,000.

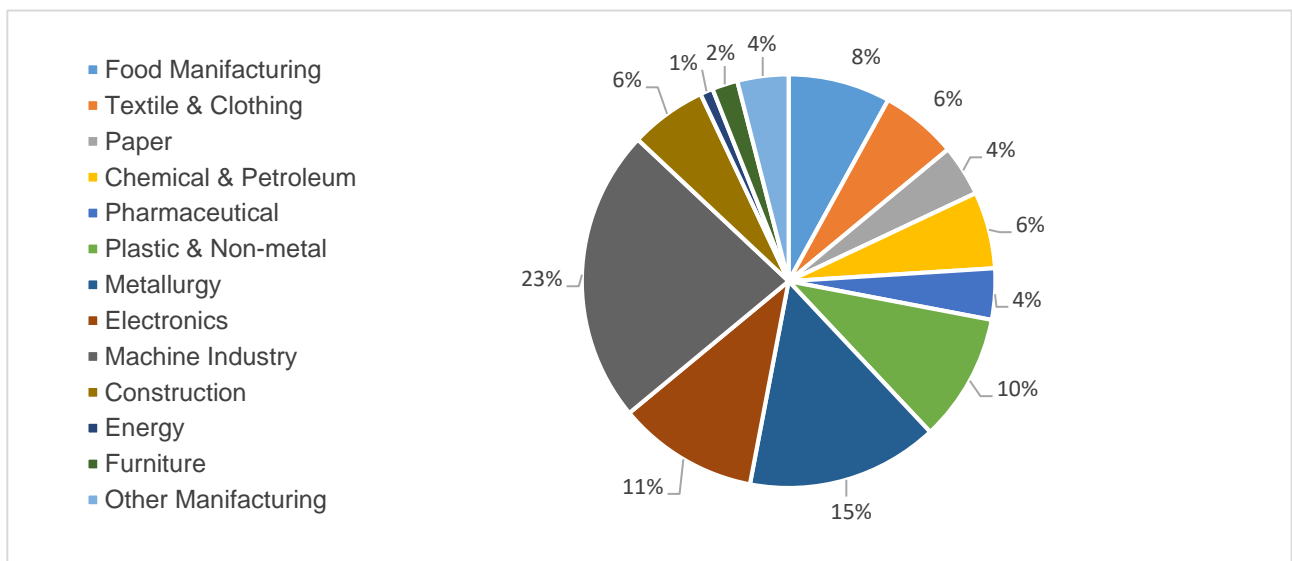
The final sample encompasses a wide array of diverse manufacturing sectors, ranging from food manufacturing, to pharmaceutical and metallurgical sectors. In particular, 23% of the respondents operate in the machine industry (i.e. production of machineries, engines, vehicles etc.), 15% operate in the metallurgical and steelmaking industry, 11% in the electronics industry and 10% in plastics and non-metals industries (see Figure 1 for the breakdown by sector).

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<sup>1</sup> ATECO Manifatturiero (10-11-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32- 33) costruzioni (41-42-43)

Most respondents in the final sample hold managerial positions in the environmental or safety management field, such as Health, Safety and Environment (HSE) managers. Other respondents cover a wide range of functions, such as CEOs, energy management, risk management and operations managers. More than 40% of the respondents have more than 16 years of working experience in their current company, while 37% report a 6 to 15 years working experience in their current position. These data suggest that the surveyed respondents are well informed about their companies' decision-making and strategy planning processes on environmental issues.

Figure 1. "Breakdown of Respondents by Sector"



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# 1. AWARENESS AND PERCEPTIONS OF CLIMATE CHANGE.

## Measuring the Antecedents of Climate Action among Italian Companies.

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### 1.1 | WHY COGNITION MATTERS?

Understanding companies' involvement in climate action requires a deep analysis of decision-making processes under risk and uncertainty. Indeed, despite the reality of anthropogenic climate change has been confirmed by the scientific community, the extent of the change and its distributional impacts are highly uncertain. Moreover, despite a changing climate is perceived as a risk or threat by most economic actors, climate actions may not have tangible benefits in the short-term and only uncertain benefits in the long-term.

Nowadays, the prevailing understanding of risk as a socially constructed phenomenon suggests that decision-makers rely on personal "risk judgements" when facing choices under risk, rather than on completely rational expectations. Individual sense making, beliefs and prospects make up the so-called "risk perceptions", which influence individual preferences towards action, while intangible cognitive factors, such as concerns for the future and social norms, motivate and drive behavior. Cognition, defined as the psychological process underlying the acquisition of knowledge, the formation of beliefs and the elaboration of responses, emerges to be a crucial stepping-stone in explaining human behavior under uncertainty.

In the last three decades, the fields of applied psychology, organizational behavior and behavioral economics have provided important insights to the understanding of economic actors' behavior towards environmental issues (such as climate change) based on individual cognitive factors. Dimensions like the awareness of adverse consequences towards valued properties, the personal beliefs about the efficacy of particular actions and the framing of uncertain outcomes have been identified as relevant antecedents of pro-environmental actions among consumers, entrepreneurs and employees.

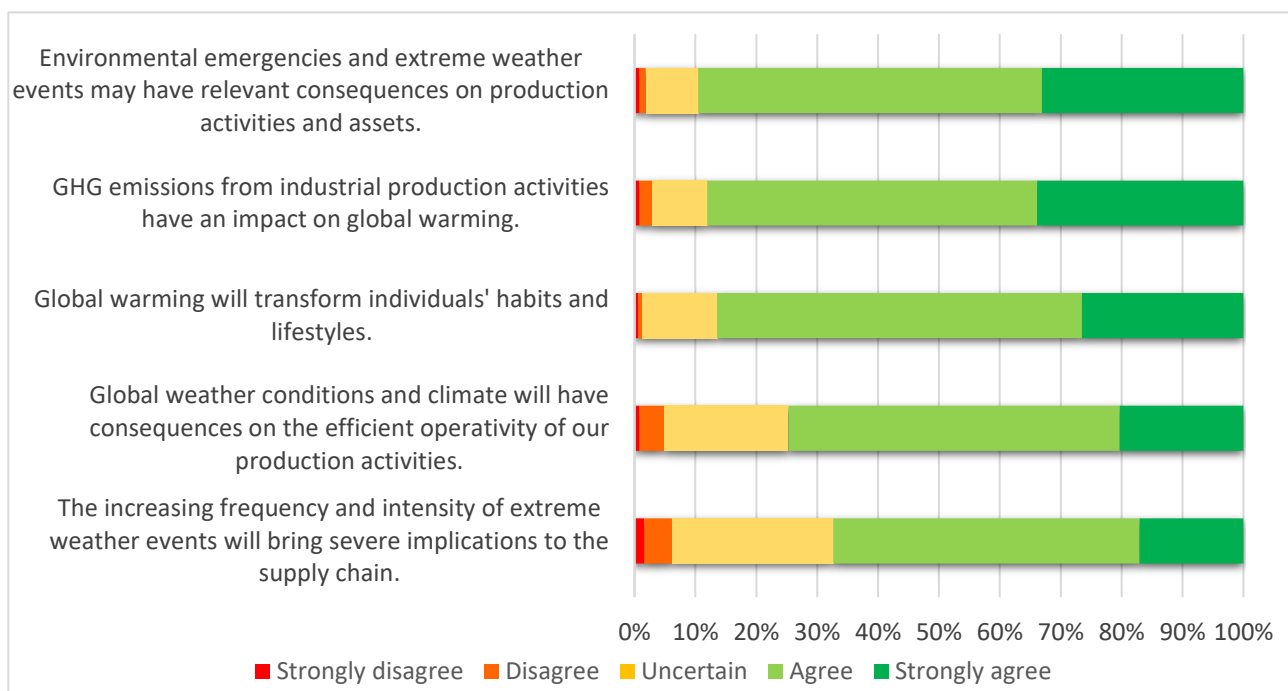
In this report, notions related to decision-making under uncertainty and to theories of pro-environmental behavior are combined in order to investigate a comprehensive set of potential determinants of climate action among a sample of Italian companies. In the following chapter, the awareness of climate impacts, the perceptions of climate risk exposure and the perceived efficacy of climate mitigation and adaptation efforts are

presented and discussed as latent drivers of climate action among the managers who participated in our research.

## 1.2 | AWARENESS OF CLIMATE IMPACTS.

Climate change may affect society and industry on different levels. It threatens the safety of assets and properties, it affects individuals' lifestyles and patterns of consumption and it undermines the legitimacy of current production patterns, deemed responsible for the emissions of climate-altering greenhouse gases (GHG). Assessing managers' awareness of climate impacts implies measuring beliefs about the actual or potential consequences of global warming and extreme weather events on the regular execution of business operations (such as production and procurement), on the integrity of company's assets and on the broader spectrum of society and environment. In this report, the awareness of climate impacts is assessed by measuring the respondents' level of agreement with five sentences, describing a broad range of climate impacts relevant for the industrial sector.

Figure 2. "Awareness of Climate Impacts": 487 respondents



The responses collected (illustrated in Figure 2) indicates a high level of awareness of climate impacts associated both to the industrial sector (i.e. safety of production activities and assets) and to society and environment. In particular, Italian managers emerges to be highly aware of the adverse consequences of industrial production activities on the environment, with particular reference to the role of GHG emissions in exacerbating global warming. Indeed, 34% of the respondents strongly agreed with the sentence "GHG emissions from



*industrial production activities have a tangible impact on global warming*", while 54% expressed a general agreement. This result may signal the increasing legitimization of anthropogenic climate change as a discourse supported by scientific evidence, within the Italian industrial sector. Slightly lower levels of agreement are expressed concerning the impact of climate change on households' consumption patterns and lifestyles (i.e. *"Global warming will transform individuals' habits and lifestyles"*), but still very far from disagreement. Indeed, 60% of the respondents expressed general agreement with the sentence, while 26.5% strongly agreed.

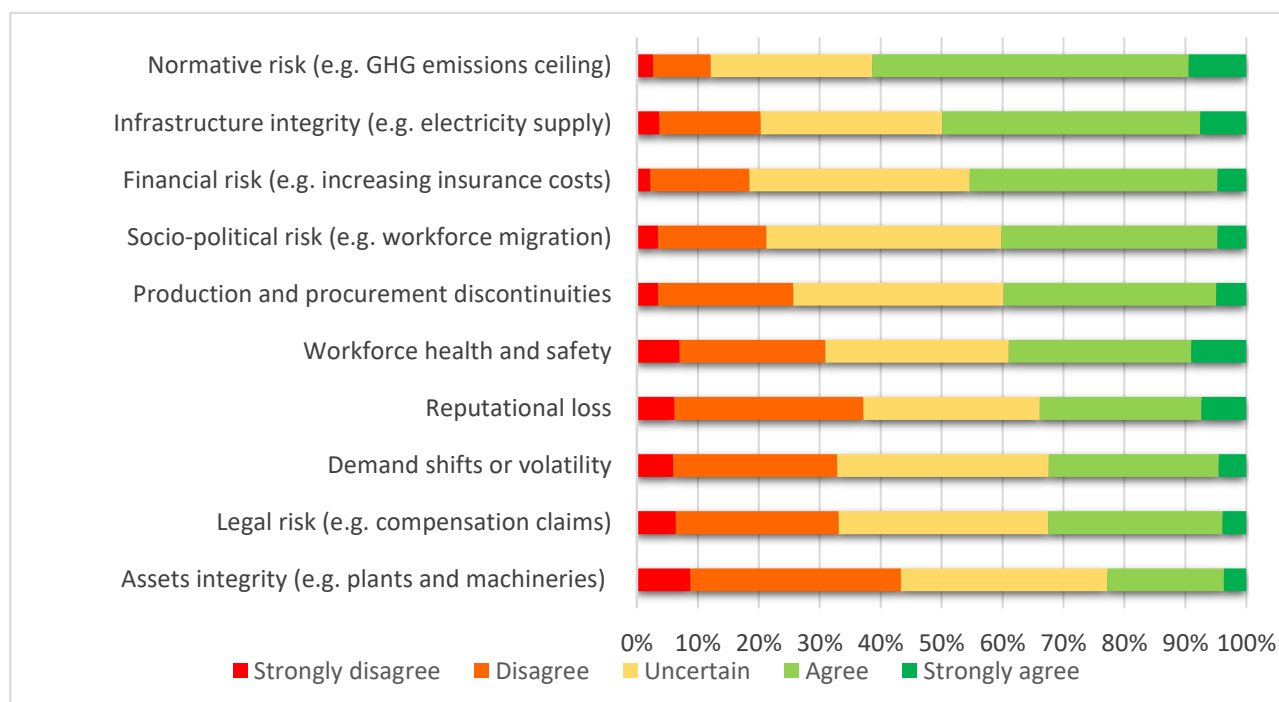
Greater uncertainty surrounds the consequences of climate change on production activities, which might not be perceived by Italian executives as imminent concerns for the continuation and efficiency of business operations or as a burden on the bottom line. However, despite 20% of the respondents expressed uncertainty towards the proposed sentence (i.e. *"Global weather conditions and climate will have consequences on the efficient operativity of our production activities."*), 54% and 20% agreed and strongly agreed, respectively. Less uncertainty is expressed towards the adverse consequences of extreme weather events and environmental emergencies on the companies' assets and production activities, which may be associated to the direct experience of these phenomenon in recent years (such as floods, heat waves, heavy rains etc.). 56% and 33% of the respondents agreed and strongly agreed, respectively, with the sentence *"Environmental emergencies and extreme weather events may have relevant consequences on production activities and assets"*, indicating a high level of awareness towards the potential exposure of companies' physical assets to extreme weather events. This result might also be associated to the high level of capital-intensity characterizing the sectors involved in the research (i.e. manufacturing and extractive), which require large investments in physical assets and maintenance.

On the other hand, lower levels of awareness are expressed concerning climate impacts that may affect the supply chain, disrupting or obstructing companies' procurement activities. Indeed, 26.5% of the respondents expressed uncertainty regarding the implications of extreme weather events on the supply chain (i.e. *"The increasing frequency and intensity of extreme weather events will bring severe implications to the supply chain"*), while the 17% and the 50% strongly agreed and agreed, respectively, with the proposed sentence. The uncertainty may be associated with the difficulty in predicting climate impacts occurring upstream or downstream the value chain. This kind of "indirect impacts" does not concern companies' assets, but indirectly affects those activities associated with suppliers or clients (such as procurement), preventing direct assessment and monitoring.

### 1.3 | PERCEPTIONS OF CLIMATE RISK EXPOSURE.

Assessing executives' perceived exposure to climate impacts implies identifying all aspects of a business that may be negatively affected, directly and indirectly, by hazards associated to climate change. Being very complex systems, business enterprises are exposed to a broad spectrum of climate risks, ranging from physical damages on plants and infrastructures to less tangible harms like shifts in the demand of products and services or reputational crisis. For the sake of this report, ten distinct risk categories are considered in order to provide a comprehensive picture of climate risks affecting the industrial sector. The level of perceived exposure to climate risks is then assessed by asking executives the question: **“Do you agree with the possibility that your company will be exposed to the following climate risks in the next 10 years?”**

Figure 3. “Perceptions of Climate Risk Exposure”: 487 respondents



Compared to the high level of awareness of climate impacts, Italian executives appear to belittle more uncertain regarding their companies' exposure to climate risks. Taking in consideration that most organizations might not monitor or quantify climate risks as part of their risk management routines, this general uncertainty is not surprising. Indeed, according to recent researches, European organizations are generally unprepared in terms of climate risk assessment or tend to focus, temporarily, on a very limited set of climate risk drivers of concern.

The majority of the respondents (62%) agree or strongly agree on their exposure to increasingly stringent normative requirements concerning GHG emissions, both at national and international level. In the aftermath of the Paris Agreement, “*command and control*”

regulations aiming at mitigating climate change by targeting industrial emissions may represent a pressing concern for business enterprises, especially for those operating in the manufacturing and extractive sectors. By setting a clear direction towards a zero GHG emissions and climate resilient economy, the Paris Agreement poses a meaningful challenge to business, but also an historic opportunity for change.

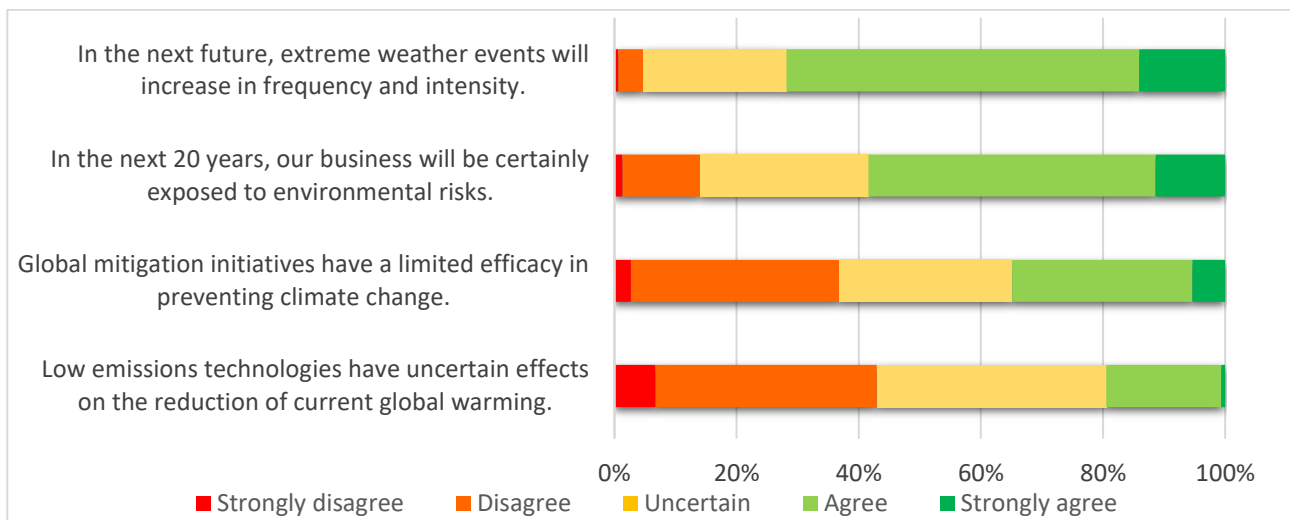
Interestingly, the integrity of critical infrastructures (such as electricity lines, telecommunication networks, roads, lighting etc.) is perceived as exposed to climate impacts occurring in the next ten years by half of the respondents. In particular, 42% and 8% of the respondents expressed agreement and strong agreement, respectively, with this risk category. On the other hand, the integrity and safety of companies' assets (such as plants, machineries, buildings and other means of production) are not perceived as exposed to climate impacts by 43% of the respondents, and represent the least relevant risk category on the list. In particular, 34% and 9% of the respondents disagreed and strongly disagreed, respectively, with the prospective exposure of company's assets within the 10 years-time horizon. Such divergence in the perceived exposure of infrastructures and assets may be associated to executives' inability to monitor, manage or mitigate climate impacts affecting public infrastructures. In this sense, executives' powerlessness over infrastructures may exacerbate the perception of risk exposure. On the other hand, executives have a greater ability to monitor their own assets and may feel empowered to adopt adaptation measures in order to reduce the exposure to climate risks.

The perceived exposure to financial risks, confirmed by the 45% of the respondents, signals that executives perceive climate change as a prospective burden on their companies' balance sheets. Financial risks associated to climate change may include, for instance, expensive insurance coverage on companies' assets, higher volatility in commodity prices or stock prices, or narrowed access to external funding because of heightened vulnerability to climate risks. Similarly, 40% of the respondents expressed agreement with the prospective exposure to discontinuities in production or procurement activities within a 10 years timeframe, while 36% expressed uncertainty. This ambivalent result may confirm that Italian executives perceive that climate impacts will adversely affect their business activities, both in terms of indirect impacts (as in the case of normative and financial risks) and direct impacts (as in the case of infrastructures exposure), but still lack a sufficient preparation or knowledge to reliably assess the actual extent of such impacts.

## 1.4 | PERCEIVED EFFICACY OF MITIGATION AND ADAPTATION EFFORTS.

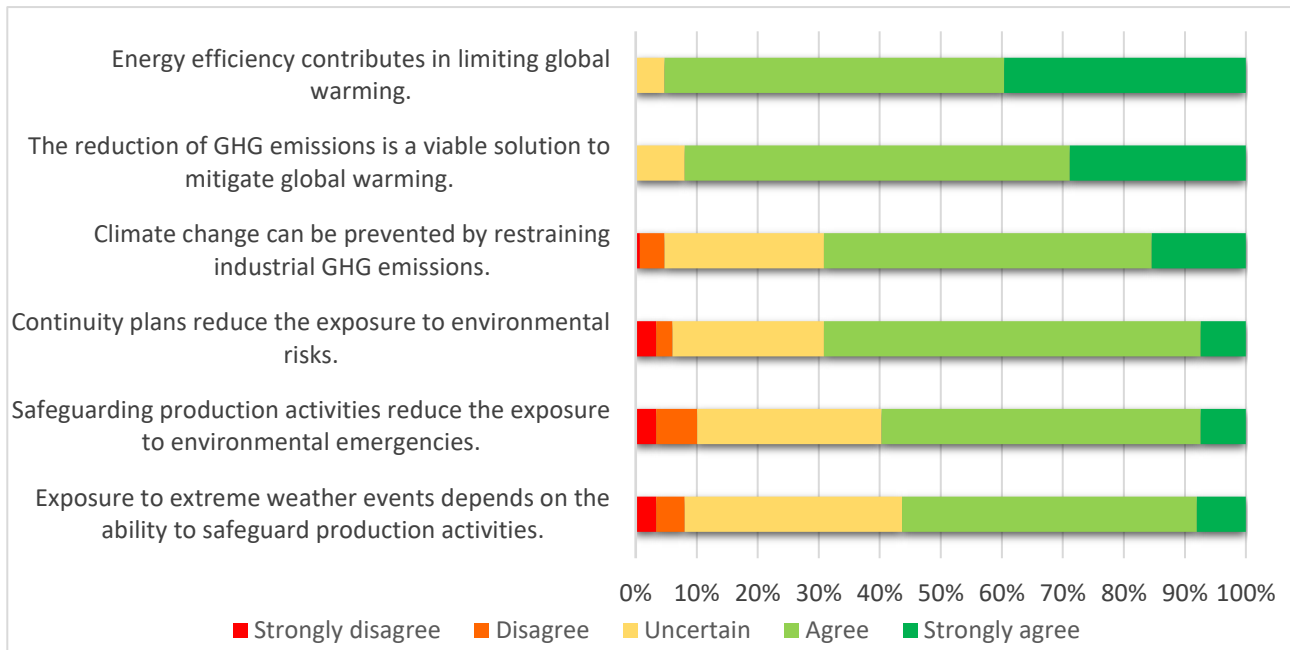
Perceiving that our own actions will be effective is a crucial prerequisite in determining our actual behavior. Similarly, business managers' perceived efficacy of mitigation and adaptation initiatives may determine whether companies engage in climate actions or not. In order to assess executives' perceptions towards climate action, we first investigated the way respondents frame climate change in terms of irreversibility of the phenomenon. Second, we asked respondents to express their level of agreement with a set of sentences describing several climate initiatives (three mitigation measures and three adaptation measures) as highly effective in contrasting global warming and its impacts on the industrial sector.

Figure 4. "Perceived efficacy of Mitigation and Adaptation Efforts" Part 1: 149 respondents



The results to the first set of sentences depict an ambivalent trend in respondents' framing of climate change. Sentences describing climate change as a certain and irreversible phenomenon (such as "In the next 20 years, our business will be certainly exposed to environmental risks") scored high levels of agreement, while sentences describing climate initiatives as ineffective (such as "Global mitigation initiatives have a limited efficacy in preventing climate change") scored higher levels of disagreement and uncertainty. This result may indicate that, despite climate change is perceived as an actual future challenge by most of the respondents, Italian executives are still confident in the efficacy of climate initiatives and new low-carbon technologies in mitigating the most adverse climate impacts and restoring a more sustainable relationship with the natural environment.

Figure 5. "Perceived efficacy of Mitigation and Adaptation Efforts" Part 2: 149 respondents



In line with the previous reasoning, the results to the second set of sentences illustrate a very positive perception towards the efficacy of both mitigation and adaptation measures. More than 56% of the respondents agreed or strongly agreed with all the proposed sentences. Interestingly, mitigation initiatives are perceived as very effective in limiting or preventing climate change, while adaptation measures are perceived as somewhat more uncertain in reducing the exposure to climate impacts. This result may signal respondents' awareness that efficient adaptation measures may reduce the vulnerability of a company, but they do not prevent hazardous natural events from happening and they rarely eliminate risk.

Energy efficiency is perceived as an effective measure to limit global warming by 96% of the respondents; in particular, 40% and 56% expressed strong agreement and agreement, respectively. Similarly, the reduction of GHG emissions is considered effective in mitigating global warming by the 92% of the respondents; in this case, 29% expressed strong agreement with the sentence "The reduction of GHG emissions is a viable solution to mitigate global warming", while 63% expressed agreement. However, somewhat lower levels of agreement (70%) and greater level of uncertainty (26%) surrounds the efficacy of mitigation initiatives in preventing climate change, which may confirm the belief of climate change as an irreversible phenomenon.

On the adaptation side, business continuity plans emerge as the most effective adaptation measure in limiting a company's exposure to environmental risk. Indeed, 62% of the respondents agreed with the effectiveness of continuity plans, while 7% expressed strong agreement, signaling that good preparation and planning are considered as the best investments in safety.

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## 2. ASSESSING THE INTERNALIZATION OF ENVIRONMENTAL PROTECTION.

### Moving Towards a Climate Strategy?

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#### 2.1 | CLIMATE ACTION & BUSINESS STRATEGY: DO THEY MATCH?

Given the extent of actual and potential impacts, climate change poses serious strategic dilemmas to business actors across a wide range of industries. While fossil fuels producers and fossil fuels-dependent sectors are primarily concerned in terms of carbon footprint reduction, most or all business sectors are also involved in terms of adaptation needs or opportunity seizing. In this sense, the reasons behind climate action in the business environment are decidedly strategic and aligned with an organization's business strategy, even if they spur from different pressures or opportunities.

Despite common needs or pushes for climate responses, organizations may considerably differ in the way and extent they internalize their awareness of climate impacts and their perceptions of climate risks or opportunities in their business strategy. Indeed, the factors influencing an organization in identifying and implementing the most appropriate mitigation or adaptation measures may pertain to the organizational, inter-organizational, as well as institutional, normative and political spheres.

In recent years, research on corporate sustainability has expressed the need to deepen the understanding of variability in environmental strategies among companies operating in similar social, regulatory and policy settings. Indeed, while the institutional and normative framework may restrain the range of feasible environmental strategies, the specific organizational context may provide executives with a broader sub-range of strategic options. In this sense, micro dimensions like the organizational culture, the managerial interpretation of environmental issues or power-relations between different departments may explain the variability in the strategies implemented.

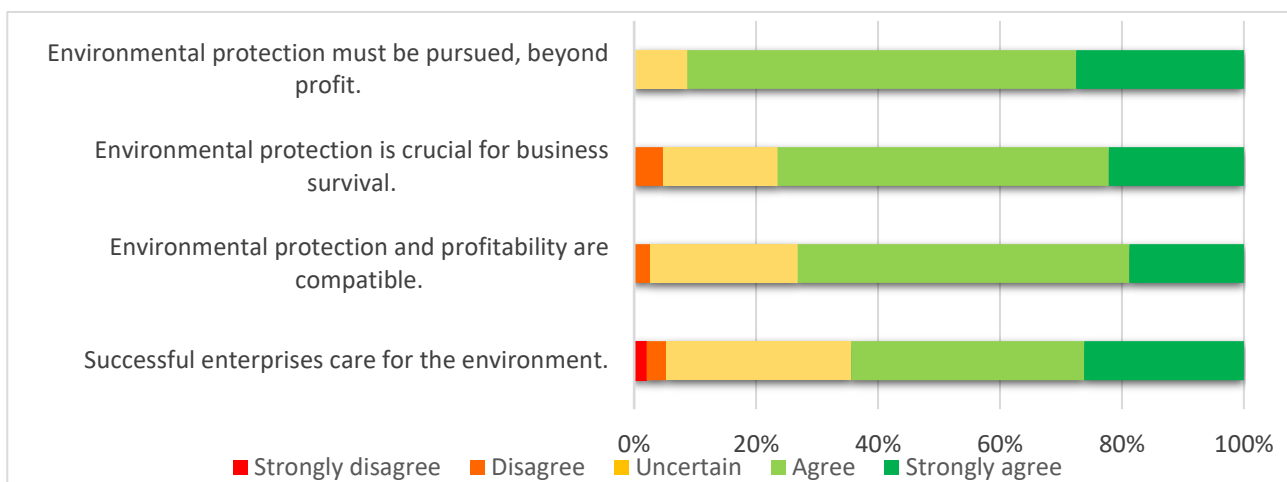
In the following chapter, we present and discuss pro-environmental managerial values, the perceived organizational culture and the perceived economic viability of climate actions as potential drivers of climate strategy variability among the surveyed Italian executives.

## 2.2 | ENVIRONMENTAL PROTECTION AS A MANAGERIAL VALUE.

Business leaders' personal values have attracted considerable attention as a powerful source of influence on organizational culture and, eventually, on business strategy. Indeed, values, defined as normative beliefs that shape unwritten standards of conduct, may reinforce or undermine formal organizational goals by feeding the collective sense-making process. In this sense, organizations may expect different outcomes, in terms of goals, strategy and performance, according to different managerial values.

Accordingly, corporate sustainability strategies, environmental-friendly practices or climate change mitigating initiatives might be triggered, in the first instance, by pro-environmental values nurtured by managerial figures inside organizations. For the sake of understanding the antecedents of climate action, we measured pro-environmental values within our sample of Italian executives, by asking respondents to express their level of agreement with four sentences depicting environmental protection as a crucial and strategic goal for business success.

Figure 6. "Environmental Protection as a Managerial Value": 149 respondents



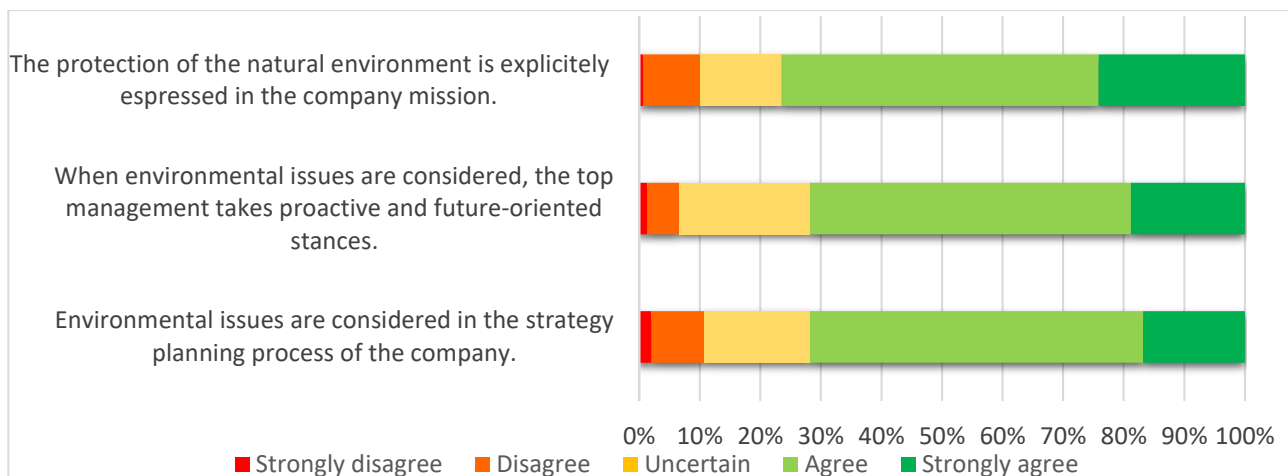
Environmental protection clearly emerges as a managerial value for a great share of respondents, as more than 64% agreed or strongly agreed with all the proposed sentences. According to 91% of the respondents, the conservation of the environment should be pursued as a company goal. In particular, 64% expressed agreement with the sentence "Environmental protection must be pursued, beyond profit", while 27% expressed strong agreement. More than 70% consider environmental protection as a crucial feature for business survival and therefore compatible with the primary profitability goals characterizing business enterprises. These results may be associated with the increasing consideration of environmental sustainability, within the business environment, both as a source of

legitimization for business activities in the eyes of society and as a source of competitive advantage in the marketplace.

## 2.3 | ENVIRONMENTAL PROTECTION AS A DETERMINANT OF BUSINESS STRATEGY.

Organizational culture connotes an organization's behavior, ethical conduct and management style. By incorporating the shared values, beliefs and assumptions underlying daily operations and practices, organizational culture relates with the strategic, political and institutional aspects of organizational life. By encompassing proenvironmental values in its culture, an organization may envision environmental sustainability as a guiding principle for its business strategy and, therefore, embrace a proactive stance towards environmental issues. In order to assess environmental protection as a cultural and strategic feature, we asked respondents to rate their level of agreement with three sentences depicting their organizations as environmentally involved, both at the cultural and strategic level.

Figure 7. "Environmental Protection as a Determinant of Business Strategy": 149 respondents



It is an increasingly common practice, across companies, to explicit organizational values in formal mission statements addressed to the public. Such statements are expected to mirror the prevailing organizational culture characterizing the organization. According to 76% of the respondents, environmental protection is explicitly expressed in their companies' mission statements, while only 10% and 14% denied this aspect of their company mission or were uncertain about it. When asked about the top management's attitude towards environmental issues, 53% and 19% of the respondents agreed or strongly agreed, respectively, that senior-level executives in their companies pro-actively approach environmental concerns. Similarly, 72% of the respondents expressed agreement or strong agreement with the sentence "Environmental issues are considered in the strategy planning



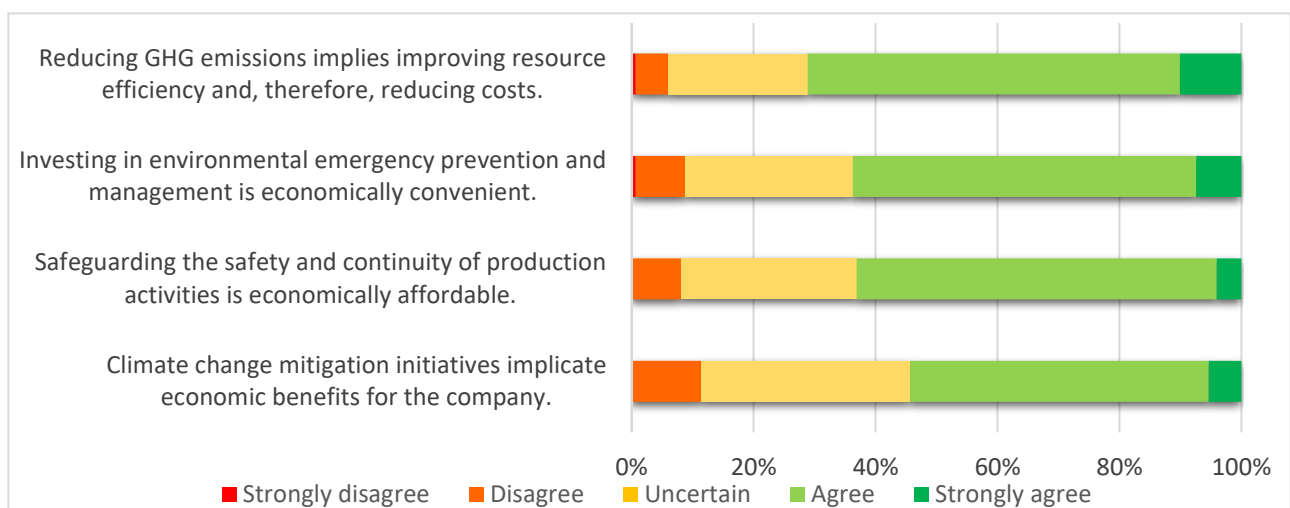
process of the company”, indicating that environmental protection is considered not only as an organizational value, but also as an actual strategic feature.

The pro-environmental values of Italian executives (previously assessed in 2.2) appear to be represented at the organizational level. Furthermore, the similarly high level of agreement expressed towards this whole set of propositions may signal a meaningful internalization of pro-environmental values in the strategy planning process, rather than a merely symbolic one.

## 2.4 | THE ECONOMIC VIABILITY OF CLIMATE ACTION.

Mobilizing private financial resources is a crucial step in supporting national climate mitigation plans and global efforts in building climate resilience. However, the perception that climate initiatives may not be affordable or practical could hold back private actors from implementing mitigation or adaptation measures. The perceived economic impracticability of low carbon or climate-resilient investments may drive entrepreneurs and executives to give up the substantial implementation of sustainable practices and settle for a symbolic adoption of said practices (commonly known as “green washing”). In order to assess the perceived economic viability of climate action within our sample, we asked respondents to rate their level of agreement with four sentences depicting climate mitigation and adaptation measures as economically viable and convenient.

Figure 8. “The Economic Viability of Climate Action”: 149 respondents



According to the responses collected, Italian executives appear confident in the economic viability of climate action. In particular, 71% of the respondents associate the reduction of industrial GHG emissions with cost reductions, signaling confidence that simultaneously addressing carbon reduction and resource efficiency may result in improved economic

outcomes. This result may be associated with the direct experience of the surveyed executives with the implementation of resource efficiency programs such as, for instance, energy efficiency measures. Surprisingly, slightly different results are observed towards the sentence *“Climate change mitigation initiatives implicate economic benefits for the company”*; despite 54% of the respondents expressed agreement or strong agreement, 34% and 11% expressed uncertainty and disagreement, respectively. In this case, some respondents may not have associated climate mitigation with direct economic benefits, as the proposed sentence did not explicitly associate carbon reduction with resource efficiency.

Slightly higher uncertainty surrounds the affordability of adaptation and prevention measures, but still more than 60% of the respondents expressed agreement or strong agreement with the proposed sentences (such as *“Investing in environmental emergency prevention and management is economically convenient”*). In particular, while 4% and 59% expressed strong agreement and agreement, respectively, towards the economic viability of production continuity and safety measures, 29% expressed uncertainty. In this regard, considerations about the uncertainty of climate impacts, combined with the irreversibility of adaptation costs, may influence the economic evaluation of adaptation measures and could possibly be associated to the higher levels of uncertainty expressed by the respondents.

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# 3. RESPONDING TO CLIMATE CHANGE.

## Mitigation and Adaptation Efforts among Italian Companies.

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### 3.1 | WHAT IS THE STATE-OF-THE-ART?

Being the largest contributors to GHG emissions, industries are expected to play a decisive role in stabilizing the concentration of GHGs in the atmosphere and in achieving the mitigation objectives set forth by the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC). However, until recent years, despite the growing scientific consensus on the potential impacts of global warming, the industrial responses to climate change have been sparse and fickle. Business enterprises, especially those operating in international markets, resisted intergovernmental efforts to control GHG emissions, by engaging in political strategies and lobbying activities. In the last two decades, as climate science matured and the Kyoto Protocol gained widespread international support, business interests in climate action became more evident and led to a shift towards a more responsive and market-oriented engagement of the industrial sector.

Given the peculiarities of their institutional, competitive and organizational contexts, business enterprises may differ considerably in the way they engage in climate action and integrate specific practices into a coherent strategy. Climate strategies may envision mitigation and adaptation measures, and may vary in terms of strategic intents (i.e. aims, incentives and expected benefits) and organizational scope.

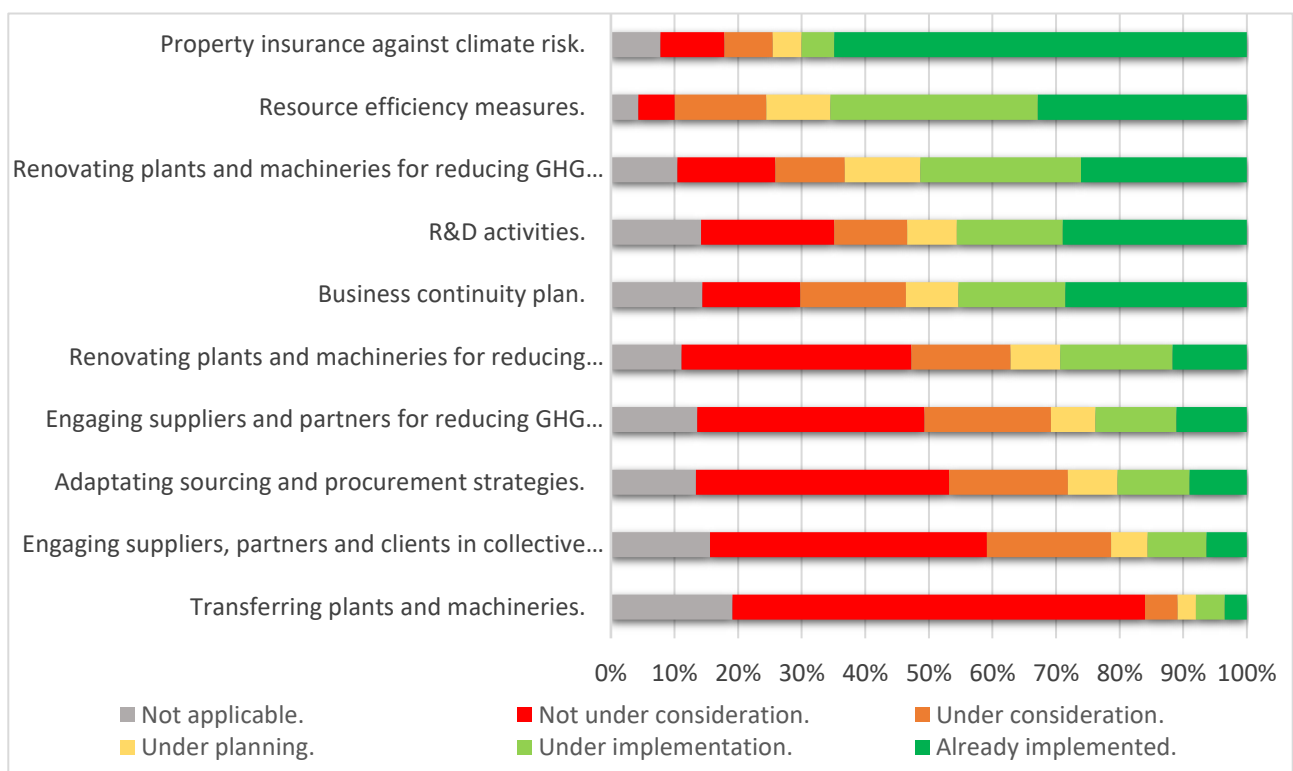
In particular, mitigation measures aim at reducing or preventing the emissions of GHGs from operations in order to decrease the exposure to climate change. At the company level, mitigation measures consist of energy-saving or resource-efficient process improvements that, besides reducing the impact of operations on climate, may imply cost-savings, better control over internal production processes and strengthen regulatory compliance. At the supply chain level, mitigation measures may envision advancements in raw materials specifications aimed at improving products' carbon footprint, while creating opportunities for new products development and therewith market benefits. Beyond the supply chain, companies may engage in mitigation initiatives with governments, partners or members of the civil society in order to strengthen stakeholders' relationships while improving their legitimacy or reputation.

Adaptation, on the contrary, refers to adjustments organizations implement in response to current or predicted impacts associated to climate change. Being part of companies' risk or crisis management, adaptation measures aim at preserving the continuity and safety of operations thanks to proactive risk assessment and preparation, as well as reducing the uncertainties and avoiding the costs associated to potential climate impacts and extreme weather events.

### 3.2 | MITIGATION AND ADAPTATION PRACTICES: ASSESSING THE LEVEL OF IMPLEMENTATION.

Assessing organizational responses to climate change requires investigating a wide set of very diverse practices. Climate initiatives may range from emissions-cutting resource efficiency measures, to the undersigning of specific insurance products or to the relocation of plants and machineries to reduce risk exposure. To accommodate such diverse practices, we asked Italian executives to rate the level of implementation of ten broad typologies of climate initiatives, divided between adaptation and mitigation measures. For each measure, respondents were asked to indicate if their organizations were currently evaluating its implementation or not (i.e. corresponding to “Under consideration” and “Not under consideration”, respectively), if they were planning the implementation (i.e. “Under planning”), if they were currently implementing the measure (i.e. “Under implementation”) or if they have already implemented the measure (i.e. “Already implemented”).

Figure 9. “Mitigation and Adaptation Practices – Level of Implementation”: 487 respondents



Insurance coverage emerges to be the most widespread adaptation measure among Italian manufacturing and extractive companies. In particular, 65% of the respondents have already purchased insurance coverage against climate risk, while 10% are either currently undertaking or evaluating some form of insurance products. Property insurance allows decision-makers to better codify their risk exposure in economic terms and therefore reduce the economic uncertainty associated to climate impacts and extreme weather events, by transferring the risk to the insurer in the form of a premium. Consequently, insured organizations are assisted in the monitoring and assessment of climate risk, and are therefore facilitated in the long-term planning of business activities and investments.

On the mitigation side, resource and energy efficiency measures are the most diffused. These kinds of initiatives have been already implemented, or are under implementation, according to the 33% and 32% of surveyed executives. Other 10% of the respondents are planning the implementation of resource efficiency measure, while 14% are evaluating this investment. These results are not surprising as, besides mitigating GHG emissions, improving the resource efficiency of production activities may lead to considerable cost reductions, governmental financial incentives, as well as enhanced operations management capabilities. Similarly, the renovation of plants, machineries or infrastructures may be associated, besides carbon reduction, to a long-term cost-cutting strategy. Despite renovating physical assets may entail considerable upfront investments, 26% of the respondents have already undertaken such investments, while 25% and 12% are currently implementing or planning emission reductions, respectively, by renewing plants or machineries.

Interestingly, 29% and 17% of the surveyed executives have already invested in research and development (R&D) activities or are currently engaged in innovation processes linked to climate change mitigation. Investments in so-called "eco-innovations" may entail deploying new low carbon technologies in existing processes, substituting fossil fuels with renewable energy resources (such as solar, wind or biomass), as well as changing product specifications in order to reduce climate-altering effects. This sort of R&D investments may stem from a proactive approach towards environmental issues, fueled by strong innovation capabilities.

On the other hand, the results indicate that Italian companies are reluctant towards engaging suppliers, subcontractors or partners in climate change mitigation and adaptation initiatives at the supply chain level. Only the 11% of the respondents have already collaborated with suppliers in mitigating GHG emissions along the supply chain, while 36% are not even considering engaging this kind of stakeholders in mitigation initiatives. Concerning supply chain adaptation, only 6% and 9% of the respondents already undertook or are undertaking adaptation measures in collaboration with suppliers, partners or clients, while 43% are not considering adaptation at the supply chain level. In line with these results, only 9% of surveyed Italian companies have modified their procurement or sourcing strategies to adapt to potential climate impacts, while 40% are not taking into consideration this kind of action. These results may be associated to clear difficulties in

engaging and coordinating numerous upstream and downstream stakeholders, both from a logistic and cost perspective, as well as to a lack of financial incentives.

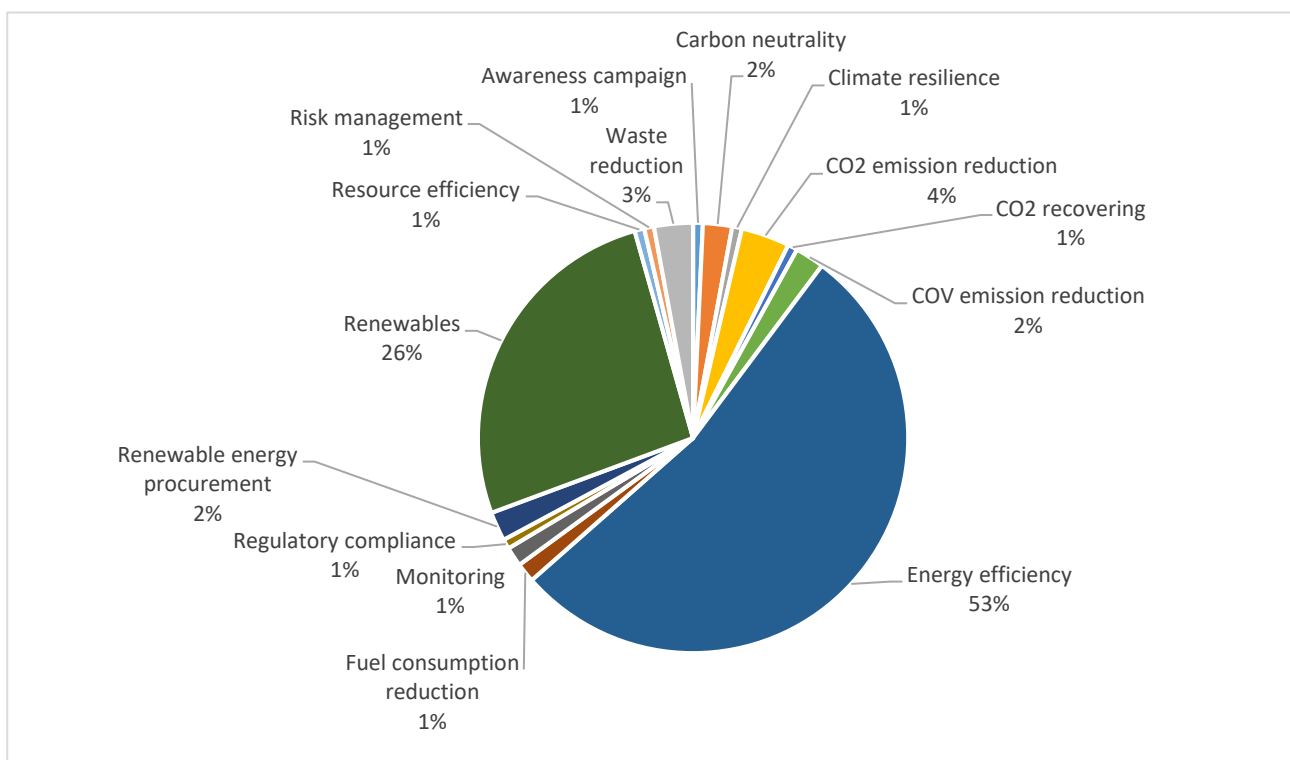
### 3.3 | CLIMATE ACTION EXPOSED: BUSINESS CASES AND BEST PRACTICES

Regarding the initiatives related to mitigation and adaptation disclosed by the Italian companies in this survey, the vast majority of these are aimed at mitigation (99%) and only a few at adaptation (1%). Among the formers, the measures aimed at improving energy efficiency represent the 53%, those relying on renewable energy production the 26% (Figure 10). Other measures cover other means such as fuel consumption reduction, waste reduction, CO<sub>2</sub> emission reduction, renewable energy procurement and so on.

Particularly interesting seem to be the projects aimed to carbon neutrality since these involve the implementation of several measures at the same time, such as renewable energy procurement, renewable energy and energy efficiency, avoiding fuel consumption. These projects either concern a residential building/district or a production facility.

In addition, at international level the need to adapt has been formalized only on last year with the Paris Agreement. In fact, in this agreement Governments also agreed to strengthen societies' ability to deal with the impacts of climate change; and to provide continued and enhanced international support for adaptation to developing countries.

Figure 10. "Climate change mitigation or adaptation measures implemented by the Italian companies"



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# 4. ADVANCING CLIMATE ACTION.

## Assessing Motivating Factors and Hurdles to Climate Action within the Italian Industry

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### 4.1 | WHEN PUSH COMES TO SHOVE, WHAT MATTERS?

After the analysis of climate initiatives proposed in the previous chapter, the present section of the report shifts the focus on the pressures, incentives and barriers that may facilitate or hamper the achievement of mitigation and adaptation goals. Hurdles, as well as pressures or motivations, may reside in the competitive and institutional environments in which companies operate, but also inside the power relations underlying organizational structures. Therefore, understanding the contextual pressures and organizational barriers that may affect the implementation of climate initiatives requires the adoption of diverse complementary perspectives.

First, the intra-organizational perspective aims at shedding light on governance mechanisms reinforcing or frustrating executives' environmental efforts. Organizational structure and governance define companies' boundaries, rules of interaction and patterns of decision-making. Therefore, to properly address climate change and succeed in climate initiatives, appropriate organizational structures must be in place in order to legitimate and empower business leaders with well-defined roles, responsibilities, resources and the capacity to engage organizational supporters.

However, as organizations exist within broader social and economic contexts, an external perspective is needed in order to understand the effect of environmental factors on the success or failure of climate initiatives. Social, regulatory or competitive pressures may force organizations to conform to dominant expectations of behavior in order to preserve legitimacy. This phenomenon, commonly referred to as "isomorphism", may be associated to companies' willingness to support climate initiatives or, on the other hand, to refrain from action. Diverse forms of pressure may have diverse sources, such as legal requirements, management standards or competition. Similarly, stakeholders, such as governments, customers or the civil society, represent active constituents of the social and economic context in which organizations are embedded.

In order to provide a comprehensive picture of what matters when companies approach climate action, both perspectives are adopted in the following chapters. The first part of the chapter investigate and discuss the extent of Italian executives' leadership on

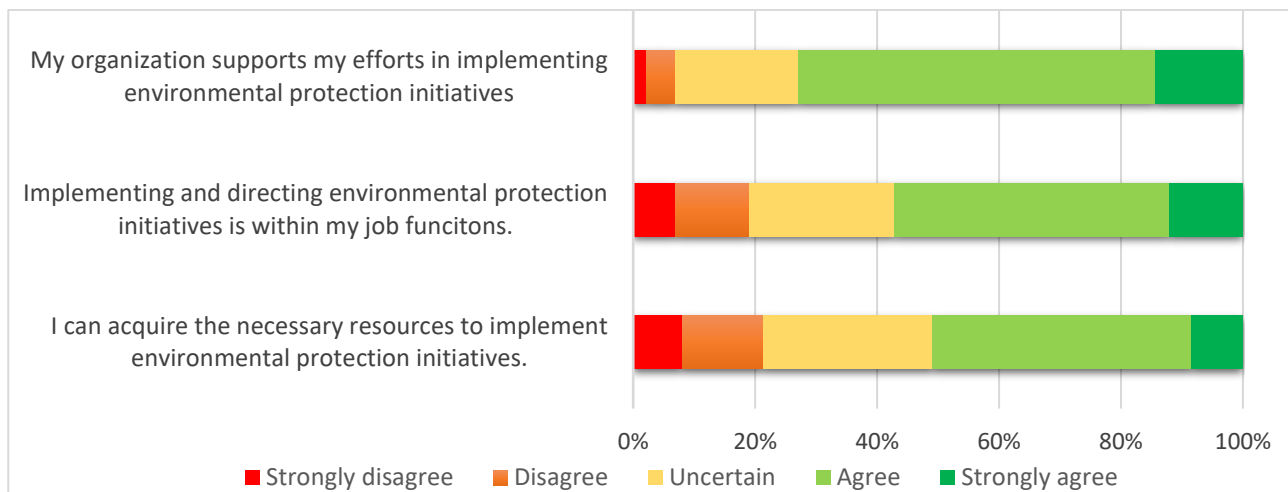
environmental protection and empowerment for climate action. The last two chapters focus instead on analyzing the contextual pressures and the role of diverse stakeholders in motivating corporate climate strategies.

## 4.2 | LEADERSHIP: DEFINING ROLES & RESPONSABILITIES

Climate action and organizational responses to environmental issues require empowered decision-makers, as well as collaboration across departmental units. Empowered executives are assigned to clear and agreed functions, they are able to master leadership and to create consensus on common goals within their organizations. Furthermore, they are entitled to mobilize appropriate human and financial resources in order to fulfill their responsibilities.

As climate change mitigation and adaptation rarely represent clear job functions for a specific managerial figure, the lack of such formal requirements and inconsistencies in the distribution of responsibilities may constitute a barrier to the effective implementation of climate initiatives. For the sake of measuring leadership on environmental issues within our sample of Italian executives, we asked respondents to express their level of agreement with three sentences measuring environmental protection as a job function, the level of perceived organizational support towards environmental protection and the ability to mobilize resources for environmental initiatives.

Figure 11. "Leadership: defining roles and responsibilities": 487 respondents



The results indicate a high level of perceived organizational support towards pro-environmental efforts. Indeed, 59% and 14% of the respondents expressed agreement or strong agreement, respectively, with the sentence "My organization supports my efforts in implementing environmental protection initiatives". As the perception of support from colleagues, collaborators and superiors is assumed to play a key role in stimulating pro-



environmental commitment, we could consider this result as a positive indicator of effective leadership in the environmental domain.

On the other hand, when asked about environmental protection as a job function associated with their position (i.e. *“Implementing and directing environmental protection initiatives is within my job functions”*), executives expressed lower levels of agreement and higher levels of uncertainty. In particular, 57% of the respondents agreed or strongly agreed with their formal duty to promote environmental initiatives, while 24% expressed uncertainty. The higher level of uncertainty may confirm the expectation that pro-environmental efforts are perceived, at least by part of Italian executives, as an individual's voluntary commitment, rather than as part of their formal contractual agreement.

Despite the high level of organizational support, Italian executives admit difficulties in obtaining resources for environmental protection initiatives. Only 51% of the respondents expressed agreement or strong agreement with their ability to mobilize resources for environmental initiatives (i.e. *“I can acquire the necessary resources to implement environmental protection initiatives”*), while 28% and 21% expressed uncertainty or disagreement, respectively. Financial constraints, especially during times of crisis, may exacerbate the difficulties in mobilizing appropriate resources for environmental initiatives; on the other hand, the lack of budget and dedicated human resources may be associated to a lack of leadership on environmental management issues or lack of formal assignments and agreed objectives in the environmental domain.

### **4.3 | EMPOWERMENT: ACCESSING KNOW HOW, TECHNOLOGIES AND RESOURCES.**

The sense of empowerment does not exclusively relate to an organization's governance structure or to individuals' formal job requirements. Executives' perceived empowerment may also depend on the presence (or absence) of requisite resources, technologies, and know-how that increase (or decrease) the perceived difficulty in performing a specific task. Accordingly, executives' perceived ease or difficulty of implementing climate initiatives, and controlling the outcomes of such initiatives, may provide insights about an organization's propensity to engage in climate action.

We assume that executives' perceived empowerment for climate initiatives is associated to the perceived availability, or opportunity to access, financial resources (e.g. dedicated budget for environmental protection etc.), affordable technological resources (i.e. clean low-carbon technologies), private financial incentives (e.g. discounted insurance premium for climate adapted assets etc.), reliable climate data, and collaborators' know-how concerning climate change mitigation and adaptation. Therefore, we asked respondents to rate the level of availability of these five classes of resources and capabilities, inside and outside their organizations, for climate change mitigation and adaptation separately.

Figure 12. "Empowerment – Climate Change Mitigation": 149 respondents

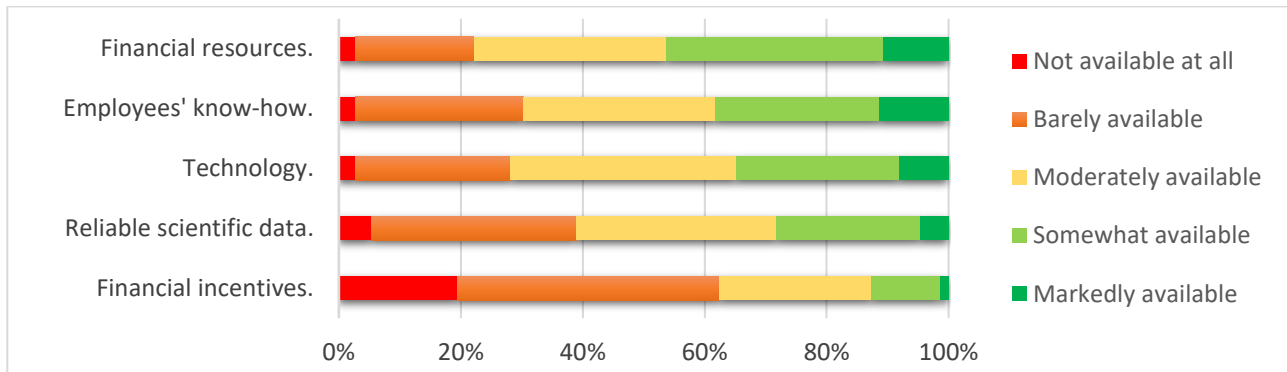
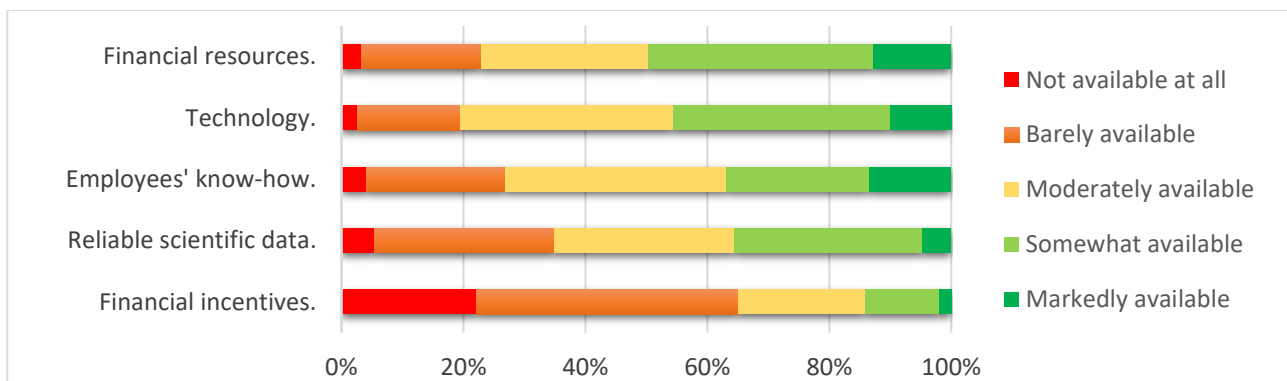


Figure 13. "Empowerment – Climate Change Adaptation": 149 respondents



The responses collected present almost similar results for mitigation and adaptation. In particular, financial resources do not emerge as a relevant concern hindering climate action. Indeed, 50% and 46% of the respondents indicate that financial resources are somewhat or markedly available inside their organizations, both for mitigation and adaptation measures, respectively. If combined with the previous findings exposed in this chapter, this result may signal that the difficulties in mobilizing appropriate resources for environmental protection (previously discussed in section 4.2) may be associated with a lack of leadership on climate issues, rather than with contingent financial hurdles and lack of liquidity.

On the other hand, financial incentives are lacking for both typologies of climate action. Given the high level of regulatory and market uncertainties surrounding the climate issue, financial incentives are expected to play a key role in guiding low carbon and climate-resilient development, by creating favorable conditions for private sector investments. For instance, carbon markets and emissions trading represent a mean to leverage private investments in carbon reduction by promoting the cost-effectiveness of mitigation initiatives. However, according to our results, only 35% of the respondents consider financial incentives for mitigation measures as moderately, somewhat or markedly available in their organizations, while 65% consider this kind of incentives as not available at all or only barely

available. Similarly, on the adaptation side, 62% of the respondents consider financial incentives as not available or only barely available. These results may be associated to a lack of knowledge of the available financial incentives or to the presence of barriers limiting the accessibility of this kind of instruments to Italian companies.

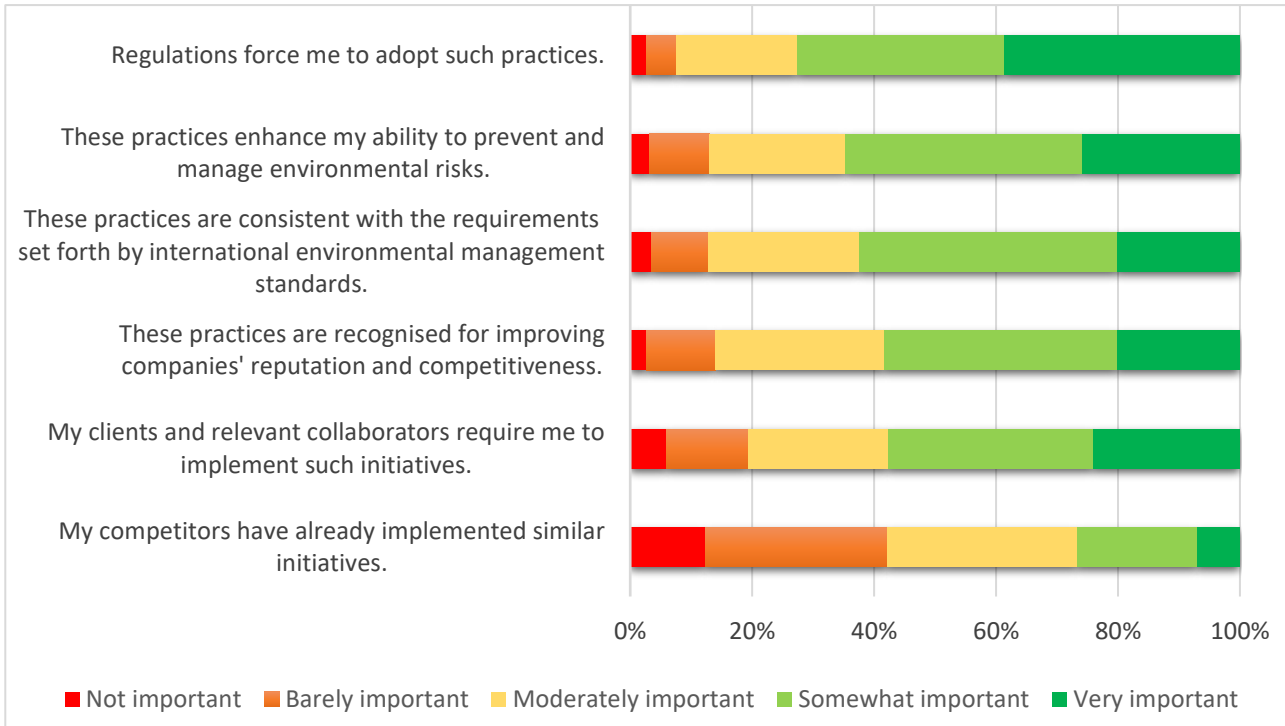
Technological solutions for mitigation and adaptation initiatives appear to be already available in the surveyed organizations. In particular, 80% and 72% of the respondents defined technology as a moderately-to-markedly available factor in their organizations for mitigation and adaptation, respectively. On the other hand, the availability of reliable scientific data emerges to be a somewhat relevant concern for Italian executives, in particular for the sake of adaptation needs. While 28% of the respondents consider climate data as somewhat or markedly available for informing their organizations' adaptation initiatives, 39% consider data as unavailable or only barely available. Executives' perceived lack of data may be associated to the need to reduce climate uncertainty by better understanding the magnitude and urgency of potential climate impacts and by estimating the costs associated to climate action. As far as mitigation is concerned, reliable data are somewhat or markedly available in the 36% of the cases, and unavailable or barely available according to the 35% of the respondents.

#### **4.4 | ISOMORPHISM: DISCERNING PRESSURES TOWARDS ACTION.**

Business enterprises are exposed to very diverse contextual pressures, which may originate from very different external sources, such as competitive dynamics, legal requirements or cultural norms. By determining appropriate and legitimate behaviors within a specific sector or community, such pressures constitute relevant sources of influence on executives' decision-making. Especially under conditions of uncertainty, organizations may seek legitimization by conforming their behavior to the prevailing contextual pressures within their sector, rather than to rational utilitarian considerations.

Accordingly, organizations may engage in climate action as a response to particular contextual pressures, not necessarily related to pro-environmental concerns or economic convenience. In this sense, specific mitigation or adaptation initiatives may originate, for instance, from the pressures to conform to coercive regulations, to improve organizational reputation or to imitate competitors' behavior in the attempt to gain competitive advantage. In order to understand the contextual pressures underlying climate action, we asked respondents to rate six different pressures, according to their level of importance in motivating climate action.

Figure 14. "Discerning Pressures towards Action": 487 respondents



Not surprisingly, legal requirements emerge to be the most important pressure towards climate action according to the vast majority of respondents. As failing to comply with pollution thresholds may imply legal sanctions or the suspension of operating permits, regulations can be considered as coercive pressures towards proactive environmental initiatives. Accordingly, 40% and 34% of the surveyed Italian executives rate regulations as very important and somewhat important pressures, respectively.

Interestingly, the opportunity to enhance organizational capabilities in the environmental domain constitutes a relevant motivation for climate action. Indeed, according to 65% of the respondents, strengthening risk management and environmental liability prevention is a very important or somewhat important pressure for implementing mitigation or adaptation initiatives. Similarly, meeting the requirements set forth by international standards on environmental management (such as ISO 14001 and EMAS) represent a very important or somewhat important motivation for engaging in climate action according to 63% of the executives in our sample. The relevance of this kind of pressures may be associated to the growing professionalization of environmental management in the Italian industrial sector, which lead executives to proactively approach the implementation of environmental protection initiatives as an opportunity to acquire and develop valuable competences for their business activities.

On the other hand, 20% and 38% of the respondents consider the improvement of organizational reputation and competitiveness as very important or somewhat important pressures towards the implementation of climate initiatives. This finding may be associated to the expectation that the market may reward organizations' environmental efforts, as a

result of the increasing public awareness of environmental issues. However, environmental efforts motivated by reputational objectives could be associated to a superficial environmental commitment. Indeed, this kind of pressures may lead organizations to imitate the best practices promoted by more successful companies in the attempt to keep up with their competitive stance, rather than to adopt a more proactive approach.

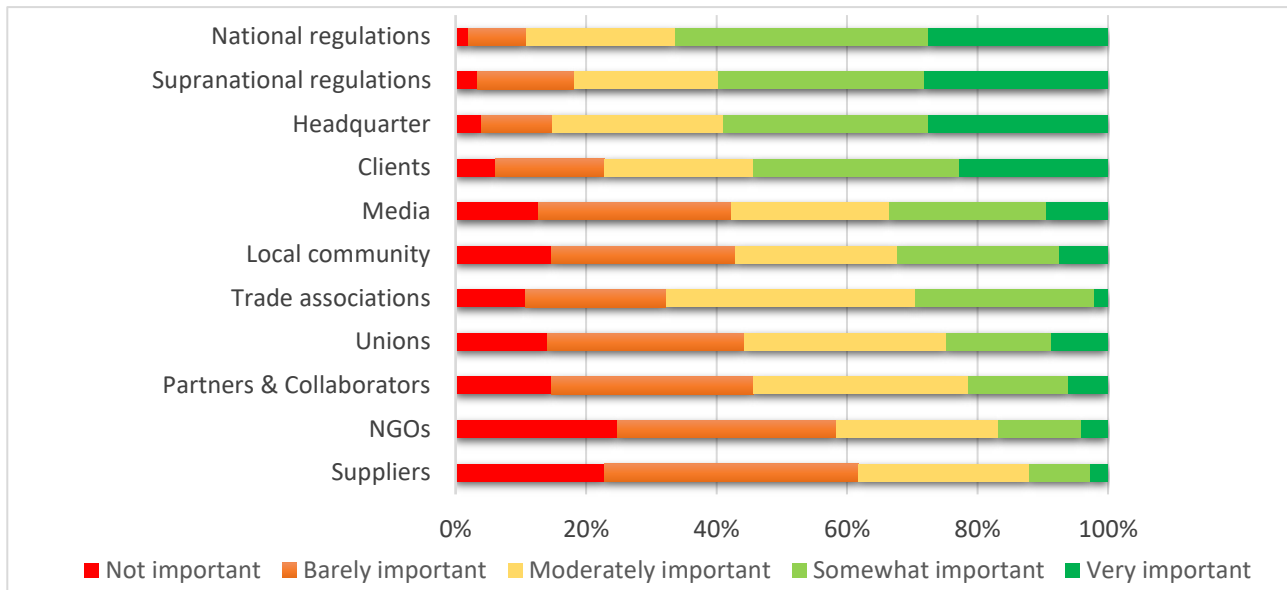
Similarly, clients and collaborators exercise a very important or somewhat important pressure towards the implementation of climate initiatives according to the 58% of the respondents, while 23% consider this pressure moderately important. As environmental provisions may constitute binding contractual clauses, explicit requirements (such as GHG emissions disclosure or the adoption of specific business continuity procedures) may constitute coercive pressures underlying the implementation of mitigation or adaptation measures. On the other hand, considerably lower importance is ascribed to contextual pressures originated by competitors. While 27% of the respondents consider this motivation as very or somewhat important, 42% consider competitors' climate initiatives as not important or only barely important pressures. Interestingly, this result may signal that Italian executives do not envision climate action as a feature of their competitive strategy or as a mean to gain competitive advantage in the marketplace.

## **4.5 | STAKEHOLDERS: IDENTIFYING THE CLIMATE-RELEVANT POWER STRUCTURE.**

Increasingly, governments, capital markets and civil society expect companies to publicly disclose GHG emissions, to improve energy efficiency and to achieve increasingly challenging carbon reduction targets. Due to the increasing public awareness towards environmental issues and climate change, failing such expectations may imply incurring in legal sanctions, declining stock prices or serious reputational losses.

Customers, employees and environmental activists are just a few examples of a wide set of diverse stakeholders that may force organizations to act on climate change, by exerting pressures on companies' top management. Consequently, assessing the diverse stakeholders' capacity to influence organizations' behavior may provide interesting insights on the power relations underlying corporate responses to climate change. Therefore, we asked respondents to rate eleven categories of actors according to their level of importance in motivating climate action.

Figure 15. "Stakeholders: Identifying the Climate-Relevant Power Structure": 149 respondents



In line with previous results, national and supranational regulatory authorities emerge to be the most important stakeholders in exerting pressures towards climate action. According to 27% and 39% of the respondents, national authorities are very important and somewhat important actors, respectively, while supranational authorities are considered very important and somewhat important by the 28% and 32%, respectively. As discussed in the previous section of this chapter, regulatory authorities may exercise coercive pressures on the industrial sector, in the form of emissions ceilings, energy saving requirements or carbon reduction incentives. Being entitled to set the “rules of the game”, national and international regulatory agencies are thus able to alter the market environment and, therefore, determine the competitive dynamics that companies face in their daily activities.

Not surprisingly, corporate headquarters represent very important and somewhat important influencers on climate initiatives according to the 28% and 31% of the surveyed executives, respectively. Headquarters embody the top management functions in the corporate governance structure: they are in charge of long-term strategy planning, as well as legal and financial duties, such as ensuring the legal compliance of operational units and the achievement of financial objectives. Consequently, by setting the strategic agenda and enforcing top-down monitoring activities at the facility level, headquarters dictate objectives, codes of conduct and management practices to operational branches by means of hierarchical authority.

Supply chain stakeholders (such as customers and suppliers) represent a very different, but similarly crucial, set of stakeholders. Given their preferred position within the supply chain, clients are perceived as very or somewhat important by 54% of the respondents. Client stakeholders can impose specific environmental practices or climate initiatives as a mean to reduce environmental liabilities or climate risk exposure along the supply chain. For instance, as climate impacts may threaten the quality and continuity of supplies, corporate

customers could force the adoption of adaptation measures and continuity plans. Similarly, in order to enhance brand reputation, clients may require suppliers to disclose GHG emissions or to conform to specific environmental quality standards. On the other side of the supply chain, suppliers are not in a favorable position to exert relevant pressures towards clients. Accordingly, 62% of the respondents dismissed suppliers as not relevant or barely relevant in influencing organizational responses to climate change.

Among the civil society, media and local communities emerge as the most relevant entities. However, this whole set of stakeholders, which also includes labor unions and NGOs, appear to exert less tangible or urgent pressures on business enterprises compared to previous categories. Indeed, according to 42% and 43% of the respondents, the media and local communities, respectively, are not important or only barely important influencers on climate issues. Probably due to their limited diffusion in Italy, NGOs are considered not important or barely important by 58% of the respondents. In some circumstances, these groups of stakeholders may mobilize public opinion on environmental issues and publicly criticize companies' behavior if deemed harmful to the environment. As failing to respond to local communities, media or NGOs may damage brand reputation, civil society may force companies to disclose GHG emissions or to commit to improve environmental performance.

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# 5. DEVELOPING CLIMATE KNOWLEDGE.

## Assessing the Availability of Information on Climate Impacts among Italian Companies

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### 5.1 | WHAT KIND OF CLIMATE KNOWLEDGE DO COMPANIES NEED?

Given the uncertainties surrounding climate change and its impacts on organizations, accessing reliable scientific information is crucially important for managerial decision-making in driving effective adaptation and mitigation strategies. Engaging with reliable sources of information on climate issues may enhance executives' understanding of their companies' exposure and vulnerability to climate impacts and shed light on previously unnoticed adaptation needs. Similarly, a comprehensive understanding of climate issues may strengthen companies' commitment to reduce GHG emissions and support decision-makers in developing cost-efficient mitigation plans. Eventually, by acquiring and processing climate-related information and scientific data, companies may be able to develop valuable organizational knowledge, enhancing companies' adaptive capacity in the face of climate change and environmental risks.

Despite its importance, developing practical climate-related knowledge may prove challenging, both in terms of availability of information and quality of information. On the one hand, organizations may lack the necessary resources or ability to access information sources and therefore experience a shortage of valuable information inside the organization. On the other hand, executives may struggle to find information that directly link climate change and business outcomes in a pragmatic and accessible way for a business audience. As companies may find difficulty in processing scientific or academic literature, useful information must be business-relevant in detailing specific climate impacts and their potential outcomes on organizations' operations, supply chain, clients etc.

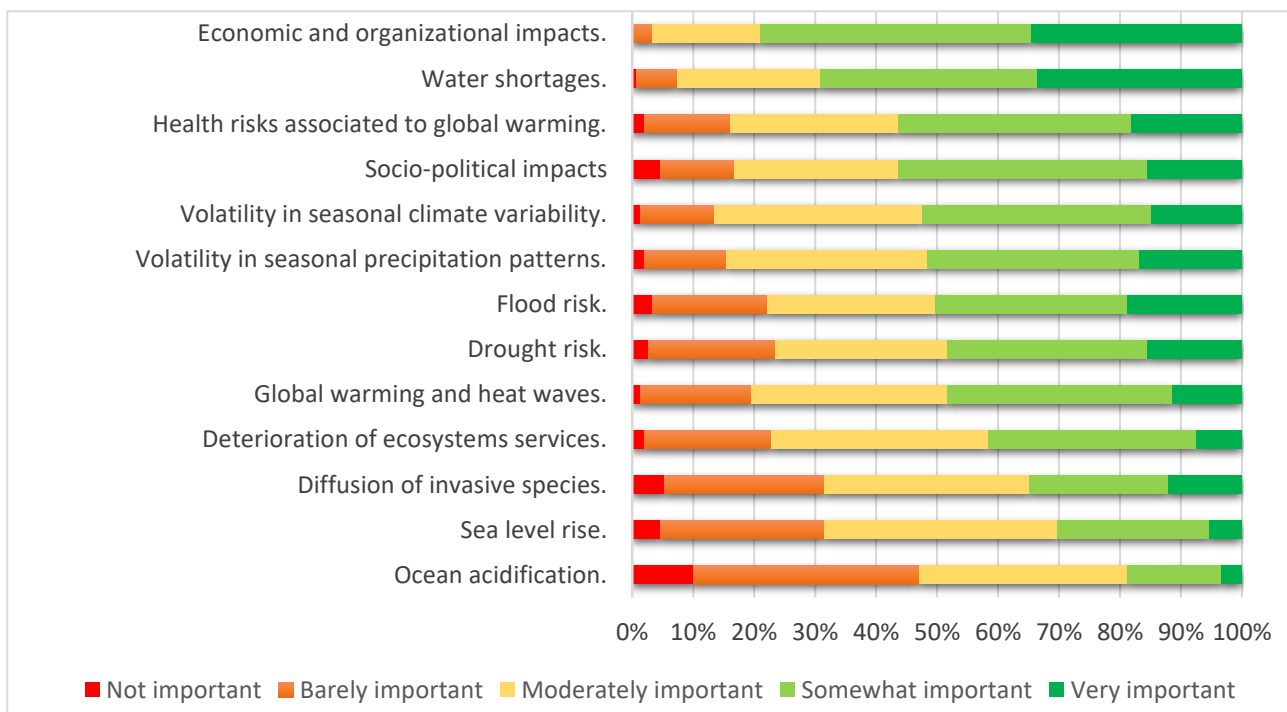
In this sense, assessing what kind of climate-related information companies need in order to support data-driven decision-making is as important as assessing the availability of information sources within the organization. This section of the report aims at assessing both what kind of climate data is relevant for Italian organizations and whether companies are able to access sufficient climate information.



## 5.2 | THE NEED FOR CLIMATE-RELEVANT DATA.

In order to assess what kind of climate-related data may support managerial decision-making on climate issues in the Italian industry, respondents were asked to rate a comprehensive list of 13 topics in terms of importance for their business activities (on a scale ranging from “not important” to “very important”). Climate-related topics include both scientific information on climate change (i.e. “volatility in seasonal climate variability”, “volatility in precipitation patterns”, “flood risks”, “drought risks” etc.) as well as information on indirect impacts of climate change on society, political stability and economic activities (i.e. “economic and organizational impacts”, “socio-political impacts”, “health risks associated to global warming” etc.).

Figure 16. “The importance of climate-relevant data”: 149 respondents

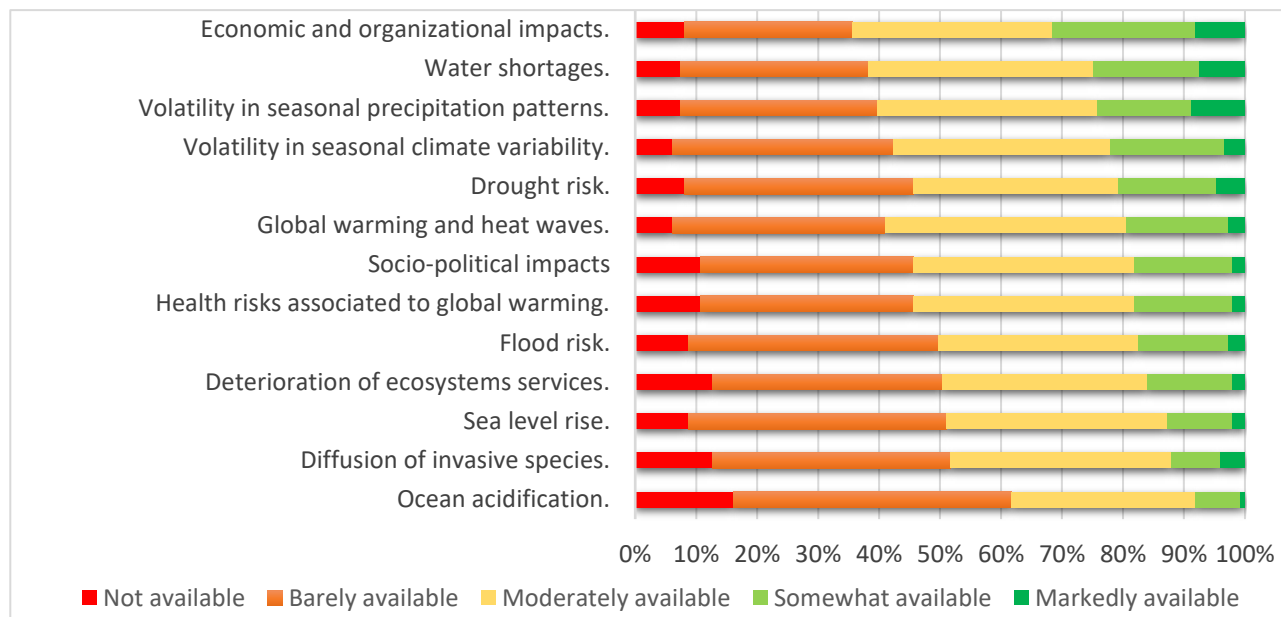


The results clearly suggest that pragmatic and business-relevant information on the indirect impacts of climate change are considered particularly important for decision-making in the organizational context, compared to scientific data on specific climate issues. In particular, 78% of the respondents consider accessing information on the economic and organizational impacts of climate change as very or somewhat important for their companies’ decision-making processes on climate issues. Accessing information on the health risks associated to global warming is considered as very or somewhat important by 56% of the respondents and, similarly, information on the socio-political impacts are important to the 56% of the surveyed executives. On the other hand, only water shortage risks appear to be particularly important among the topics concerning specific climate

issues. Indeed, 34% of the respondents consider accessing information on water shortages as very important for their company, while 36% consider it as somewhat important.

Consequently, in order to assess whether organizations are able to access sufficient climate-relevant information, respondents were asked to rate the same set of topics in terms of the availability of information within their organizations (on a scale ranging from “not available” to “markedly available”).

Figure 17. “The availability of climate-relevant data”: 149 respondents



Interestingly, while 78% of the respondents consider information on the economic and organizational impacts of climate change as important, only 31% express satisfaction (i.e. somewhat or very available) with the availability of this typology of information within their organization. On the other hand, 36% consider this information as not available or only barely available, while 33% express a moderate availability. Similarly, information on the health risks associated to climate change are very or somewhat available according to 18% of the respondents against the 56% who considered this information as important for the company. Information on water shortages are not available or only barely available according to 38% of the respondents, while 25% consider it as somewhat or markedly available within their organization.

As a result, while Italian executives emerge to value more the pragmatic and business-relevant information on climate impacts compared to scientific knowledge on climate change, they admit difficulties in accessing both typologies of information and lack of satisfaction with the availability of climate-related data within their organizations.

## 5.3 | KNOWING THE GLOBAL CLIMATE ACTION AGENDA INITIATIVES.

In December 2014, the Peruvian and French COP Presidencies, the Office of the Secretary-General of the United Nations and the UNFCCC Secretariat launched the Lima-Paris Action Agenda (LPAA) at the Lima Climate Conference (COP20). The aim of the LPAA was accelerating the engagement of all parts of society in climate action and building concrete, ambitious and lasting cooperative initiatives ahead of the Paris conference (COP21), where governments were expected reach a new, universal climate change agreement. The importance of the Lima-Paris Action Agenda is the demonstration of the commitments and partnerships of cities, regions, businesses and civil society organizations, often along with governments, which reduce greenhouse gas emissions and build greater resilience against climate change. In fact, it demonstrated that the world was already taking climate action and constantly increasing the response even before the Paris climate change agreement signed the following year and taking effect from 2020.

The Lima-Paris Action Agenda aimed at strengthening climate action throughout 2015, in Paris in December and well beyond by:

- mobilizing robust global action towards low carbon and resilient societies;
- providing enhanced support to existing initiatives, such as those launched during the NY SG Climate summit in September 2014; and
- mobilizing new partners and providing a platform for the visibility of their actions, commitments and results in the run up to COP21.

At last, in 2015 the Paris Agreement was signed at COP21 building upon the UNFCCC and – for the first time – bringing all nations into a common cause to undertake take ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so.

The Paris agreement also welcomed the efforts of all non-Party stakeholders within the LPAA, calling them to a Global Climate Action, and encouraged an increasing participation and action sharing through the web-portal.

The Global Climate Action initiatives can provide significant support to countries when implementing their own national climate action plans in terms of measures' repertory. In fact, Global Climate Action initiatives represent concrete climate solutions based on technological, political and financial innovation.

The Global Climate Coalition has already become a major force in reducing emissions, improving energy efficiency, building resilient communities and economies and curbing destruction and waste in forestry, water and agriculture to shape tomorrow's sustainable world. In fact, to date<sup>2</sup> the Global Climate Action accounts for:

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<sup>2</sup> Retrieved from <http://climateaction.unfccc.int/> [accessed on 19/12/2016]

- 77 major cooperative initiatives involving almost 10,000 players from 180 countries
- Almost 12,549 total commitments on the NAZCA platform, including 2,508 cities and 209 regions; 2,138 companies, 479 investors, and 236 civil society organizations
- Hundreds of billions of dollars redirected to invest in the transition toward a low-carbon and resilient economy
- One third of the 2,000 biggest global companies committed to climate action with a market value equivalent to the combined GDP of China, Germany and Japan
- Thousands of local leaders, business leaders and civil society figures travelled to Paris to show their commitment and present their solutions and proposals.

The Global Climate Action topics are: Energy access & Efficiency, Renewable Energy, Private Finance, Transport, Short Term Pollutants, Forest, Resilience, Innovation, Emissions Reduction, Use of carbon price, Others.

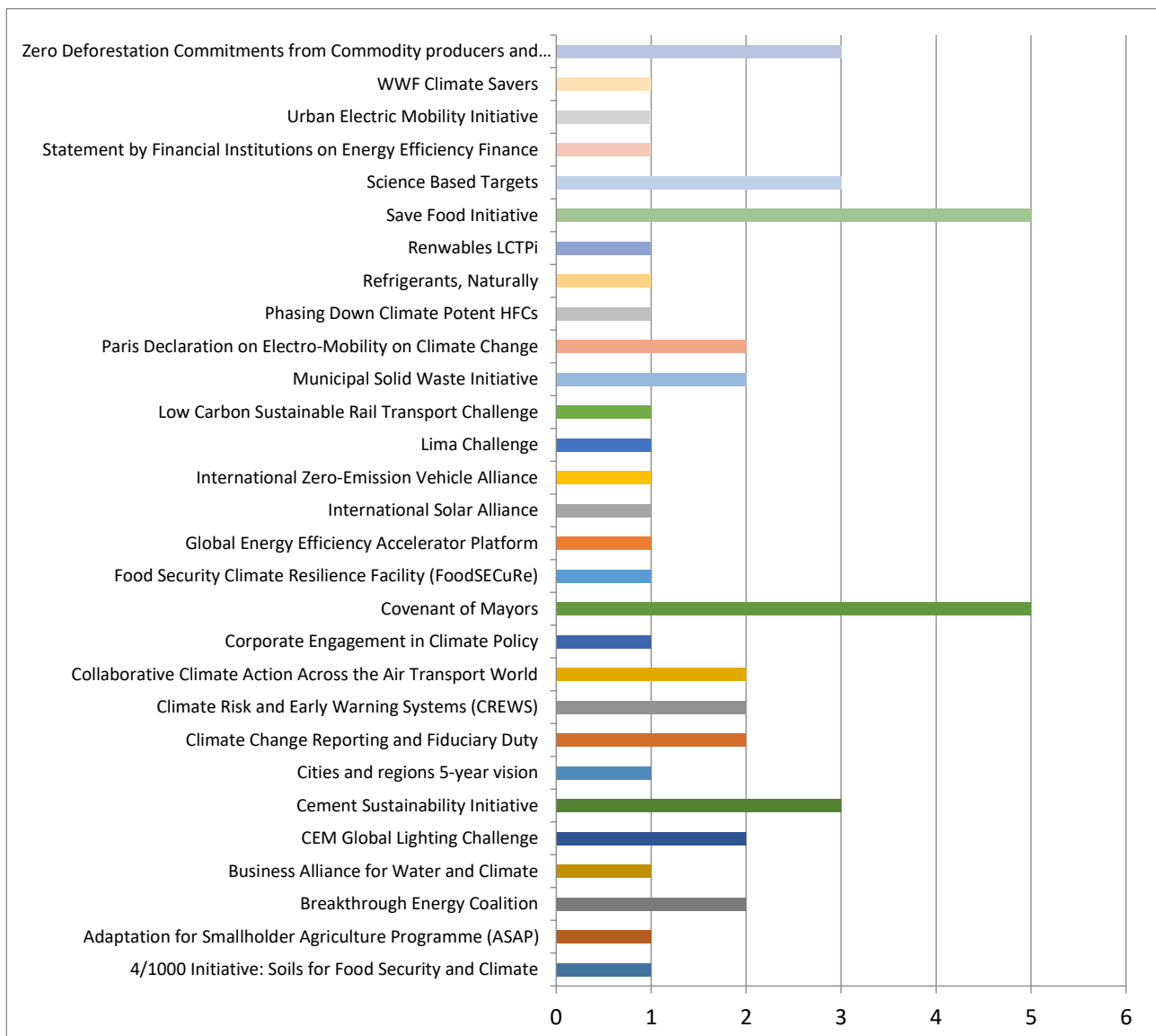
The Italian companies already register in the web portal of the Global Climate Action (i.e. NAZCA) are: A2A, Acea Spa, Adler Plastic SpA, Alcantara, Ansaldo STS; Assicurazioni Generali SpA, Atlantia (autostrade per l'Italia)\* , Banca Monte dei Paschi di Siena Group, Bcube, Bormioli Luigi, Bucci Unicem, Casalasco – Fontanellato, Cementir Holding SpA, Cosmint, DiasorinSpA, Credito Valtellinese, Enel, ENI SpA, Ferrero\*, Ferrovie dello Stato SPA (FS), FIAT Chrysler Automobile NV, Finmeccanica, GoConceptsrl, Green Arrow II (Enna Energia), Gruppo Ferrovie Nord Milano (TRENORD), Hera, Industria Grafica EurostampaSpA, Intesa Sanpaolo\*, IrenSpA, Italcementi, Nuovo Trasporto Viaggiatori SPA\*, Pasell, Pirelli\*, Sabaf SpA, SAD Trasporto Locale, Sofidel, Tecsystemsrl, Telecom Italia\*, Terna, Unicredit\*, YOOX SpA, Zignago Vetro SpA. Pasell, Pirelli\*, Sabaf SpA, SAD Trasporto Locale, Sofidel, Tecsystemsrl, Telecom Italia\*, Terna, Unicredit\*, YOOX SpA, Zignago Vetro SpA.

Among the international initiatives reported within the Global Climate Action, the Italian companies participating to this survey know or take part to 29 of these. As shown in Figure 18, only a few had been ticked by more than 2 respondents. In particular:

- *Global Covenant of Mayors for Climate and Energy*, previously *Covenant of Mayors*, which is an initiative launched by the European Commission in order to endorse and support local authorities in the implementation of sustainable energy policies;
- *Save Food Initiative*, launched by the FAO and Messe Düsseldorf, which aims at encouraging dialogue between industry, research, politics, and civil society on food losses and at raising public awareness on the impact of food waste;
- *Cement Sustainability Initiative*, which is a global effort by 25 major cement producers with operations in more than 100 countries who believe there is a strong business case for the pursuit of sustainable development. Collectively these companies account for around 30% of the world's cement production and range in size from very large multinationals to smaller local producers.
- *Science Based Targets*, which is a partnership between CDP, UN Global Compact, WRI and WWF, helping companies determine how much they must cut emissions to prevent the worst impacts of climate change;

- *Zero Deforestation Commitments from Commodity producers and traders*, which aims to eliminate deforestation from the production of agricultural commodities such as palm oil, soy, paper and beef products by no later than 2020, thereby contributing to the goal of ending natural forest loss by 2030.

Figure 18. "Lima-Paris Action Agenda initiatives known by Italian companies or in which they take part"



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# 6. CONCLUSIONS AND POLICY RECOMMENDATIONS.

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## 6.1 | MODELLING THE ANTECEDENTS OF CLIMATE ACTION.

As stated in the introduction to the report, the objective of the present study is to investigate the antecedents, drivers and barriers to climate action within the Italian industry sector, in order to support policy-making at the institutional level, as well as decision-making at the organizational level. Deriving meaningful policy implications from the measurement of climate-related managerial, organizational and environmental factors requires assessing how these variables interact and relate to the adoption of mitigation and adaptation initiatives. Therefore, the final section of the report focuses on the analysis of the latent relations existing between the factors examined in the previous chapters, by discussing a comprehensive statistical elaboration of the data collected within the sample of surveyed organizations.

The statistical model presented in this section (represented in Figure 19) grounds on the hypothesis exposed in the previous chapters. Accordingly, the model distinguishes between three macro set of variables, i.e. *managerial*, *organizational* and *contextual* variables. The variables pertaining to the managerial-level (circled in green in Figure 19) represent the cognitive and perceptual factors that may drive executives' decision-making processes on climate issues (such as the awareness of climate change, pro-environmental managerial values etc.). Organization-level factors (marked in yellow) encompass the availability of resources and executives' empowerment towards climate actions, as well as the presence of a pro-environmental organizational culture. Factors pertaining to the external context (circled in blue) includes stakeholder-induced as well as institutional and regulatory pressures, summarized within a single construct. Finally, the adoption of climate change mitigation and adaptation initiatives (circled in red) constitutes the actions that this model aims to explain.

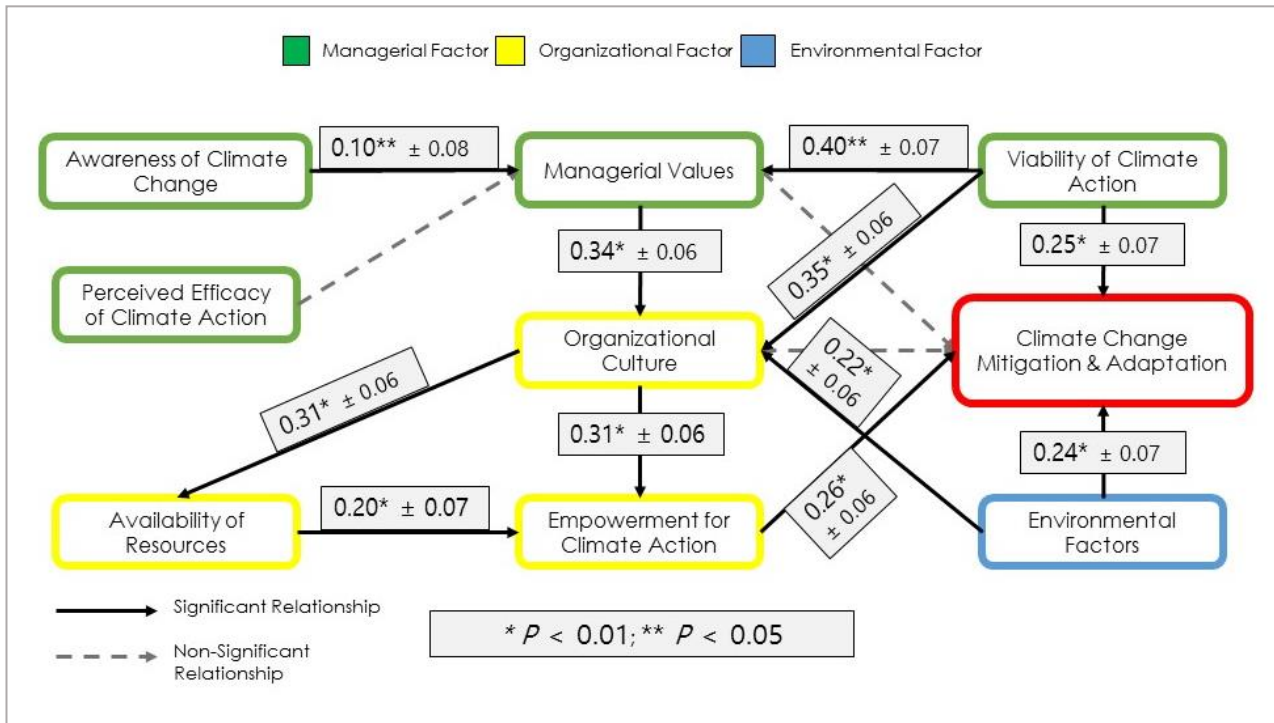
In order to investigate the role of these three macro set of variables (*managerial*, *organizational* and *environmental*) on the adoption of climate change mitigation and adaptation initiatives, a structure equation model was performed. The final model depicted in the Figure 19 was the results of a comparison among several competing models and it represents the model that better shows the complex relations among the several antecedents of climate change mitigation and adaptation initiatives. The structural equation model proposed showed the best value of goodness-of-fit indices<sup>3</sup>

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<sup>3</sup> The RMSEA for the measurement model is below .05 and the CFI and the NNFI for the measurement model are above .95 as required to consider a model satisfactory.

In the next sections, the most significant relations highlighted by the model are examined for each level of analysis. Finally, policy implications are derived and discussed.

Figure 19. "Modelling the antecedents of climate action."



## 6.2 | ASSESSING RELATIONS AT THE MANAGERIAL, ORGANIZATIONAL AND ENVIRONMENTAL LEVEL.

**Assessing relations at the managerial level** – According to the model presented in Figure 19, the managerial-level variables (circled in green in Figure 19) play a significant role in directly or indirectly explain the adoption of climate change mitigation and adaptation initiatives.

First of all, executives' pro-environmental values (i.e. "Managerial values") exert an influence on their companies' organizational culture. According to our model, the endorsement of environmental protection at the managerial level translates, at the organizational level, into the internalization of pro-environmental values within the culture, mission and strategy planning process of the organization. Therefore, this result partially supports the expectation that a corporate culture oriented towards environmental sustainability might be triggered, in the first instance, by the top management's commitment to environmental protection.

Additionally, an interesting finding refers the role of the perception of climate action as an economically viable investment (i.e. "Viability of Climate Action"). The model reveals its strong influence on managerial values, on the organizational culture and its direct relation

to the adoption of mitigation and adaptation initiatives. According to the model, the perceived viability of low-carbon and climate-resilient investments reinforces the pro-environmental values endorsed by executives and organizations, and further motivates the substantial implementation of climate initiatives. This result confirms the expectation that the association between carbon reduction, cost savings and resource efficiencies represents a major stimulus for climate action in the organizational context.

On the contrary, focusing on the determinants of managerial values, some unexpected results emerged. In detail, the cognitive factors associated to executives' perceptions of climate change (i.e. "*Awareness of Climate Change*" and "*Perceived Efficacy of Climate Action*") are not related to pro-environmental values in a significant way. In this sense, executives' awareness and perceptions of climate issues do not influence their management style and decision-making process towards endorsing pro-environmental values. Similarly, pro-environmental values do not emerge as significant drivers of climate action within the organizational context. According to these results, managers' positive attitudes towards environmental protection may be associated to a generic affection towards the natural environment, rather than to an informed appraisal of climate impacts. Therefore, the endorsement of pro-environmental values may drive executives towards adopting other forms of environmental-friendly practices (such as, for instance, sustainable waste management practices), rather than mitigation and adaptation measures.

**Assessing relations at the organizational level** – At the organizational-level (denoted by the yellow colour in the Figure 19), the model shows the role of pro-environmental organizational culture, availability of resources devoted to climate initiatives, organizational empowerment for climate action in predicting the adoption of mitigation and adaptation measures. According to the model, a pro-environmental organizational culture (i.e. "*Organizational Culture*") plays a crucial role. On the one hand, it positively influences both to the availability of resources dedicated to climate initiatives (i.e. "*Availability of Resources*") and to the extent of leadership on climate issues and empowerment for climate action (i.e. "*Empowerment for Climate Action*"). These results suggest that a meaningful internalization of pro-environmental values at the organizational level supports the appointment of a defined and clear leadership on climate issues within the governance structure, and facilitates the arrangement of resources (e.g. human, financial, technological etc.) devoted to mitigation and adaptation. Furthermore, as denoted by a significant relation between the two constructs, the availability of necessary resources drives the empowerment of executives for engaging in climate initiatives. On the other hand, a pro-environmental organizational culture is influenced by the environmental value of managers and their belief on the economic viability of climate actions. This result confirms the expectation that the managers' commitment on environmental issues, driven by their personal beliefs, is fundamental to spread a proactive environmental culture within an organization.

Regarding the effect of organizational factors on the adoption of mitigation and adaptation initiatives, the model highlights a positive relation between executives' empowerment for



climate action and the implementation of these initiatives. This result supports the expectation that formal and agreed responsibilities on environmental issues at the top management level, organizational support towards pro-environmental initiatives, as well as the access to requisite resources devoted to environmental protection, drive the implementation of environmental practices, including climate change mitigation and adaptation initiatives.

**Assessing relations at the external context level** – Finally, the model assesses the role of external factors, which encompass the diverse pressures exerted by stakeholders (e.g. national and supranational regulatory bodies, supply-chain partners, competitors, members of the civil society etc.). Interestingly, contextual factors (i.e. “*Environmental Factors*”) significantly influence the organizational culture, highlighting the role of stakeholders and institutional or normative pressures as sources of influence on organizations’ manifested values and strategic directions. In this sense, external pressures operate as social or cultural norms, determining patterns of appropriate and legitimate behaviour, therefore encouraging the endorsement of pro-environmental values at the organizational level. The extent of the relation between external pressures and the actual behaviour of the surveyed organizations is expressed by the significant relation existing between environmental variables and the implementation of mitigation and adaptation initiatives in the model. Consequently, according to the model, the pressures exerted by the regulatory, institutional and competitive environment represent a significant driver of the adoption of mitigation and adaptation practices in the Italian industry sector.

## 6.3 | POLICY RECOMMENDATIONS.

Based on the results of the previous analysis, policy recommendations can be derived in order to guide policy-makers towards raising awareness of climate change within the Italian industry sector and supporting the implementation of mitigation and adaptation measures by Italian manufacturing companies. This section of the report aims at providing and discussing policy recommendations at a general level.

**Emphasizing the role of direct regulation in driving the technological transition** – In the aftermath of the Paris Agreement, the expectation of more stringent regulations on GHG emissions emerges as a major pressure towards the implementation of mitigation and adaptation measures within the industry sector. As highlighted by the analysis of the contextual factors driving climate investments, direct regulation (both at the national and international levels) represents a powerful incentive for improving environmental performance in order to meet legal compliance and anticipate future restrictions. Furthermore, given the ambitious mitigation objectives set forth in the Paris Agreement, the introduction of direct regulation at the national level is favourable in order to accelerate the required change towards a decarbonised economy. Indeed, if properly designed, direct regulation is expected to foster companies’ innovation potential and accompany

the transition towards low-carbon technologies. Therefore, effective environmental policies should phrase environmental rules as goals that can be met in flexible way encouraging innovation to reach and exceed those goals. They must create the maximum opportunity for innovation, leaving the approach to innovation to industry and not the standard-setting agency. With this aim in mind, the role of the European Union Emission Trading System (EU ETS) in supporting the technological transition within the Italian industry should be strengthened, by optimizing the allocation of allowances among industrial sectors, by promoting emissions trading among business actors, while progressively decreasing the emissions cap. However, the environmental regulation system should be administered in a coordinated way by focusing on a strong coordination between industry and regulators; and between regulators at different levels and places in government.

**Climate action should be rewarded (especially adaptation)** – The data collected highlights as most surveyed executives complain the lack of financial incentives supporting the implementation of climate initiatives. Despite mitigation emerges to be frequently associated to cost saving strategies, the uncertainty associated to climate investments (especially in adaptation) and the lack of direct rewards may hold organizations from acting on climate change. Indeed, the study points at the economic viability of climate investments as a major driver of mitigation and adaptation in the industry sector, therefore underlining the need of introducing rewarding mechanisms for low-carbon and climate-resilient investments. Rewarding systems may envision risk pricing mechanisms that account for companies' climate risk exposure and vulnerability, therefore incentivizing investments in climate risk reduction and loss prevention in return for lower insurance premiums. Similarly, innovative resilience-related criteria may be studied and diffused in the banking system for the allocation of loans for business enterprises. The policy sector could therefore promote the development and diffusion of new insurance and banking products among the industry sector, by means of public-private partnerships aimed at designing a coherent national insurance and banking system based on the coexistence of post-disaster state reliefs, private insurance programs and eased access to finance for climate-resilient enterprises. Similarly, rewarding mechanisms may envision emission-based tax deductions as incentives for the adoption of mitigation initiatives.

Moreover, policy makers should emphasize the economic and competitive benefits deriving from the adoption of mitigation and adaptation measures in order to make managers more aware that climate change actions generate a win-win mechanism. Initiatives for increasing company's reputation by an active role of National Authorities as direct endorsers of proactive initiatives may be effective.

Moreover, further initiatives could be implemented to support external recognition of worthwhile initiatives at firm level. The reasoning is that environmental proactive behaviour is positively liked to a positive corporate image. The introduction of Climate Mitigation & Adaptation Awards for best initiatives (from sustainability, attractiveness, innovation and

cost efficiency points of view) could be particularly appreciated by managers that could use in their marketing strategy.

**Strengthening executives' empowerment for climate action** – The results of the study emphasize the importance of empowering managerial figures for climate action and environmental protection as a driver of mitigation and adaptation initiatives among Italian firms. Empowering executives implies appointing specific responsibilities (job functions) as well as entitling managers to mobilize and manage resources in order to fulfil their objectives and responsibilities. This cultural change should be not focused on one specific business functions but should involve several departments (from R&D to marketing, from operations to supply chain, etc.) and requires a decisive modifications in the mind-set of managers and executives.

A public endorsement towards some existing voluntary policy instruments among Italian companies could support the adoption of tools that, whether properly implemented, can support companies in this transition path. For instance, ISO standards and European voluntary instruments on business continuity or environmental management system can be effective if ad-hoc guidelines on how to adapt these schemes on climate change issues are properly designed.

However, top management commitment and leadership is necessary to trigger a mind-set change. Therefore, public seminars and discussion which involve top managers could help to increase their awareness and culture on the need of climate change mitigation and adaptation action and the potential benefits that a company can obtain.

**Supporting the cultural change at industry and organization level** – According to the results of the study, organizational culture emerges to play an important role in directing resources towards climate investments and empowering executives for climate action. In this sense, organizations that value environmental sustainability as a guiding principle and as a strategic feature appear to endorse a pro-active approach towards mitigation and adaptation. As above mentioned, this result underlines the importance of encouraging, by means of appropriate policies and institutional support, a widespread cultural shift towards corporate sustainability among Italian companies. Institutions should therefore aim at raising awareness of climate issues at top and middle-level management within organizations, by means of training and educational activities concerning the challenges, risks (financial, normative, legal etc.) and opportunities (e.g. technological, market opportunities etc.) associated to climate change in the Italian industry sector.

**Raising public awareness and encourage transparent carbon disclosure** – As institutions should support a cultural shift towards corporate sustainability at the supply side of the

market, similar efforts should aim at raising awareness of climate change at the demand-side, in order to stimulate more informed and sustainable consumption patterns among increasingly larger shares of consumers. According to the results of the study, clients (both final and intermediate customers) constitute a relevant source of influence towards the adoption of mitigation and adaptation measures among Italian companies. Further stimulating the demand for low-carbon or carbon-neutral products among final and intermediate customers would contribute to the creation of business opportunities for climate-friendly companies. It is therefore important to leverage consumers' influence in order to accelerate the transition towards a decarbonised economy.

In order to foster the dialogue on what the market can do to contrast climate change and actively engage both sides of the market, transparent communication should be supported and rewarded on the supply side. Institutions should therefore encourage companies to disclose their current impact in terms of GHG emissions and communicate their target objectives and strategies for carbon reduction to the public. Existing initiatives, such as the Carbon Disclosure Project (CDP) of the Rockefeller Philanthropy Advisors, can be promoted among Italian companies in order to increase the participation of the Italian industry in globally acknowledged carbon disclosure initiatives. As well as public national schemes which promote a reliable information on the carbon footprint of products and organization, by supporting, for instance, European tools such as PEF and OEF methods ( EU Recommendation 2013/179), could be likewise effective. Voluntary carbon disclosure is a fundamental tool to nurture a transparent dialogue on climate change between business enterprises and clients, inform customers' responsible purchasing behaviour and therefore enhance the visibility of virtuous and climate-responsible organizations.

**Enhancing transparency and communication across the supply chain** – Dysfunctions in terms of information flows and lack of transparency among actors within the supply chain distort market mechanisms and implies control and monitoring costs. Furthermore, lack of information concerning partners' climate risk exposure and vulnerability, both in the upstream and downstream sides of supply chains, may lead to unexpected disruptions. Soft instruments, such as eco-labelling or certification systems, have proved their potential in enhancing transparency within the market, by communicating the environmental characteristics of products, companies' environmental performance or management standards both to final and intermediate customers. The current lack of soft and voluntary instruments aimed at transferring verified information concerning the risk profile of companies, implies verification costs and high levels of information asymmetries across supply chains. Policy-making should therefore fill the current gap in information by developing appropriate instruments, by engaging market actors and stakeholders in participatory and transparent policy-design processes.

**Promoting companies' engagement in multi-stakeholders initiatives** – The urgency of mitigating and adapting to climate change requires collaborative, inclusive and participatory initiatives. Indeed, effective adaptation measures often require the monitoring and assessment of direct and indirect impacts, shared responsibilities between diverse actors and high upfront investments. However, most surveyed organizations appear to be reluctant towards engaging supply chain partners (i.e. suppliers and clients) and other stakeholders in collaborative mitigation and adaptation measures. Such tendency may be associated to the difficulties of coordinating numerous and diverse stakeholders, as well as to the lack of information concerning collaboration opportunities. Institutions should therefore promote the engagement of business actors in multi-stakeholders initiatives (such as compacts, research projects, policy-design processes etc.) in order to encourage and support cooperation, information transfer and ideas generation between business actors and stakeholders. In order to increase the participation of businesses in multi-stakeholder initiatives, institutions may leverage companies' need to join collaborative solutions in order to amortise costs, share risks, duties and responsibilities, as well as enhance their reputation in the eyes of institutional partners, clients and society at large.