



UNIVERSITE CATHOLIQUE DE LOUVAIN
LOUVAIN SCHOOL OF MANAGEMENT

**An analysis of the contributions of management science to corporate
greenhouse gases emissions reductions. The cases of strategic management
and human resources management.**

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Abstract

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by Pierre-Ami MAUDOUX

More frequent, visible and devastating consequences of climate change and an increasing number of international agreements to cut CO₂ emissions are putting private firms under pressure to reduce their own emissions. For those reasons, we chose to explore the roles of strategic management and HRM in the emissions reduction efforts of companies.

We found that, in order to develop a GHG-reduction strategy, companies could decrease the carbon intensity of their products and services, compensate their emissions through carbon markets or develop new low-carbon solutions subject to a growing demand. We also determined how internal and external support of stakeholders could help in the implementation of the climate change strategies of firms. Third, we identified a number ways to develop competitive advantages for companies engaged in emissions reductions, including differentiation through the offering of low-carbon products and services.

Regarding the contributions of the HRM function of firms, we determined that providing training to employees and modifying the recruitment and selection policy of companies could prepare their workforce for changes inherent to carbon reduction strategies. Also, employee involvement and empowerment was found as an optimal lever to develop an active participation of employees towards emissions reductions goals. Finally, we identified how performance management systems and pay and rewards schemes can manage employee performance in the context of climate change strategies.

Keywords: green human resource management, greenhouse gases reductions, corporate environmental strategies

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Abbreviations

CDM	Clean Development Mechanism
CO₂	Carbon Dioxide
CO₂e	Carbon Dioxide Equivalent
EE	Employee Empowerment
EI	Employee Involvement
EU ETS	European Union Emissions Trading Scheme
GHG	Green House Gas
GHRM	Green Human Resources Management
HRM	Human Resources Management
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KPI	Key Performance Indicators
LCA	Life Cycle Assessment
MAC	Marginal Abatement Costs

Chapter 1

Introduction

Since the beginning of the first industrial revolution, human societies have been at the centre of a dramatic increase in fossil fuel (e.g. oil, coal, natural gas) consumption being caused by a spectacular growth in industrial activity and in corresponding consumption of goods and services. This has led to a substantial surge of greenhouse gases (GHGs) concentrations in earth's atmosphere ([IPCC, 2013](#), p. 17).

It has been established that this increase in GHGs concentrations is the major cause of the continuous rise in atmospheric temperatures observed since the start of the 20st century ([IPCC, 2013](#), pp. 6, 13-14), a phenomenon known as “climate change” or “global warming”. Scientists not only estimate that the surface temperature on our planet is now 0,85°C warmer than in 1880 ([IPCC, 2013](#), p. 5), they are also forecasting a global increase in temperatures in excess of 2°C compared to pre-industrial levels by the end of this century ([IPCC, 2013](#), p. 20).

The various consequences of climate change on natural ecosystems and on human populations, their societies and economic systems have the potential to be extremely destructive. These include dangerous increases in sea levels and extreme weather events (e.g. droughts, floods, hurricanes, wildfires, etc.), which in turn has dramatic impacts on crop yields, human infrastructure and human health ([Schultz and Williamson, 2005](#), p. 384), but indeed also on ecosystems and the multitude of animal and vegetable species living on our planet ([IPCC, 2013](#), p. 9) ([IPCC, 2014a](#), p. 6).

Facing those unprecedented threats to humankind, the international community has been trying—with limited success—to engage in a coordinated action plan to control GHG emissions since the adoption of the Kyoto Protocol in 1997. In the past months, intellectual leaders around the world have been urging governments to reach a comprehensive and binding agreement on GHG reductions at the forthcoming United Nations Climate Change Conference in Paris (Rudd, 2015). They argue that time is running out to take action on climate change that would prevent those extremely damaging consequences of global warming (Sachs, 2014).

There are however, signs that a momentum is forming ahead of the conference, with major economies pledging to remarkable cuts in their carbon emissions (Rudd, 2015), hinting at a possibly historic agreement in Paris. In any case, it is likely that governments and virtually every organisation in the world will face increasing pressure to reduce their greenhouse gases emissions. Indeed, as severe weather events become more frequent and regulations more stringent, the moral and legal obligation to act on carbon footprints will only become more and more evident.

1.1 Motivations of the study

The magnitude of the consequences of global warming will depend on our ability to mitigate climate change by stopping the increase in atmospheric GHG concentrations. In this ambitious endeavour, every actor of our society has a role to play. In particular, industrial activities are currently responsible for 32% of the total greenhouse gases emissions per year (IPCC, 2014b, p. 8) and must therefore take the necessary actions to reduce this enormous impact.

In addition to being one of the main emitter of GHG in our atmosphere, the industry sector is also highly threatened by the consequences climate change. Indeed, a substantial warming of our climate would put companies in jeopardy by increasing the probability of capital losses caused by extreme weather events and rising seas (Jones and Levy, 2007, pp. 428-429). They are also likely to face rising insurance premiums for the same reasons (IPCC, 2014a, pp. 19). Furthermore, the private sector should see a reduction in the demand for goods and services as global warming is bound to increase poverty through various mechanisms (e.g. higher frequency of large-scale populations displacements and violent conflicts, higher food prices, etc.) (IPCC,

2014a, pp. 20). Overall, “optimistic” estimates anticipate global economic losses of around 1% of income per year for a 2°C warming scenario. Indeed those losses would be even larger for greater temperatures increases (IPCC, 2014a, pp. 19).

It is therefore urgent to find ways to dramatically decrease the carbon footprint of those organisations. In this context, what is exactly the role of management sciences and its various areas of research (e.g. strategic management, human resources management, marketing)? How could managers in companies contribute to the organisational efforts towards emissions reductions and how important would those decisions be? In a time where firms are under increase pressures to reduce their impact on global warming, these are very relevant questions to address.

1.2 Scope of our work

We thus believe that the managerial dimensions of the companies’ fight against GHG emissions should be better explored, analysed and articulated. This is precisely what we will aim to achieve in this master thesis, and the question that will guide us in our research is the following:

Research Question. *“What management practices can be used to support the decarbonisation of private companies, and how can managers implement them?”*

Let us clarify this research question by defining its key terms. First, by “management practices”, we refer to the processes and systems pertaining to the fundamental functions of business management (i.e. to plan, organise, coordinate, direct, and control; as first identified by Fayol), which encompass modern disciplines such as strategic management, financial management, human resource management, information technology management, marketing management and supply chain management.

However, conducting a comprehensive analysis of each of those fields in the present work is not realistic, due to length limitations. Instead, we chose to focus on the disciplines of strategic management and human resources management. Three more precise research questions were defined to direct our study of each field and address their most important issues, as indicated by table 1.1.

Management discipline	Research questions
Strategic management	“What are the different modalities of carbon-reducing strategies?” (1.1) ; “How can companies support the implementation of their climate change strategies?” (1.2) ; “How can GHG-reducing strategies help companies to gain competitive advantages?” (1.3)
Human resources management	“How can companies prepare their workforce for the various changes inherent to GHG reduction strategies?” (2.1) ; “How can companies encourage their employees to actively participate in their emissions reductions efforts?” (2.2) ; “How can companies control the performance of their employees in the context of a climate change strategy?” (2.3)

TABLE 1.1: Sub-research questions of our work

Second, the term “decarbonisation” will be used to refer to the process of reducing greenhouse gas emissions caused by a particular organisation. The range of emissions taken into consideration will be large and include: direct emissions of GHG originating from an organisation’s facilities, vehicles and all other sources it owns or control (i.e. *scope 1* emissions); indirect emissions caused by the external production of electricity, heating, cooling or steam and acquired by the firm (i.e. *scope 2* emissions); indirect emissions arising from external sources which the company does not own or control, but which are related to the activities of the organisation, such as its suppliers, clients or employees (i.e. *scope 3* emissions) ([United States Environmental Protection Agency, 2012](#)).

Let us also note that in the following pages, the terms “carbon”, “greenhouse gases” and “GHG” will be used interchangeably. Indeed multiple gases are at the source of global warming, but talking about “carbon” reductions is more common in colloquial English, when referring to all gases responsible for the greenhouse effect (“greenhouse gases” in general, such as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride, etc.) ([Brander, 2012](#)). This is due to the fact that carbon is the single greenhouse gas responsible for the largest share of anthropogenic GHG emissions ([IPCC, 2014b](#),

p. 6), it is also the benchmark to measure the global warming impact of other GHGs (we talk about “Carbon Dioxide Equivalent” - CO₂e) ([Brander, 2012](#)).

Finally, as indicated by our research question, we will focus our study on private for-profit companies. However, as many management methods are used by other organisations, such as non-for-profits and governmental institutions, a substantial part of our findings should also be applicable to other organisations.

1.3 Objectives and plan of the study

The aim of this work will be to identify and analyse management practices that can be used to reduce carbon emissions in private companies, underline their interactions and propose ways to monitor their effectiveness when they are being used in practice by managers.

To do so, we will first analyse real-life case studies of companies that have achieved remarkable reductions in their carbon footprints, then we will delve deeper in the contributions of the fields of strategic management and human resources management by reviewing relevant literature and producing a synthesis of the available means of action (“levers”) of both fields. A summary of our results will subsequently be presented, before giving an overview of the potential contributions of other fields in the management discipline and concluding our work.

Chapter 2

A Framework for Corporate GHG Emissions Reductions

This chapter's purpose is to give a global view of the possible means for companies to reduce their carbon emissions. To do so, we will first define the key concepts of “techno-economic” and “management” measures to reduce carbon emissions. We will then conduct an analysis of the emissions reductions achieved by real-life organisations. The aim of that investigation will be to classify reported emissions reductions in techno-economic or management measure and to observe their relative importance. Building on this, we will offer an overview of the means of actions available for managers aiming to address their GHG emissions.

2.1 Definitions

There are a number of well known and documented measures that companies can take in order to decrease their GHG emissions. First, firms can increase the *energy efficiency* of their equipments ([Enkvist et al., 2008](#), p. 27), for example by switching to LED lighting ([The Guardian, 2014](#), p. 44) or replacing their fleet of vehicles with automobiles that consumer less fuel per kilometre ([The Guardian, 2015g](#)). They can also *save energy*, by automatically turning off lights and computers at night for example. Companies can also ensure that the *waste* they create is recycled or dealt with in a way that generates less emissions (e.g. by composting, recycling, or recovering

resources from the waste instead of burning it in incinerators or sending it to landfill) ([The Guardian, 2015g](#)) ([The Guardian, 2013](#), p. 49). Another way to reduce emissions would be to power one's operations with *renewable energy* sources such as solar, wind or biomass sources ([The Guardian, 2014](#), pp. 43,47). Finally, firms can *compensate* their remaining GHG emissions by investing in projects that reduce the amount of GHG in the atmosphere (e.g. planting trees in developing countries) ([The Guardian, 2014](#), p. 49) ([The Guardian, 2012](#), p. 34). We will label these first categories of actions to curb emissions as “techno-economic” and define them as follows:

Definition 2.1. *“Techno-economic” practices: widespread, easily identifiable and “tangible” (i.e. related to the purchase and/or installation of new equipment, inside or outside of the business) measures taken by firms to tackle their carbon emissions.*

Examples of such practices are: investments in vehicles with better fuel efficiency, generation or sourcing of renewable energy to power one's business activities, improvements in the energy efficiency of one's business facilities by updating its lighting, insulation or air-conditioning equipment.

Aside from this first type of practices, it can be argued that the management of a company also has a specific role to play to reduce its GHG emissions. Indeed, we could think of GHG emissions reductions being fostered by setting emissions abatements goals and tying them to executives' compensation plans ([The Guardian, 2012](#), p. 35), which are modalities of human resources management practices (i.e. performance appraisal and reward systems). Another example would be the implementation of an internal market for carbon emissions by a corporation's Chief Financial Officer, which would internalise the GHG emissions problem of the company into its accounting books ([The Guardian, 2015b](#)) ([The Guardian, 2012](#), p. 33). We could also think of a firm's Supply Chain managers deciding to reward suppliers who achieve substantial emissions reductions in their production processes (as we will see in the next section, carbon emissions can and should be taken into account along a firm's value chain) ([The Guardian, 2015f](#)). We label these second categories of actions as relevant of “management” and define them in the following way:

Definition 2.2. *“Management” practices are measures taken by companies to decrease their carbon emissions which are “untangible” (i.e. related to human behaviour and the design of business processes or products).*

Examples of such practices are: the elaboration of a carbon reduction plan by a firm's senior management, the appointment of a specific team in charge of supervision the implementation of such a plan, the design of products with lower impact on a company's carbon emissions.

Of course, those two types of measures are not to be taken in isolation and are most of the time reflecting complementary dimensions of a given solution to carbon emissions. For instance, the installation of a lower-consumption lighting system on the workplace should be complemented by changes in employees habits, such as switching off office lights when leaving the building. Failure to do so might result in a so-called "rebound effect": the energy savings resulting from the enhanced efficiency of the equipment may be suppressed by an increase in consumption resulting from an unconscious belief that employees do not have to mind electric appliances since those now have a smaller impact on emissions.

2.2 An empirical analysis of current practices

In this section, we will try to better understand what the actual situation looks like in companies actively trying to reduce their carbon footprint. We would first like to assess the importance that management measures have currently in companies relative to techno-economic measures, to gauge the firms' belief in the potential of those practices to effectively curb carbon emissions. If they turn out to be marginal, maybe that would indicate that companies do not believe in their efficiency in reducing GHG emissions, or it could also mean that firms are not quite aware that such solutions exist, and instead focus solely on techno-economic practices. We also want to have a comprehensive view of the diversity of management practices currently used by companies to mitigate GHG emissions.

This will help us to get a better understanding of what management measures are currently used by organisations, which are most and popular and which are less explored by companies. Ultimately, this input will also give us valuable insights for our deeper analysis of those practices.

To do this, we propose to analyse a corpus of best practices of carbon emissions management in various organisations. We will first present the sample and methodology used for the analysis, then the results and conclusions of this first approach will be discussed.

2.2.1 Sample

The case studies used for this empirical part of our research were obtained from the Sustainable Business page on [The Guardian](#)'s website. Since 2010, the news organisation has organised an annual awards ceremony called the "Guardian Sustainable Business Awards" (GSBA), in which it has rewarded British and International companies for their latest achievements in making their businesses more sustainable. Awards are granted for 13 different categories (e.g. "Communicating Sustainability", "Biodiversity", "Carbon", etc.), and the Guardian has been publishing case studies about the winners and runners-up of each category since 2012.

For this research, all 29 available case studies on greenhouse gases reductions, from the 2012 to 2015 editions of the GSBA, were downloaded and analysed. 24 different companies were represented in the sample, the sectors in which they operated were very diverse, ranging from Farming to Public Education.

The choice of these GSBA case studies was motivated by the fact that they contain some of the best and most recent practices in carbon management and are selected by a panel of professionals, journalists and academics specialised in relevant fields of sustainability studies ([The Guardian, 2013](#), p. 85).

2.2.2 Methodology

The process used to analyse these case studies was based on the "Qualitative Content Analysis" suggested by [Mayring \(2000\)](#). The methodology aims to systematically analyse qualitative texts to sort their content into categories related to one's research question, which are built and reviewed throughout the analysis.

In particular, categories are first inductively developed from the analysis of the texts: based on the research question, the researcher will progressively regroup similar ideas of the texts into categories, in order to structure its content and highlight what the main concepts of the documents are ("Inductive category development"). Once this tentative classification has been performed, those categories are revised with existing theoretical concepts linked to the subject

of the analysis, in order to better define key concepts and develop robust coding guidelines (“Deductive category application”).

In the context of the present work, the analysis of the case studies was carried out in an Excel spreadsheet, following the methodology presented above. GHG reduction measures were thus identified and classified in categories (such as “3. Green Marketing Practices” or “7. Workplace Energy Efficiency”) to provide an overview of current practices used by organisations to reduce the carbon footprint of organisations.

The spreadsheet, providing details about the measures identified, the coding criteria defined for the categories and results of our analysis can be found in Appendix A.

2.2.3 Results

Our qualitative analysis of the case studies led us to identify 123 different measures by organisations to reduce carbon emissions. 12 categories of carbon management measures, and numerous subcategories, were subsequently determined, as shown in table 2.1 below.

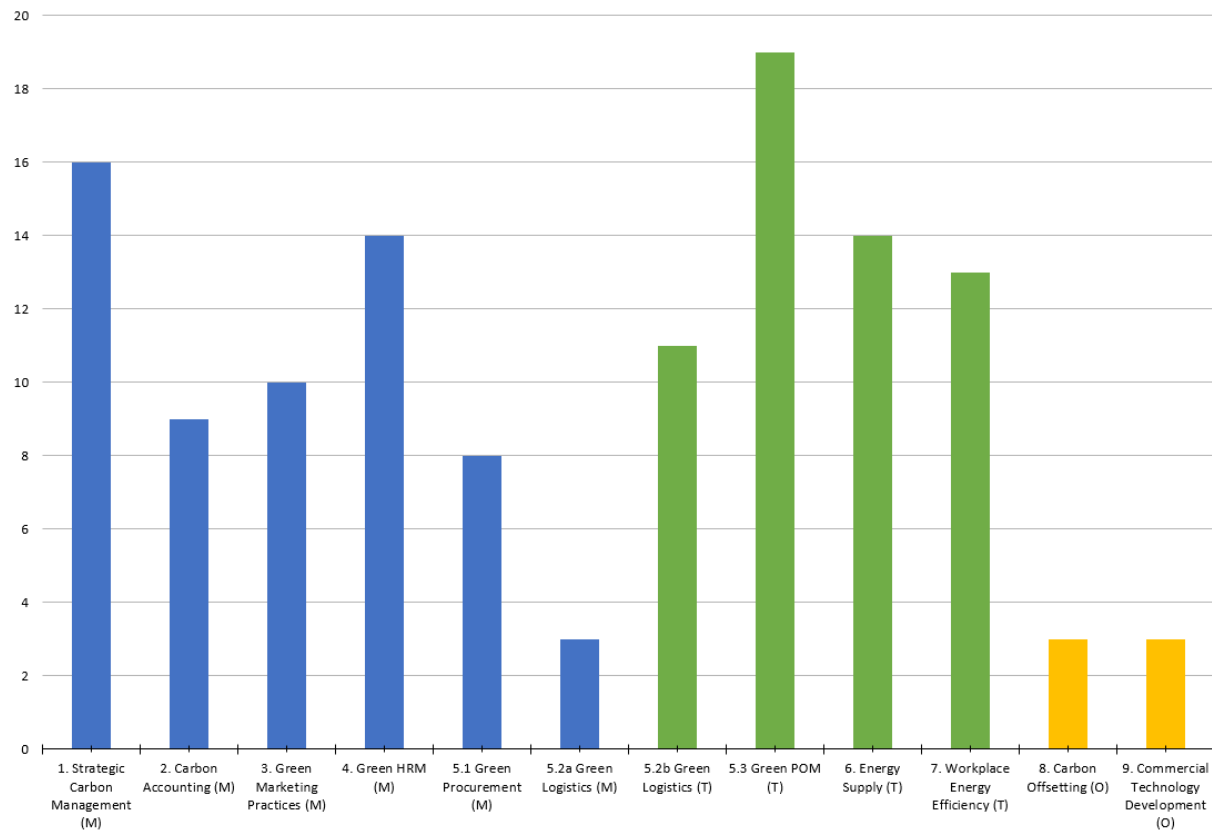
Category	Subcategories
1. Strategic Carbon Management (M)	Carbon Reduction Programme; Carbon Reduction Targets
2. Carbon Accounting (M)	Physical carbon accounting; Monetary carbon accounting
3. Green Marketing Practices (M)	Product Design; Production Process improvement; Packaging Design; Advertising; Distribution
4. Green Human Resources Management (M)	Employee recruitment and selection; Training & Development; Performance management and appraisal; Pay and Reward systems; Employee involvement/engagement
5. Green Supply Chain Management	
5.1 Green Procurement (M)	Green Suppliers Selection; Emissions Reduction Partnership with Suppliers

5.2a Green Logistics (M)	Transportation; Warehousing; Value Added Services; Reverse Logistics
5.2b Green Logistics (T)	Transportation (T)
5.3 Green Productions and Operations Management (T)	Inputs/Energy Use Reduction; Waste Management
6. Energy Supply (T)	Renewable Energy Generation; Renewable Energy Sourcing
7. Workplace Energy Efficiency (T)	Insulation; Heating, ventilation, and air-conditioning (HVAC); Lighting
8. Carbon Offsetting (O)	Renewable Energy; Forestry; Resource Conservation; Unspecified
9. Commercial Technology Development (O)	Lighting (Technology); Engineering; Chemistry

TABLE 2.1: Identified categories and subcategories of GHG reduction measures (See Appendix A for more details)

We labelled all categories with “(M)”, “(T)”, or “(O)” to indicate whether they were “Management”, “Techno-economic” (based on the definitions we formulated in chapter 1) or “Other” measures, respectively. With 19 occurrences, the “Green POM” (T) category was the most represented in the sample of measures identified. It is followed by measures pertaining to “Strategic Carbon Management (M)” (16 occurrences), “Green Human Resources Management (M)” and “Energy Supply (T)” (both 14 occurrences). The least represented categories of GHG reduction measures were “Carbon Offsetting (O)”, “Commercial Technology Development (O)” (both 3 occurrences) and “Green Logistics (M)” (9 occurrences). The exact number of measures identified for each category can be found on figure 2.1 below.

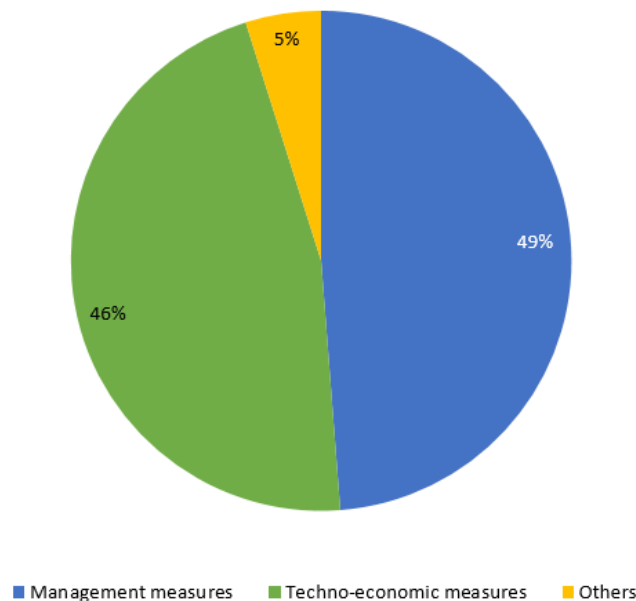
FIGURE 2.1: Number of occurrences for each category of carbon reduction measures identified



As we mentioned, the categories which we identified were grouped in three clusters in order to assess the importance of measures arising from the management functions of organisations compared to other types measures (i.e. techno-economic measures and other actions). Below, figure 2.2 presents the relative importance of those three clusters in our sample.

FIGURE 2.2: Three main types of measures identified and their relative importance in the total sample

Share of the three main types of measures identified



As figure 2.2 shows, measures arising from management functions of the organisation (i.e. categories 1-5.2a) constituted a considerable share of the identified methods to decrease carbon emissions with roughly 49% of the identified measures. Techno-economic measures to reduce GHG emissions (i.e. categories 5.2b-7) were just a little bit less prevalent (46%) and other measures (i.e. categories 8-9) only had a marginal importance in our sample (5%).

2.2.4 Discussion and implications for the work at hand

Our results suggest that management has a substantial role to play in reducing carbon emissions in organisations: almost half of the measures we identified pertained to management functions in the case studies analysed. Moreover, more conventional solutions to decrease emissions, such as favouring renewable sources of energy or increasing energy efficiency on the workplace, were – surprisingly – less represented in our sample.

This raises a number of questions. For instance, “What kinds of strategies can be formulated to engage in company-wide efforts to mitigate GHG emissions?”, or “Can competitive advantages be maintained or developed despite this strategic focus on emissions reductions?” and

also “What is necessary to take into account to ensure the success of such strategies?”. Further, “How can the efficiency of management measures to reduce emissions be measured?”.

Considering the importance of reducing carbon emissions for the future of our societies, these questions need to be addressed. We have seen that organisations have been launching initiatives to curb their emissions not only by using new equipment and technologies, but also by implementing new management practices. We believe that research should support the development of such activities by proposing a comprehensive, theory-backed presentation of the different “levers” offered by the fields of management to contribute to GHG emissions reductions in private companies. Attention should also be paid to their respective advantages and limitations, as well as how to measure their effectiveness.

The activities related to GHG emissions reductions distributed among the management functions of the organisations should thus be integrated into a coherent and formal framework in order to better understand the role of each management field and to highlight their potential synergies. In the present work, we will explore the different dimensions of such a framework.

2.3 A management framework for carbon emissions reductions

As we realised in our case studies analysis, the contribution of management science to enterprise carbon emissions reductions can be distributed in five fundamental domains constituting the field: strategic management, accounting, marketing, the management of human resources and supply chain management. The contributions of those areas of study are complementary and indispensable for an effective reduction of carbon emissions in corporations. However, as figure 2.1 showed, strategic management and human resources management (HRM) seem to have an especially important contribution to GHG emissions reductions relative to the three other functions of management.

For this reason and because a comprehensive analysis of each of those fields is not realistic due to the length requirements of the present work, we chose to focus our inquiry on the role and contributions of strategic management and HRM with respect to carbon emissions reductions in

modern companies. We will, however, briefly cover the potential issues pertaining to marketing, accounting and supply chain management before concluding our investigation.

Chapter 3

Literature Review

In this chapter, we will give an overview of the existing literature on the topic of GHG emissions reduction in the fields of strategic management and human resources management. Summaries of scientific articles, books and reports will be presented and grouped into specific areas of research for each field.

3.1 Strategic Management

In this first section, we summarise existing research in the field of strategic management regarding carbon emissions reduction. In particular, we distinguish and structure our review of literature around four study areas: the analysis of typologies of carbon reduction strategies, the identification of determinants and barriers for those strategies, their modalities of implementation in companies and the economic rationale underlying those strategies.

3.1.1 Typologies of carbon reduction strategies

[Kolk and Pinkse \(2004\)](#) explored the range of options available for companies to address climate change. They argued that the two main “strategic options” to reduce GHG emissions were to *innovate* (in their products or processes) or to *compensate* (through emissions trading mechanisms or carbon offset projects). Moreover, these two orientations can be carried out on three

different organisational levels (i.e. *Internal*, *Vertical* and *Horizontal*), yielding six modalities to reduce corporate carbon emissions, as shown on table 3.1.

	Innovation	Compensation
Internal (company)	Process Improvement	Internal Transfer of Emission Reductions
Vertical (supply chain)	Product Development	Supply-Chain Measures
Horizontal (beyond the supply chain)	New product/Market Combinations	Acquisition of Emission Credits

TABLE 3.1: Strategic options for climate change (Kolk and Pinkse, 2004)

In a 2005 study, the same authors carried out a cluster analysis of 136 firms and identified six strategic configurations, made of different combinations of the modalities described above. About one third of the companies were labelled as “Cautious Planners”, which scored only moderately in all strategic options and therefore were rather slowly preparing for initiatives to reduce emissions than actually carrying them out. Another third were described as “Emergent Planners”, focusing on internal transfers of emission reductions and supply-chain measures and thereby engaging in organisational change to tackle emissions. Companies with a marked internal focus were called “Internal Explorers”, emphasised process improvements and internal transfer of emission reductions and accounted for about 15% of the sample. Another strategic configuration was the “Vertical Explorers” cluster, reducing emissions mainly through product development and supply-chain measures (potentially because their production process is relatively less carbon intensive than their upstream and downstream activities). Finally, “Horizontal Explorers” and “Emissions Traders” were more marginal approaches and focused respectively on new product/market opportunities and emissions trading (internally and externally).

Enkvist et al. (2008) discuss the strategies that companies can implement in order to secure a profitable position in the upcoming low-carbon economy. One major option, they argue, is to

“*optimise current assets and products*” by (1) improving energy efficiency along businesses’ value chains and designing lower carbon-intensive products, (2) reconsidering their portfolio of assets by selling highly carbon-intensive installations and investing in more efficient plants and equipment and (3) develop expertise in carbon emission trading to increase profits.

The second strategy that the authors present involves “*building new low-carbon businesses*”, to reduce companies’ emissions while offering low-carbon solutions to their clients (e.g. Carbon Capture and Storage businesses).

Finally, the importance of “*shaping the regulatory landscape*” is stressed, and firms are encouraged to (1) gauge their vulnerability to potential new carbon regulation (e.g. mandatory participation to a cap-and-trade system) and subsequently develop a regulatory management policy (i.e. the extent to which the company will be involved in the underlying negotiations), (2) position oneself as an “incumbent” (i.e. firms bound to achieve emission reductions and strengthen their position in carbon-constrained markets) or as an “attacker” (i.e. low-carbon businesses aiming to weaken competition by promoting more stringent carbon regulation) and (3) get involved in regulation negotiations at multiple levels (e.g. local, national, global) notably by forming partnerships with other organisations to carry a stronger voice.

Weinhofer and Hoffmann (2010) classified carbon reduction strategies of companies according to three general strategic objectives of carbon management, identified based on previous research: *CO2 compensation* (e.g. buying carbon credits or investing in carbon offset projects), *CO2 reduction* (i.e. long-term plan to significantly reduce corporate GHG emissions) and *carbon independence* (i.e. aiming to an absolute business independence from fossil fuels in the long run).

Depending on whether companies focused on one particular objective or on a combination of objectives, they were labelled as “All-Rounders” (i.e. companies aiming for the three objectives), “Compensators” (i.e. firms focusing on CO2 compensation), “Substituting compensators” (i.e. companies compensating their emissions while aiming for long-term carbon independence), “Reducers” (i.e. aiming solely on reducing its emissions, not on carbon independence), “Substituting Reducers” (i.e. reducing emissions while aiming to carbon independence) and “Preservers” (i.e. not focusing on any objective—having no carbon reduction strategy).

The authors also tried to identify the antecedents to those strategies and found out, by surveying 91 major companies in the electricity sector, that all-rounder companies tended to: (1) be more prevalent in regions with more stringent regulations regarding GHG emissions (i.e. EU and Japan), (2) be greater in size than other firms (and had therefore arguably more resources to devote to such strategies) and (3) have larger absolute CO₂ emissions than companies with other strategies.

[Sprenkel and Busch \(2011\)](#) identified eight types of responses from companies to stakeholder pressures to reduce GHG emissions. These were the following: (1) reduce total emissions by changing the design of products and production processes, (2) progressively abandon GHG-intensive products and favour the development of cleaner ones, (3) communicate the organisation's efforts to decrease its carbon emissions, (4) attempt to shape future climate change regulations to accommodate them to the company's plan, (5) buy emissions credits when it is cheaper than achieving emissions reductions in the company, (6) migrate to markets where those pressures to reduce emissions are less important, (7) engage in a long-term plan to eradicate GHG emissions from corporate activities, and (8) outsource activities with a major impact on corporate emissions.

After conducting a cluster analysis on a sample of 141 large companies from GHG-intensive sectors, the authors were able to single out four generic strategies used by organisations to respond to the demands of their stakeholders regarding GHG emissions reductions. While all four types of strategies put significant emphasis on responses (1) and (3), "regulation shapers" (representing about 40% of the sample) also had a strong focus on response (4), "Pressure Managers" (about 10%) gave much importance to responses (5) and (6) and "Emission Avoiders" (20%) emphasised responses (2) and (7). "Minimalists" (about 30%) only focused on responses (1) and (3).

Moreover, the authors argued that the main stakeholders responsible for pressures to reduce firms' carbon emissions were their clients, investors, suppliers and competitors, in addition to governments and NGOs. Although it is well established that these groups of stakeholders have influence on companies' willingness to tackle their GHG emissions, it could not be demonstrated in the article that each of the four generic strategies identified were subject to different "patterns of stakeholder pressure".

3.1.2 Determinants and barriers of carbon reduction strategies

Based on previous research, [Murillo-Luna et al. \(2011\)](#) have compiled a comprehensive set of internal and external obstacles for firms to engage in environmental strategies. Those problems are listed in table 3.2.

External barriers	Associated problems
High costs of environmental technologies/services	High prices of environmental technologies; High prices of environmental services
Priority of other external matters or requirements	Other competitive pressures; Other regulatory pressures
Inadequate industry regulation	Rigidity of regulation (limited flexibility in deadlines and measures of compliance); Scarcity of information; Bureaucratic obstacles
Insufficient supply of equipment/information for environmental adaptation	Poor development of clean technologies and procedures; Lack of information about the technologies and procedures available; Uncertainty about the potential environmental and economic benefits resulting from the implementation of clean technologies
Internal barriers	Associated problems
Lack of organizational capabilities	Limited environmental motivation and preparation of employees; Inadequate top management leadership; Lack of employee involvement; Poor communication systems; Operational inertia
Lack of strategic capabilities	Lack of management commitment; Lack of research and development; Conflict with managers' personal goals; Short term planning
Lack of financial capabilities	Lack of financial resources available; High opportunity cost of environmental investment; Replacement of current technologies that are still profitable

TABLE 3.2: Problems associated to external and internal barriers to environmental proactivity
([Murillo-Luna et al., 2011](#))

The authors conducted an empirical analysis on the perceived effect of those barriers with 240 companies located in Spain. They concluded that internal barriers are generally more problematic than external barriers for companies that want to engage in environmental strategies, which was consistent with the findings of a number of previous studies.

In particular, they point to limited financial and organisational resources, opposition to innovation and technological transition, lack of employee motivation/preparation and “operational inertia” as the biggest internal challenges for those organisations. However, it is noted that these challenges being internal, it is possible for organisations to solve them by investing in relevant resources.

[Clarkson et al. \(2011\)](#) explored the factors that influenced companies’ choice to engage in environmental strategies. To do so, they conducted a large-scale longitudinal study on 242 companies from highly carbon-intensive sectors, the data covered the years 1990 to 2003.

Their conclusions indicated that companies wanting to engage in “proactive environmental strategies” must first build significant financial resources and management capabilities (as measured by R&D intensity, sales growth and enterprise value to assets in the study) to be successful.

In addition, the authors have observe that the firms which increased their environmental performance tended to reap subsequent economic gains, while the opposite was also verified.

In an analysis of the United Kingdom’s 100 largest corporations, [Okereke \(2007\)](#) identified the main “motivations” (i.e. aspects of emissions reductions having a potential impact on a company’s profitability), “drivers” (i.e. external forces pushing corporations to act on their carbon emissions) and obstacles facing companies wishing to reduce their GHG emissions.

The author identifies increased profit, development of a certain type of credibility in a changing business world (“*credibility and leverage in climate policy development*”), anticipation of long-term changes of climate change in their markets (“*fiduciary obligation*”), prevention of the future damages of a changing climate on businesses (“*guiding against risk*”) and a willingness to take ethical decisions which will ultimately benefit the reputation of the company (“*ethical considerations*”) as the most prevalent motivations of companies to manage their carbon emissions.

The main drivers identified by the author are the following: a willingness to mitigate the energy prices volatility risk on companies' bottom lines ("*energy prices*"), a need to consider the potential market impacts of climate change (e.g. changing consumer preferences towards low-carbon products and services) ("*market shifts*"), the pressure of present and future climate change regulations ("*regulation and governments directives*"), demands from (institutional-) investors for more action and transparency on emissions reductions ("*investors pressure*") and the increasing availability of low-carbon product and services ("*technological change*").

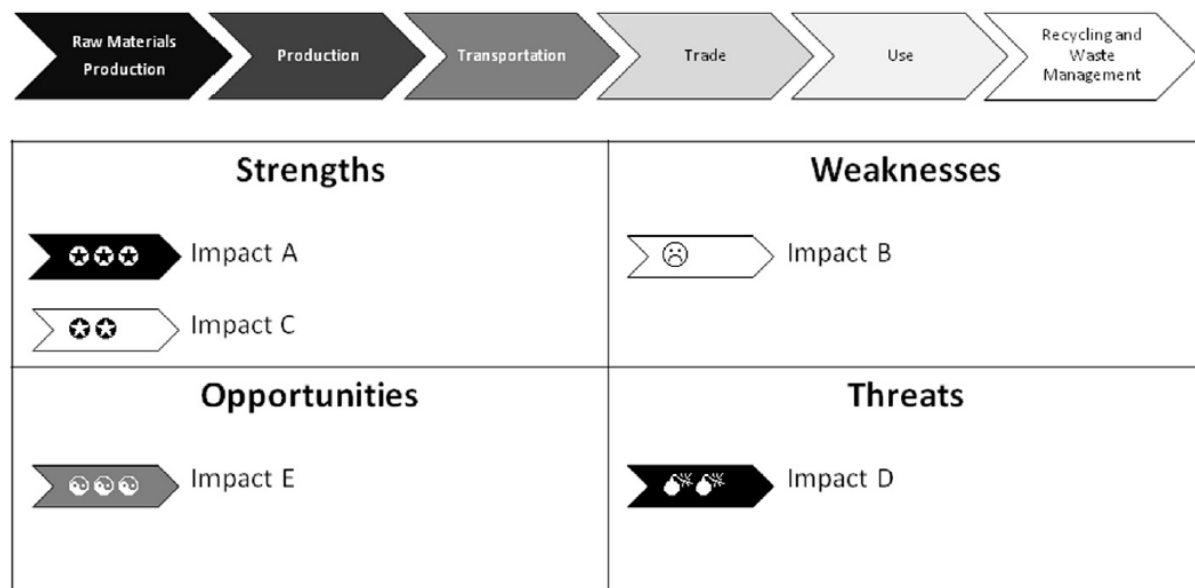
Lastly, he mentions the absence of significant regulatory incentives for GHG emissions reductions ("*lack of strong and policy framework*"), "*uncertainty about government's action*" and concerns regarding the future willingness of consumers to turn to low-carbon products and services ("*uncertainty about the marketplace*") as the main barriers for firms to engage in carbon management strategies.

3.1.3 Implementation of carbon reduction strategies

In a survey of 36 organisations, [Pesonen and Horn \(2014\)](#) found that managers consider the Climate SWOT as an effective tool to raise awareness about climate change and integrate its threats and opportunities in corporate strategies. The Climate SWOT was seen to leverage the innovativeness of managers by prompting them to think of new ideas regarding how to decrease their organisations' impacts on global warming.

The Climate SWOT was designed by combining the SWOT analysis of strengths, weaknesses, opportunities and threats that an organisation faces, with the Life-cycle Assessment (LCA) technique, which involves the identification of the environmental impacts of a product throughout the various stages of its "life".

FIGURE 3.1: The Climate SWOT (Pesonen and Horn, 2014)



To carry out a Climate SWOT analysis, companies must first perform a LCA of their products or services' present and future climate impacts and assess the significance of those impacts on a scale of one to three. Current impacts should then be classified as either strengths or weaknesses and future impacts as either opportunities or threats for the organisation, as shown in figure 3.1.

FIGURE 3.2: Climate strategy options (Pesonen and Horn, 2014)



Next, the firm should build on those insights to identify its strategic options regarding climate change, as indicated by figure 3.2. Finally, the company should design strategic plans for each identified impact on climate change.

[Boiral \(2006\)](#) considers that a climate change strategy should include three fundamental elements. First, “managerial actions” should be implemented to involve employees in the resolution of environmental issues and integrate these issues into the activities of the organisation. According to the author, this set of actions corresponds to the implementation of an environmental management system (ISO 14001 is suggested) and should include communicating of the efforts to decrease GHG emissions to the company’s stakeholders; identifying and quantifying the current GHG emissions and defining relevant reductions objectives and programmes; defining the employees’ roles and responsibilities in the implementation of the strategy, providing the necessary training and involving top management in the supervision of the strategy; embedding GHG issues into internal and external audits.

Second, appropriate “technical actions” must be taken, such as switching to renewable energies, rethinking the design of products to decrease their impacts on emissions and using compensation solutions such as the purchase of emissions allowances or the engagement in carbon offset initiatives (e.g. Clean Development Mechanism [CDM] and Joint Implementation [JI] programmes). The author underlines the importance of having a “continuous improvement” approach in this endeavour, and not rely solely on major projects or investments. In addition, Research & Development alliance with other companies might be a solution to the high costs developing cleaner technologies.

Finally, firms should not underestimate the importance of “socio-political” actions to leverage the potential of GHG reduction strategies to improve their image and legitimacy for their key stakeholders and to actively lobby regulators to increase the benefits and decrease the costs of GHG reduction endeavours.

In a 2006 report, [Hoffman et al.](#) compiled best practices regarding the development and implementation of GHG reduction strategies. The methodology presented is divided in eight steps, which are grouped in three stages. A summary of those is presented in table 3.3 below.

Carbon strategy development	Description
(1) Emission sources identification	Identify and measure direct and indirect carbon emissions
(2) Determination of risks and opportunities	Determine the risks related to those emissions; identify how demand for products and services will change as the public gets more conscious about climate change; identify how to reduce emissions better than competitors
(3) Assessment of strategic options	List the innovation possibilities and options to reduce GHG emissions; determine the impact of potential emissions reduction strategies on top and bottom-line targets
(4) Determination of objectives	Understand how to connect emissions reduction targets to business strategies; decide what targets to pursue and over which period of time
Internal concerns	Description
(5) Inventory of financial tools	List financial instruments with the potential to support emissions reductions (“emissions trading, carbon shadow pricing, lower hurdle rates, and special capital reserves”); establish their advantages and drawbacks
(6) Workforce engagement	Determine how to involve employees and managers in the emissions reduction strategy; identify drivers and obstacles to change and how to overcome resistance; understand how to integrate GHG-reducing activities to the core business
External concerns	Description
(7) Regulatory strategy formulation	Identify regulations with the potential to negatively affect one’s emission-reducing activities; explore how upcoming policies could favour one’s emission reduction strategy; understand how to effectively influence GHG regulations
(8) External stakeholders management	List critical stakeholders for the success of emissions reduction strategies; identify how to best engage them

TABLE 3.3: Stages for the development and implementation of a GHG reduction strategy
(adapted from [Hoffman et al., 2006](#))

3.1.4 Economic rationale for carbon reduction strategies

In a classic article, [Porter and Van der Linde \(1995\)](#) point out that pollution (and therefore greenhouse gases) must be seen as an inefficiency by company executives, as it generally reflects an incomplete use of materials. They underline that environmental product- and process-innovation, if carefully designed, should lead to resource productivity improvements by using inputs more efficiently and getting rid of superfluous packaging or activities in the production process, for example. This makes it possible to reduce costs and improve competitiveness and product quality while reducing a company's impact on the environment.

The authors urge managers to embrace this “dynamic mindset”, which sees environmental innovation as an opportunity to enhance competitiveness and to abandon a “static mindset” focusing on the immediate costs of complying to new environmental legislation and standards.

[Porter and Reinhardt \(2007\)](#) complement these ideas by affirming that climate change is a powerful new force that will reshape competitive markets and that, therefore, managers should consider the strategic threats and opportunities that it implies for their businesses.

In particular, firms can derive competitive advantages in two ways. On the one hand, they should identify new opportunities and threats related to changes in the climate system (i.e. temperature, weather) and to climate change regulation (i.e. which puts a price on GHG emissions), the authors call this an “outside-in analysis”. By addressing these new sets of opportunities and threats more effectively than their competitors, companies should be able to gain competitive advantages in their markets.

On the other hand, all sources of GHG emissions in their value chains should be identified, in order to establish the carbon exposure of the company (i.e. how an increase in the price of carbon emissions would affect corporate profits). [Porter and Reinhardt](#) describe this as an “inside-out analysis”. Only then can managers design plans to reduce the emissions of selected business activities. In particular, they should abandon or outsource activities that emit large amounts of emissions without creating much value for the company and reduce the carbon-intensity of highly valuable activities. The authors note that these emissions reductions will be strategic if they are hard to replicate by competitors).

[Schultz and Williamson \(2005\)](#) consider GHG management as a source of competitive advantage for companies operating within the framework of mandatory carbon cap-and-trade systems such as the EU Emissions Trading Scheme (EU ETS). They notice that these frameworks represent potential additional risks and costs for companies (i.e. due to insufficient emission credits) and emphasise the importance for firms to be able to manage these better than their competitors in order to improve their competitiveness.

In this context, the authors propose three techniques to gain competitive advantage through better carbon management. First, companies should focus on “minimising the additional costs more effectively than competitors” by e.g. diversifying their energy supply and steadily managing their carbon credits to avoid losses due to carbon prices fluctuation. Also, firms can differentiate themselves from competition by bundling carbon credits to the products they sell to clients short on carbon allowances. Finally, the most efficient enterprises may find themselves in a position to profitably sell large quantities of carbon credits, creating a new profit centre for the company.

In a 2005 article, [Hoffman](#) explore the strategic advantages for companies to achieve *voluntary* reductions (i.e. greater in importance than what relevant legislation may require) in GHG emissions. These benefits are summarised in table 3.4.

Advantage	Description
Improving operational efficiency	Achieve cost reductions by investing in buildings’, operations’ and company vehicles’ energy efficiency.
Influencing climate change policy	Anticipate the emergence of international, national and state-level climate change legislation by developing competences such as emissions measurement and carbon credits trading (e.g. through the implementation of internal carbon trading mechanisms). Influence upcoming regulations to favour policies that best fit one’s approach to emissions reductions (e.g. promote more stringent regulation which particularly weakens competitors; influence the design of emissions trading schemes to correspond to one’s internal trading system).

Diversifying sources of capital	Generate revenues by selling one's carbon allowances surplus to governments (offering incentives to carbon reductions) or other companies (within carbon trading systems).
Enhancing risk management	Mitigate risks linked to the natural consequences of global warming (e.g. rising seas, extreme weather events), financial risks arising from present and future carbon regulations (e.g. taxes, penalties and purchase of emissions credits) and changing investors' preferences (companies emitting large amounts of GHG are increasingly seen as being negatively exposed to GHG regulations).
Building organisational reputation	Emissions reductions can improve a company's image for a number of stakeholders, such as its consumers and employees, but also journalists, NGOs, communities in which plants are installed, investors, etc.
Identifying business opportunities	Companies can identify opportunities to reduce their carbon emissions while improving performance in their market (e.g. firms in biomaterials have turned away from fossil materials and embraced renewable resources such as agriculture by-products as their inputs). In addition, the increasing demand for GHG reductions is at the source of high growth in environmental technologies markets (e.g. renewable energy, CCS).
Improving human resource management	By modifying one's organisational culture in a way that engage employees in the conception and implementation of carbon reducing strategies, firms can significantly increase employee motivation, innovation and, ultimately, productivity. Other advantages include the retention and attraction of highly competent employees.

TABLE 3.4: Strategic advantages to voluntary GHG reductions (adapted from [Hoffman, 2005](#))

Bortree (2009) found out that stakeholders who were aware of an organisation's actions to minimise its impact on the environment tended to assume that its "corporate environmental performance [was] desirable, proper, or appropriate". In addition, if those environmental initiatives are solving its stakeholders' concerns, their admiration for the company is likely to increase.

3.2 Human Resources Management

The aim of this second section is to provide an overview of the HRM literature relevant to GHG emissions reduction in private companies. Similarly to the previous section, sources will be grouped into six areas of research: green human resources management (GHRM), employee training and development, recruitment and selection, employee involvement (EI) and employee empowerment (EE), performance management and appraisal and pay and reward systems.

3.2.1 Green human resources management

Renwick et al. (2013) synthesised the existing GHRM literature in order to offer a comprehensive view of the current practices available for managers to support the implementation of environmental strategies by the HR function. These practices are summarised in the following table.

Green skills development	Existing practices
Employee attraction/selection	Inclusion of environmental topics in job descriptions; development of "green employer branding" due to increasingly environmentally-concerned applicants; recruitment of those "green applicants"; inclusion of environmental issues in corporate induction and socialisation programmes
Workforce training & development	Provision of training to strengthen environmental awareness and skills and to "create an emotional involvement in EM"; environmental (tacit-) knowledge management; development of "green leadership styles"
Green staff motivation	Existing practices

Performance management systems		Inclusion of environmental indicators in performance management/appraisal practices; allocation of environmental objectives, targets and responsibilities to workers and managers; inclusion of penalties for failure to meet environmental objectives in performance management schemes
Pay/reward schemes		Allocation of monetary- and recognition-based rewards for improvements in employee environmental competencies, suggestions of green improvements; green perks; financial and fiscal incentives to promote green behaviour (e.g. use of public transport); executive pay partially based on environmental criteria
Provision of green opportunities		Existing practices
“Employee involvement”		Involvement in environmental management through “newsletters, suggestion schemes, problem-solving groups, low-carbon champions and Green action teams”
“Empowerment and engagement”		Provision of management support to foster staff engagement in environmental efforts; company support for staff environmental amelioration suggestions
Favourable culture	organisational	Development of a culture that is concerned with the company’s environmental impact
Role of trade unions in EI and EM		Shared environmental training for union members and managers; union representatives promoting environmentally friendly practices at work, involved in environmental audit and policy setting

TABLE 3.5: Overview of current Green HRM practices (adapted from [Renwick et al., 2013](#))

3.2.2 Employee training and development

[Jabbour \(2013\)](#) performed a systematic review of the environmental training literature. He notes that environmental training is popular with researchers and professionals because it is arguably the most effective HR discipline for the implementation of environmental strategies.

[Daily et al. \(2012\)](#) conducted an empirical study on 220 Mexican companies to assess the impacts of empowerment, training and teamwork on environmental performance. They found environmental training to have more effect on environmental performance than environmental empowerment, although both variables were found to be effective in the case of employees and managers.

In addition, the effect of employee training and empowerment on environmental performance was mediated by teamwork, as predicted by prior GHRM scientific work. This means that teams are better equipped than single employees to “innovate, promote, and implement environmental improvements”. Indeed, employees working in teams are encouraged to solve problems creatively and cooperatively.

[Wagner \(2011\)](#) notes that the role of training in the context of GHRM is to (1) raise awareness regarding environmental problems and (2) “support pro-environmental behaviour of individual employees”. In addition, environmental training is seen as the enabler for employees to achieve green goals in the context of reward systems.

In his analysis of German firms from the manufacturing sector, the author points out that the size of a company was the only variable significantly predicting its inclination to offer environmental training to its employees (the effect of the “quality management system” variable was only partially confirmed).

In a survey of Spanish companies from the automotive sector, [Sarkis et al. \(2010\)](#) investigated the potential mediating role of training between stakeholder pressures and the implementation of environmental strategies. From the results of their analysis, it turned out that training was a prerequisite for the firms surveyed to implement environmental practices.

Referring to the resource-based view of the firm, the authors argue that the role of training in the context of stakeholder demands for environmental action was to “develop the necessary

intangible knowledge capacities required in order to achieve effective response to pressures.” They add that in that situation, the function of environmental training is to develop the skills and motivation of employees required to implement green policies on the workplace.

In a 2006 article [Perron et al.](#) explored ways to increase environmental awareness through organisational training. This type of awareness includes understanding how changes in the natural environment affects organisational performance, what the impacts of the business on its natural environment are, what the environmental objectives and plans of their company are and how employees can participate to the success of those news strategies.

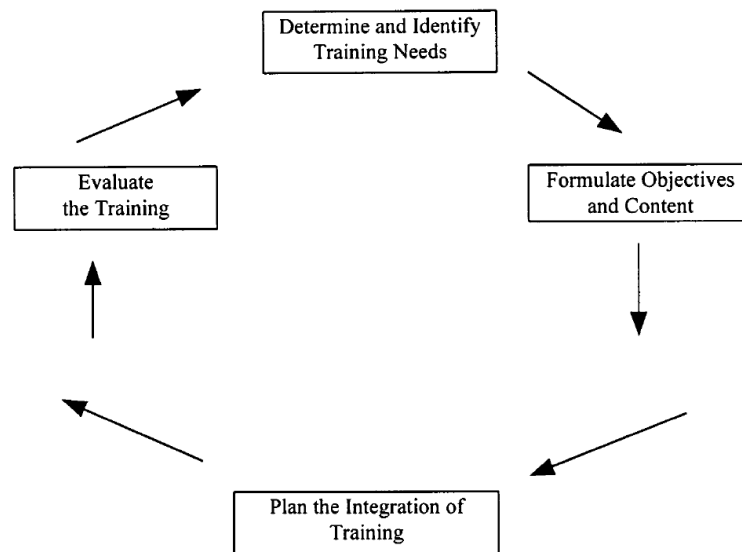
Environmental awareness is presented as crucial to overcome major barriers to the environmental transformation of firms, such as resistance to change and the rigidity of organisational cultures. Indeed, employees are usually less resistant to a change when they understand the motivations of the transformation and can develop the abilities to take part in the change process (cfr. section 3.2.4), cultivating a “sense of ownership” of that process.

It is said that HR professionals should not underestimate the importance of creating “lasting knowledge” if they want to sustain behavioural and cultural changes in organisations. Based on a case study analysis, the recommendation of the authors as to how to improve environmental training was to systematically evaluate the success of the programmes. In particular, organisations ought to evaluate the environmental awareness of employees before and after the training to ensure that it is effective.

Finally, key barriers to the effectiveness of training programmes are mentioned: unengaging teaching, content that is too complex, poor support from management towards the training initiative and insufficient employee engagement in the programme.

In a survey of 49 Australian firms, [Shaw et al. \(1999\)](#) searched for ways to optimise the conception and implementation of green organisational training. They argued that effective environmental training programmes should be based on a “systematic training cycle”, as pictured on figure 3.3.

FIGURE 3.3: “A training-cycle evaluative model” (Shaw et al., 1999)



This implies, first, analysing the training needs of the employees. On the one hand, insufficiencies in terms of environmental awareness should be identified by testing the environmental “knowledge, attitudes and awareness” of the employees. On the other hand, environmental skills needs can be determined notably by reviewing job descriptions, performance reviews, the environmental impacts of the company, its history of environmental accidents and past training programmes.

Second, the purpose and the objectives of the programme must be “concise and quantifiable”, and should clearly indicate what the participants should have learned by the end of the training. Also, previous studies have pointed at modules as being an optimal way to design such training programmes.

Third, special attention should be given to lasting knowledge and the post-training integration of the material in the organisation. To achieve this, HR professionals can resort to posters and charts on environmental performance, newsletters to update employees on the developments of the environmental programme, management support towards the new practices taught, “refresher courses” to uphold motivation and awareness of organisation-related environmental issues and green incentives and rewards schemes.

Finally, training outcomes should be evaluated to determine the effectiveness of the programmes, a widely neglected aspect of environmental training.

[Sarmiento et al. \(2007\)](#) studied the green strategies of 98 polluting firms in Portugal. They identified a relationship between environmental training and environmental innovation, suggesting that this type of training programmes could yield new ideas on how to reduce companies' environmental impacts.

[Unnikrishnan and Hegde \(2007\)](#) studied in detail 16 Indian manufacturing firms in an effort to explore the roles-, sources- and types of training in the context of green technology implementation. In their conclusions, they stress the importance of executive commitment for the success of those environmental training programmes. In particular, they should be familiarised with the content and well informed of the advantages of the courses.

Among the sources of environmental training (e.g. internal experts, external research institutions, "industry associations", consultancies and specialised providers), the suppliers of the green technologies that are being implemented represent great opportunities for companies. Indeed, the authors point to the value of a unique expertise acquired by working in similar industries, where they can collect insightful information by working with other firms.

Finally, the importance of providing LCA training to employees is underlined. This is to understand the transformations related to the environmental impacts of the inputs or products after the implementation of green technologies and make sure that these are minimised.

3.2.3 Recruitment and selection

[Jabbour et al. \(2010\)](#) define "recruitment" as a function of HR whose objective is to identify (numerous and diverse) potential applicants for positions within a company and encourage them to engage in its application process. In a GHRM context, recruiting activities will demonstrate a preference for applicants willing to solve environmental problems.

"Selection" is defined as the human resource activity whose purpose is to pick out the applicant that corresponds the most to the requirements of an available position within a company. When applied to environmental management, its role will be to choose candidates concerned with environmental issues, motivated to solve them and potentially apt to take on environmental management responsibilities.

In their article, the authors publish the results of an empirical survey of 94 Brazilian firms engaged in environmental activities. Among other things, they notice that, in general, those companies showed a preference for applicants motivated and qualified to solve environmental problems. In a complementary case study analysis of four other companies from Brazil, however, they observe that the inclusion of environmental considerations is not systematic in the recruitment and selection processes of those firms.

[Aiman-Smith et al. \(2001\)](#) studied the influence of four factors (compensation; opportunities for promotion; lay-off practices; environmental reputation) on potential candidates' attraction to a company and desire to apply for a job in that company. While environmental reputation was the strongest predictor of attraction to a company, it was surprisingly the weakest predictor of "job pursuit intentions" (the potential candidates favoured compensation aspect in this regard).

According to the researchers, this show that "being attracted to an organization and the desire to pursue a job in that organization are two different constructs, and can be predicted by different things." They note that recruiters for environmentally conscious firms should keeps this in mind when aiming to recruit environmentally concerned and motivated candidates. In particular, this finding implies that those organisations should attract potential applicants by emphasising their values for environmental protection, and then concentrate on more specific aspects of employment, such as compensation packages, during the actual selection process of candidates.

[Renwick et al. \(2013\)](#) synthesised the existing literature on green recruitment and selection. In addition to what we already mentioned above, they note that a study (Dolan, 1997) has reported that a significant share of highly qualified students would be willing to be paid less to be hired by environmentally conscious companies. In another research (Albinger and Freeman, 2000), companies with higher environmental rankings tended to attract very qualified and well educated candidates. This implies that companies seen as more environmentally friendly by the public might find it easier than other firms to hire more competent applicants.

3.2.4 Employee involvement and empowerment

[Govindarajulu and Daily \(2004\)](#) argue that employee empowerment, along with three other factors (i.e. commitment of management, feedback and review schemes and reward systems),

is an indispensable determinant of environmental performance. In the context of environmental management, employees are empowered when they are awarded the responsibility and have developed the competence to identify and solve environmental issues on the workplace.

The authors suggest to increase employee empowerment by: (1) adopting a more horizontal, less hierarchical organisational structure, in which power is more distributed and employees are able to propose and apply green practices; (2) developing employee involvement, defined as the “direct participation of staff to help an organisation fulfil its mission and meet its objectives by applying their own ideas, expertise, and efforts towards solving problems and making decisions” (Bullock, nd); and (3) forming teams of employees to carry out EI programmes, as they are particularly effective to “generate ideas, enhance learning experiences, explore issues, identify conflict and focus action to enhance understanding about why, what, how, where, and when to pursue the best practicable environmental options” (Beard and Rees (2000, p. 27), as cited by Govindarajulu and Daily (2004, p. 367)).

Empirical studies by Kaur (2011) and del Brio et al. (2007) have respectively confirmed the positive impact of employee empowerment and employee involvement on environmental performance in organisations.

Boiral (2002) reckons that the involvement of employees in environmental efforts leads to the generation of valuable tacit knowledge for organisations. The author argues that employee tacit knowledge is particularly important for three dimensions of environmental management. First, due to their practical knowledge of production process, workers are particularly apt to *detect sources of pollution* in factories and subsequently report them to environmental departments.

Second, employees working on the production lines are able to rapidly *react to emergency situations* such as an unexpected large release of pollutant. Indeed, “the identification of incidents often relies on context-specific information which calls upon the operators’ personal knowledge.”

Third, those workers can provide valuable insights regarding the *development of preventive solutions* to pollution problems. Their unique knowledge of production lines enables them to propose fixes to those processes, which are complementary to the work of engineers, focused on the design of processes on a larger level.

Of course, in order to leverage this special kind of knowledge, companies must take those workers, their ideas and suggestions seriously. Environmental departments should promote teamwork with technical departments and the sharing of ideas, in order to integrate tacit and explicit knowledge and create optimal solutions.

3.2.5 Performance management and appraisal

[Bratton and Gold \(2012a\)](#) refer to performance management (PM) as a “set of interconnected practices designed to ensure that a person’s overall capabilities and potential are appraised, so that relevant goals can be set for work and development, and so that, through assessment, data on work behaviour and performance can be collected and reviewed”. The ultimate objective of PM in organisations is to align individual performance with the strategic goals of the organisation. In this context, the measurement of key performance indicators and metrics is indeed very important.

Appraisal is defined by the same authors as a “process that provides an analysis of a person’s overall capabilities and potential, allowing informed decisions to be made for particular purposes. It is [...] central to the purpose of stimulating performance”. Appraisal most often takes place in the form of an interview between workers and their direct supervisors and expected outcomes of such a process are e.g. determining the employee’s objectives/targets, enhancing their motivation, establishing reward schemes and planning necessary training programmes and development plans.

[Govindarajulu and Daily \(2004\)](#) point to the fact that providing feedback to employees is often omitted in the context of environmental strategies. Giving feedback regarding the employees’ impact on environmental initiatives is essential to maintain their motivation towards such projects, to clarify work responsibilities and to update them on the progress of environmental programmes and their new objectives and developments.

Moreover, the authors stress that organisations should implement environmental management systems (EMS)(e.g. ISO 14001) in which the systematic measurement of environmental improvements and the identification of remaining weaknesses ought to be developed in order to satisfy the informational requirements for effective environmental performance management

and appraisal. The role of (internal and external) audits is also underlined in their article, as it provides companies with precious information regarding the performance of their EMS (as compared to external benchmarks in the case of external audits) and thus makes it possible to identify and address performance gaps. These insights can then be used to review goals and targets, and subsequently communicate those to employees.

It is also said that in order to keep employees motivated, managers should give equal importance to informal (face-to-face) and formal (written) feedback, as workers have been found to “value verbal feedback from supervisors as much as formal rewards”.

While measuring environmental performance is usually complicated, [Marcus and Fremeth \(2009\)](#) notice that 3M and other large American corporations have implemented internal audit schemes and information systems to monitor their environmental performance. What these organisations did in particular was to identify their sources of waste and other environmental impacts using LCAs (among other methods): their products and processes, factory configuration and organisational divisions were systematically tracked for various indicators of environmental performance such as the ratio of wasted material for one unit of finished product.

3.2.6 Pay and reward systems

Synthesising previous works on the topic, [Govindarajulu and Daily \(2004\)](#) mention several types of rewards (summarised in table 3.6) that companies can implement to encourage environmentally friendly practices and green product and processes improvements on the workplace.

Positive rewards	Examples
Monetary-based	Bonuses; profit-sharing schemes; other financial incentives
Non-monetary	Paid holiday; “time off from work”; privileged parking; gift cards
Recognition-based	Recognitory plaques and certificates; recommendation letters; publication of employees’ achievements; praise in internal newsletters; demonstrations of appreciation by peers and managers
Negative rewards	Examples
Non-monetary	“suspension, criticism, warnings”

TABLE 3.6: Categories and examples of environmental performance-related rewards (synthesis of [Govindarajulu and Daily, 2004](#))

While they remind of the importance to tie employees and managers’ compensation to environmental results to enhance their motivation to take part in the environmental efforts, the authors also stress that the recognition of environmental achievements is usually even more effective. Besides, it is said that although “negative rewards” are sometimes effective (but in general, less so than positive reinforcements), they present the disadvantages of fostering employee resignations and absenteeism. An even more perverse effect would be a rise in “self-protective behaviours” encouraging employees, for example, not to warn of the occurrence of environmental issues. In addition, negative reinforcement not necessarily teach employees how to avoid making the same mistakes in the future.

What is more, the need for adequate communication of new reward schemes is emphasised. The authors suggest managers to provide the details of such new plans through corporate meetings, working with videos and lecturers, for example. Finally, reward systems should be adapted to the specificities and “motivating factors” of particular corporate divisions and departments. Indeed, the effectiveness of standardised reward schemes is limited.

Surveying employees from various countries of the world, [Ramus \(2001\)](#) notes that regular management encouragement and the granting of awards for environmental performance were found

to be amongst the most critical determinants of employee eco-initiatives (e.g. environmental problem solving and green innovation).

Moreover, she mentions that in order to make line managers supportive to employees' eco-initiatives, the former must perceive that environmental policies are an integral part of their companies' business strategies. This can be done by attributing quantified environmental objectives to those managers and receive appropriate recognition from executives when they reach their goals.

[Cordeiro and Sarkis \(2008\)](#) surveyed 207 major American companies in an attempt to find out whether an explicit link between top management contracts and environmental performance is related with actual fluctuations of CEO pay arising from variations in corporate environmental performance. Indeed, one can argue that top managers have the power to “influence, support and champion” environmental projects, innovations and strategies in their companies. Therefore, from an agency theory perspective, tying their pay with the environmental performance of their firms should give them the right incentives to engage their firms in green endeavours.

Their results indicated that the firms which explicitly tied top management contracts to environmental performance had a relationship between their executive officers' compensations and their environmental performance. However, this relationship was significant only for some indicators of environmental performance. In particular, there was no significant connection between “environmental performance measured relative to industry and CEO compensation”. The authors conclude that the compensation committees of those firms might actually design such contracts in order to boost their companies' legitimacy, as corporations are increasingly expected to reduce their impacts on their natural environment.

Nevertheless, they note that, for lower-level managers, a previous study (Russo & Harrison, 2005) observed that companies which had tied their managers' contracts with environmental indicators tended to perform better than other companies on environmental criteria.

Chapter 4

The Role of Strategic Management in Achieving Corporate GHG Emissions Reductions

In this chapter, we will examine the potential contributions of the field of strategic management to carbon emissions reductions in companies. In particular, our inquiry will address three questions, as defined in chapter 1 we will first propose strategic options to address corporate GHG emissions (*“What are the different modalities of carbon-reducing strategies?”*), then we will explore how managers can generate support for those strategies (*“How can companies support the implementation of their climate change strategies?”*) and finally, we will study how those carbon strategies may help the firm build or strengthen competitive advantages (*“How can GHG-reducing strategies help companies to gain competitive advantages?”*).

Based on the literature presented above, complementary sources and personal input, we will proceed to a systematic analysis of the effectiveness and limitation of each lever that we identified, before proposing key performance indicators (KPI) for managers to monitor the performance of those levers in practice.

4.1 What are the different modalities of carbon-reducing strategies?

Based on the literature presented above, we determined that three levers (presented in table 4.1) could be used to reduce GHG emissions through the development of corporate strategies. In this section, we present and discuss each of those levers.

Lever	Description
GHG Reductions	Innovation (products/processes); Other energy inefficiencies in the company's value chain
GHG Compensation	Emission trading (internal/external); Carbon offset (CDM, JI, others)
Company reorganisation	Abandon carbon-intensive activities (plants, products, processes); Outsource carbon-intensive activities; Develop new low-carbon activities (new products/ new markets)

TABLE 4.1: Modalities of corporate GHG reduction strategies: synthesis of existing literature

4.1.1 GHG Reductions

The first lever that we identified was GHG Reductions, i.e. the reduction by a company of its existing (scope 1-3) carbon emissions by (1) improving existing products and processes to make them less carbon-intensive (Kolk and Pinkse, 2004, p. 312) (e.g. designing more fuel-efficient cars by reducing friction between engine components and using recycled materials in their manufacturing process, as mentioned in Volvo Car Group (2012, pp. 15, 18). In this regard, Hoffman (2005, p. 35) notes that the production of recycled aluminium requires 20 times less energy than producing the material through mining activities), by (2) addressing other energy inefficiencies in the company's activities (Enkvist et al., 2008, p. 27) (e.g. modernising the facilities' insulation, HVAC or lighting) and by striving for further emissions reductions in their supply chain (i.e. partnering with current suppliers and clients or switching to more carbon-efficient ones) (Enkvist et al., 2008, p. 27) (Kolk and Pinkse, 2005, p. 10).

Effectiveness

This lever has the advantage of potentially addressing the company's full scope of GHG emissions (i.e. emissions scopes 1-3 following the EPA's classification introduced in section 1.2). Indeed, by improving energy efficiencies and existing products and processes, its direct and indirect emissions can be respectively tackled, leading to a potentially large reduction the firm's carbon footprint. Moreover, addressing plants' and offices' energy efficiencies is a relatively easy task and can represent significant energy costs reductions in addition to yielding large emissions reductions (Enkvist et al., 2008, p. 27) (Sprengel and Busch, 2011, p. 355). These decreasing costs are even complemented by additional revenues related to the selling of carbon credits for companies operating in carbon trading schemes. Another advantage of this is to reduce the company's financial vulnerability to energy prices fluctuation (Okereke, 2007, p. 481).

Limitations

On the other hand, a major limitation of this lever is that improving the carbon efficiency of existing products and processes might require specific organisational capabilities, including adequate R&D competences and an environmentally-knowledgeable workforce able to identify emission-reducing opportunities (Murillo-Luna et al., 2011, p. 1419). Of course, these measures might also require the availability of large financial resources to invest in product development, transformations of production processes and renewal of facilities' equipment.

Key Performance Indicators

When undertaking emission reduction programmes, managers can monitor their effectiveness by defining key performance indicators such as the carbon footprint of their products relative to that of the previous year. Such measurements can be done with LCA tools. We believe that measuring this indicator as a percentage of what it used to be in the previous year should put pressure for further reductions, provided that the companies that implement those types of reductions set ambitious continuous improvement goals in terms of carbon intensity. Other types of relevant indicator for corporate GHG reductions would be the average energy consumption of the company's facilities, or the percentage of renewable energy in the energy supply mix of the organisation.

In summary: $\frac{\text{product carbon footprint}}{\text{carbon footprint Y-1}}$ (1. 1) ; $\frac{\text{facility energy consumption}}{\text{facility energy consumption Y-1}}$ (1. 2) ; $\frac{\text{renewable energy consumption (KWh)}}{\text{total energy consumption (KWh)}}$ (1. 3)

4.1.2 GHG Compensation

GHG Compensation was the second lever for GHG reduction strategies that we distinguished. Many large industrial companies and airlines in Europe are now obliged to take part in the EU ETS, which limits the quantity of emissions that can be emitted by all participating firms and allows them to purchase (or sell) emissions allowances, compensating for their exceeding emissions ([European Commission, 2015b](#)). Corporations that are not part of a mandatory emission trading system can either take the initiative to set up a private scheme with other firms willing to reduce their carbon emissions, or implement an internal carbon market, voluntarily limiting their corporate divisions' emissions and allowing them to trade allowances ([Kolk and Pinkse, 2005](#), p. 10). Also, all companies can compensate their GHG emissions by investing in carbon offset projects such as the Clean Development Mechanisms and Joint Implementation programs set up by the Kyoto Protocol ([Kolk and Pinkse, 2005](#), p. 10), allowing corporations to invest in emission reducing projects in developed (JI) or developing countries (CDM).

Effectiveness

The main advantages of carbon compensation mechanisms are their cost effectiveness ([Gilbertson and Reyes, 2009](#), p. 10) and ease of implementation. Indeed, purchasing emissions allowances or investing in carbon offset projects makes a lot of economic sense for companies when the price of compensating carbon emissions is lower than undertaking carbon reductions by themselves. Also, such measures are very easily implemented, as they basically come down to a transaction between the compensating company and the supplier of emission allowances.

Limitations

Emissions compensations, however, have also their limits. Obviously, their usage does not imply any actual emission reduction (of emissions scopes 1,2 or 3) in the company that purchases them, they only represent emissions *transfers* between companies or within a single company

(Kolk and Pinkse, 2005, p. 9). Moreover, the effectiveness carbon compensation mechanisms—and particularly that of the EU ETS—have been questioned for years. Critics of the EU ETS, by far the biggest cap-and-trade mechanism in the world (Hepburn, 2007, p. 380), point at its failure to give proper incentives for actual emissions reductions (Gilbertson and Reyes, 2009, p. 34) due notably to very low prices of carbon allowances caused by an oversupply of those emission credits on the market (Hepburn, 2007, p. 384).

Key Performance Indicators

Hypothesising that the goal of compensating companies is to maximise emissions compensations while mitigating the price volatility risk of allowances purchased in emissions trading schemes, a first key performance indicator for those companies would be the share of compensated emissions relative to total emissions. Also, assuming that the prices of emissions credits purchased through carbon offset projects are less volatile than those of emission allowances bought on trading schemes markets, another key performance indicator for compensating companies would be the share of carbon credits bought in emissions trading schemes relative to the sum of all emissions credits purchased.

In summary: $\frac{\text{compensated emissions}}{\text{total emissions}}$ (2. 1) ; $\frac{\text{carbon credits purchased through cap-and-trade schemes}}{\text{amount of purchased carbon allowances}}$ (2. 2)

4.1.3 Company Reorganisation

The last lever that we identified in the GHG reduction strategies literature was what we called “company reorganisation”. We found that firms could reduce their carbon footprints by either abandoning/selling carbon-intensive ventures (Sprengel and Busch, 2011, p. 354) (Enkvist et al., 2008, p. 28), outsourcing those activities to a more carbon-efficient company (Sprengel and Busch, 2011, p. 355) (Kolk and Pinkse, 2005, p. 10) or developing new low-carbon activities (Enkvist et al., 2008, p. 30) i.e. developing new products, potentially to target unknown markets for the company.

Effectiveness

If successful, those transformations have the potential to yield considerable emissions reduction and to transform big carbon emitters into companies ready to face the likely consequences

of climate change on business, notably in terms of market transformations (i.e. development of low-carbon product markets, changing consumer tastes) and regulatory environment (i.e. increasingly stringent regulations and penalties on GHG emissions).

Limitations

Such manoeuvres, however, can indeed be extremely risky and require considerable capital investments. Abandoning entire business activities, from a single product to a whole business unit, represents a big gamble for a company as it implies to let go of an existing market share, which has to be compensated for by the development and successful marketing of more carbon efficient products. Again, this requires hardly acquired organisational capabilities, such as highly qualified R&D staff, marketing experts and HR professionals and company executives able to manage the considerable resistances to change (arising, for instance, from the necessity of replacing a share of the existing workforce, adapting the company's culture and developing new employee competences) usually observed in large organisational transformations.

Key Performance Indicators

Assuming that the goal of companies undertaking such reorganisations in order to achieve GHG emissions reductions is to increase the relative importance of low-carbon products and services in their business, they might take into consideration key performance indicators such as the share of revenue generated by low-carbon products and services relative to the total revenues of the company. Those firms could also monitor the increase in sales of their new, low-carbon solutions, since they need to make up for large up-front investments.

In summary: $\frac{\text{revenues from new low-carbon products/services}}{\text{total revenues}}$ (3. 1) ; $\frac{\text{sales of low-carbon products/services (EUR)}}{\text{sales of low-carbon products/services Y-1 (EUR)}}$ (3. 2)

4.2 How can companies support the implementation of their climate change strategies?

From the review of literature that we conducted, we identified that two complementary levers were critical for the implementation of corporate climate change strategies, as presented in table 4.2 below. This section consists in the presentation and examination of those levers.

Lever	Description
Leveraging internal support	Workforce engagement (e.g. employee training and involvement in emissions reduction efforts, executive support for GHG strategies, change management)
Leveraging external support	Management of regulatory process; securing support from external stakeholders

TABLE 4.2: Supporting the implementation of emissions reduction strategies: synthesis of existing literature

4.2.1 Leveraging internal support

We first identified the need to leverage the internal support of the organisation to support the implementation of climate change strategies. It appeared clearly in the literature that obtaining the support of the employees towards emissions reductions strategies was essential for their success (Boiral, 2006, p. 326). This can be achieved by a number of means, including: providing training to (a) improve the awareness of employees regarding the science of climate change and its potential consequences on businesses (Wagner, 2011, p. 159)(Perron et al., 2006, p. 553) and (b) acquiring the skills and competences to use the necessary technologies and equipment for emissions reductions; involving employees in emission reduction efforts (del Brio et al., 2007, p. 513) and encouraging them to propose solutions to existing carbon emissions (Kaur, 2011, p. 217); getting the support of executives for climate change strategies (Hoffman et al., 2006, p. 37) and managing the change process underlying those efforts.

Effectiveness

Engaging the workforce is almost an absolute necessity for the successful implementation of GHG reduction strategies in private companies (Hoffman et al., 2006, p. 35). Ultimately, the success of the implementation of such a strategy depends on the employees of the company, who are going to be responsible for the development of low-carbon products and services and who will be a critical source of information regarding potential emissions reductions (Perron et al., 2006, p. 552). For these reasons, the efforts described in the paragraph above must be at the center of the attention of corporate leaders willing to engage in a deep decarbonisation

of their companies. Indeed, most of the actions we described will be the responsibility of the firm's HR department, as it mainly involves training and engaging the workforce. Chapter 5 will be dedicated to an in-depth analysis of these critical human resource practices for the implementation of enterprise GHG-reducing strategies.

Limitations

Business leaders must keep in mind, however, that organisational change management endeavours are particularly hard to conduct. In fact, general surveys indicate that around 65% of such change projects fail (Ashkenas, 2013). Climate change strategies, potentially implying the management of large organisational reorganisations such as the abandonment of excessively carbon-intensive activities (as we saw in section 4.1) are clearly not immune to failure either. To mitigate this risk of failure of change management processes, some argue that such undertakings should never be considered as mere ad-hoc HR projects by the organisation. Instead, Ashkenas argues that all managers must be included in change management endeavours, be knowledgeable about the details of the plan and be held accountable for such programmes to be successful.

Key Performance Indicators

If we posit that the objectives of companies, when undertaking change management projects related the implementation of climate change strategies, are to (a) limit the number of employees being laid-off as a result of the need for new types of competences and to (b) control the cost of the project (which can quickly rise, notably due to staff training requirements), we can think of two key success factors for such projects. The success of change management projects can be assessed, first, by the ratio of effective employee dismissals related to the change process on the maximum number of dismissals agreed upon before the start of the project. Second, the total cost of change management efforts can be measured against the budgeted expenses for the project.

In summary: $\frac{\text{employee dismissals related to change process}}{\text{agreed maximum number of dismissals}}$ (4. 1) ; $\frac{\text{cost of change management efforts}}{\text{budgeted expenses for the change management project}}$ (4. 2)

4.2.2 Leveraging external support

Research also pointed at the importance of leveraging external sources of support for the implementation of climate change strategies to be successful. This can first be done by means of managing the greenhouse gases regulatory process. In particular, firms can lobby regulators to take decisions in favour of emissions reductions in business (Boiral, 2006, p. 326) (e.g. grant subsidies for the purchase of equipment such as solar panels; develop mandatory carbon trading schemes) or oppose regulations negatively affecting emissions reductions initiatives by private enterprises (e.g. granting subsidies for fossil fuel extraction, keeping prices low for such GHG-intensive sources of energy; relaxing existing regulation on carbon emissions). Second, the support of critical external stakeholders such as the firm's potential investors and clients and its suppliers should also be gained (Hoffman et al., 2006, p. 51).

Effectiveness

Effective support of external stakeholders and favourable regulation can have potentially massive impacts on the implementation process of GHG reduction strategies. Indeed, supportive climate change regulation such as stricter emission quotas for industrial activities makes the implementation of a GHG reduction strategy a quasi-necessity for companies to avoid substantial fines and penalties. In the case of publicly owned companies, potential investors must back GHG reduction plans if those are to be implemented (Hoffman et al., 2006, p. 54). As for any main strategic decision, if investors are strongly against a proposed emissions reduction programme, a decrease in the company share price is to be expected, having potentially large consequences on the firm's capital stock. Suppliers' support, in the form of emission reduction in their own production process is also a precious asset for firms aiming to decrease their products' carbon footprints (Hoffman et al., 2006, pp. 58-59). Finally, demands from clients for less carbon-intensive products or services is crucial (Hoffman et al., 2006, p. 53), as it constitutes an extremely strong economic argument for a company willing to implement climate change strategies. More generally, Gailly (2014, chap.3, p. 4) notes that having legitimacy for its principal stakeholders is one of the three fundamental requirements for the survival of firms, along with a distinctive business model and an ability to adapt to its environment.

Limitations

This lever, though, has its limitation. Although a firm (depending on its size and financial resources) might have a certain control on its exterior environment, being able to successfully influence the regulatory process (especially at the national or international level) is never guaranteed. Also, the lobbying of regulation at most levels is usually performed by trade associations instead of individual companies, in order to carry more negotiation power (Enkvist et al., 2008, p. 33). The problem with this is that conflicting interests within trade associations can prevent lobbying for legislations fostering emissions reductions (Hoffman et al., 2006, p. 56).

Key Performance Indicators

Key performance indicators with regard to the obtaining of external support for the implementation of climate change strategies can be the change in emissions quotas over the last three years, the carbon footprint variation of suppliers' products as a percentage of the previous year and the share of low-carbon products' revenue on total yearly sales income, as an indicator of consumer support.

In summary: $\frac{\text{industry's total emissions quota (current)}}{\text{industry's total emissions quota Y-3}}$; (5. 1) $\frac{\text{suppliers' products average carbon footprint}}{\text{suppliers' products average carbon footprint Y-1}}$ (5. 2) ;

$\frac{\text{revenue from low-carbon products}}{\text{total sales income}}$ (5. 3)

4.3 How can GHG-reducing strategies help companies to gain competitive advantages?

This last section will present and analyse the four levers that we identified in the literature to build competitive advantages while pursuing GHG reduction strategies in corporations. A summary of those options is presented in the table below.

Lever	Description
Product differentiation	Differentiate company's products by developing low-carbon alternative to existing products
Influencing climate change regulation	Weaken competitors by lowering GHG emissions quotas; increase barriers of entry to the industry by passing more stringent carbon regulations; participate to the development of cap-and-trade mechanisms
Carbon emissions trading	Develop an expertise in the growing trade of carbon allowances
Improved corporate reputation	Communicating emissions reductions to key stakeholders to enhance the reputation of the company

TABLE 4.3: Gaining competitive advantages through carbon-reduction strategies: synthesis of existing literature

4.3.1 Product differentiation

Product differentiation is one of the levers we identified for companies to obtain competitive advantages while engaging in GHG reduction strategies. Indeed companies can, in their efforts of reducing carbon emissions, attempt to develop hardly replicable low-carbon alternative to existing products and address growing demands for such alternatives. [Hoffman \(2005, p. 35\)](#) mentions the case of DuPont, which has modified the design of its clothing material products to replace their fossil-fuel based raw materials with organic and therefore renewable inputs.

Effectiveness

Advantages of product differentiation through carbon efficiency includes being able to tap the potential of fast-growing markets for low carbon products and services ([Hargadon, 2011](#), pp. 5-6), to charge a price premium if the carbon efficiency feature of the product is not easily replicable by other companies and to potentially position oneself as a first-mover in developing markets for low-carbon solutions, which can lead to “product leadership, greater market share, revenue growth, and influence over the policies and standards that will shape the markets in the future”

(Hargadon, 2011, p. 9). In short, the main advantage such a product differentiation is to have the potential of being highly profitable.

Limitations

On the other hand, obtaining a competitive advantage through the differentiation of low-carbon products on the marketplace is easier said than done. First, firms aiming to develop low-carbon alternatives to existing products in mature markets (e.g. automobiles, ICTs, construction) are likely to face significant barriers to entry for their products, such as long established customer and business relationships, existing regulations and cost advantages (Hargadon, 2011, p. 13). Also, low-carbon innovations face particularly important political and commercial uncertainties. Entrepreneurs cited uncertain regulations (e.g. mandatory emissions reductions, financial incentives, subsidies) and hardly predictable consumer reaction to the introduction of low-carbon products (Hargadon, 2011, p. 15).

Key Performance Indicators

Assuming that the goal of companies aiming to acquire a competitive advantage by introducing low-carbon alternative to traditional products is for those alternatives to be profitable and commercially successful, a first potential key success factor for this lever would be the ratio of the low-carbon product's profitability on the profitability of its (or its competitors') alternative, high-carbon product. Also, the market share of those low-carbon products would be a good indicator of its commercial success.

In summary: $\frac{\text{low-carbon product/service's profitability}}{\text{alternative high-carbon product/service's profitability}}$ (6. 1) ; $\frac{\text{low-carbon product/service's sales (EUR)}}{\text{total size of the market (EUR)}}$ (6. 2)

4.3.2 Influencing climate change regulation

Another lever mentioned in the literature to obtain competitive advantages while conducting carbon emissions reduction plans is the ability to influence greenhouse gases regulations (Hoffman, 2005, p. 28).

Effectiveness

Developing such an expertise may help companies to increase their competitiveness through a number of ways. For instance, a firm that has successfully and significantly reduced its carbon footprint may prompt regulators to decrease emissions quotas (Gilbertson and Reyes, 2009, p. 9) allowed in its market to its own levels of emissions, effectively putting its competitors under pressure and under the threat of being penalised by the authorities (Hoffman, 2005, p. 30) (Hoffman et al., 2006, p. 47). Another effect of lobbying to reduce emissions standards in an industry is that it leads to higher barriers of entry in this industry, reducing the competitive pressure for the incumbent firms (Boiral, 2006, p. 322) and therefore potentially keeping profits high. Finally, firms that have anticipated climate change regulation by having implemented internal emissions trading schemes between their business divisions may try to influence negotiations aiming to develop external cap-and-trade mechanisms in order for their own internal schemes to be used as benchmarks (Hoffman, 2005, p. 30).

Limitations

Nevertheless, there are some limits to this lever. No matter how hard they try, firms can only have influence on regulatory processes. Given that companies stay within their legal frameworks, actual control on those processes is impossible as market authorities are supposed to promote competition, and not to serve special interests. Also, there are limits to how companies can influence regulatory decision making without facing corruption charges.

Key Performance Indicators

If we posit that the objective of firms engaging in GHG lobbying activities is to bring emissions quotas as close as possible to their own levels of emissions, a key success factor for those companies would be the ratio of current GHG emissions quotas for the industry on the firm's own emissions levels. Another possible indicator could be the total amount of fines for non-compliance with GHG regulations in the industry.

In summary: $\frac{\text{current industry's GHG emissions quotas}}{\text{company's emissions levels}}$ (7. 1); amount of fines for non-compliance with GHG regulations in industry (EUR) (7. 2)

4.3.3 Carbon emissions trading

For companies inside carbon trading schemes, developing the ability to steadily generate additional revenue by selling exceeding carbon allowances resulting from an ability to keep emissions reductions below quotas was also cited as a source of competitive advantage in the literature (Hoffman, 2005, p. 31) (Schultz and Williamson, 2005, p. 386).

Effectiveness

With carbon-trading schemes designed to progressively reduce emission allowances (European Commission, 2015a) for participating companies in order to continuously drive the price of those allowances up (Gilbertson and Reyes, 2009, p. 31), being able to be a regular seller of carbon credits to other companies may result in substantial increases in revenues (Enkvist et al., 2008, p. 29). Also, as carbon markets are bound to dramatically expand in the future (Schultz and Williamson, 2005, p. 386) (Hepburn, 2007, p. 387), developing an early expertise in the trading of GHG allowances might be an interesting opportunity for companies willing to tap the future potential of those markets.

Limitations

However, sustaining this ability in the long run might be problematic, as the necessary condition this is to constantly keeping carbon emissions below quotas. Indeed, this may be possible to achieve at first, when the “low-hanging fruits” (i.e. easy and inexpensive emissions reductions such as lighting technology upgrades) type of emissions reductions are still an option. However, marginal abatement costs (MAC) most often increase as GHG reduction are achieved (Morris et al., 2012). Therefore, when companies start having to spend large amount of money to achieve further emissions reductions, selling the resulting emissions allowances may not be profitable any more, and those former selling companies will become buyers of carbon credits. In addition, current emissions caps levels on carbon markets are arguably not putting enough pressure on the supply of emissions allowances, resulting in generally low carbon prices (Hepburn, 2007, p. 387). Consequently, incentives for companies to reduce emissions and sell resulting surplus carbon allowances could be more important.

Key Performance Indicators

As the objective of firms hoping to secure a competitive advantage through carbon trading is likely to be the maximisation of that additional source of revenue, a possible key success factor would be the ratio of yearly carbon trading revenue on the yearly total income of the firm. Another relevant KPI would be the ratio of the firm's emissions on the its emissions quota, since this strategy requires to generate surplus allowances by keeping emissions below quotas.

In summary: $\frac{\text{carbon trading revenue}}{\text{total income}}$ (8. 1); $\frac{\text{total carbon emissions (CO2e)}}{\text{company's emissions quota (CO2e)}}$ (8. 2)

4.3.4 Improving corporate reputation

We also noticed that the literature stresses the importance of enhanced reputation for companies reducing carbon emissions (Hoffman, 2005, pp. 34-35) (Boiral, 2006, pp. 322), or engaging in environmental initiatives in general (Bortree, 2009). Advantages of a good organisational reputation include a more efficient workforce, better relationships with suppliers and superior consumers attraction to a firm's products (Roberts and Dowling, 2002, p. 1079).

Effectiveness

Roberts and Dowling (2002) found that good corporate reputations represent a strong competitive advantage, as they are intangible and thus hard to replicate for competitors and because they are in general related to superior financial performances over time.

Limitations

Limitations exist for this lever. For instance, communicating emissions reductions will in most cases not result in superior organisational reputation alone. There are other constituents of reputation of a company, such as the sponsoring of public events (Roberts and Dowling, 2002, p. 1078). Thus, these other elements should also be addressed by companies wanting to build their reputation. Hoffman (2005, pp. 35) also notes that a firm's reputation is very hardly measurable, making this lever quite difficult to monitor and control.

Key Performance Indicators

Since measuring reputation in itself is problematic, firms can monitor their efforts to improve their reputation by tracking the number of sustainability newsletters and reports they publish for their stakeholders, the number of visits recorded on the CSR section of the company's website or the number of presentations they give regarding their emission reductions efforts.

In summary: total number of sustainability newsletters/reports published (9. 1) ; total number of visits on website's CSR page (9. 2); total number of presentations/conferences given on emissions reductions efforts (9. 3)

4.4 Key takeaways

Through our analysis of the potential contributions of strategic management to strategies aiming to reduce greenhouse gases emissions in private companies, we found that:

- those strategies could take the form of (1) carbon efficiency improvements of the company's products and processes, and on the workplace; (2) GHG compensation plans using cap-and-trade schemes or CDM/JI mechanisms; (3) strategic reorganisations of firms in which carbon-intensive activities are abandoned or outsourced and new low-carbon products and services are developed.
- for those strategies to be successful, the support of internal (i.e. employees) and external (e.g. regulatory authorities, investors, clients and suppliers) stakeholders should be secured.
- such strategies could help companies create or develop competitive advantages by (1) offering low-carbon alternative to existing products, a form of product differentiation; (2) lobbying regulators to impose stricter carbon emissions in their industry, weakening unprepared competitors and increasing barriers to entry for potential new actors; (3) developing an expertise in the trade of carbon allowances; (4) communicating their efforts to decrease their carbon footprint and therefore enhance their reputation, as perceived by key stakeholders.

Chapter 5

Analysing the Contributions of Human Resources Management to Carbon Emissions Reductions

This chapter will be dedicated to an analysis of the possible contributions of the human resources management field to the implementation of climate change strategies in private firms. Our investigation will again be centred around three interrogations defined in the introduction: first, we will seek to determine how companies can equip their employees with the necessary skills and knowledge for climate change strategies (*“How can companies prepare their workforce for the various changes inherent to GHG reduction strategies?”*), then we will explore how those firms can foster the active participation of their employees to their emissions reduction efforts (*“How can companies encourage their employees to actively participate in their emissions reductions efforts?”*) and finally, we will analyse the potential methods to manage employee performance while pursuing carbon emissions reduction goals (*“How can companies control the performance of their employees in the context of a climate change strategy?”*).

Our methodology for evaluating each lever that we identified will be similar to that of chapter 4.

5.1 How can companies prepare their workforce for the various changes inherent to GHG reduction strategies?

Two levers were identified in the literature to prepare employees to the various requirements of carbon emissions reduction strategies. Indeed, for those strategies to be successful, employees need to develop new knowledge (e.g. regarding the impact of their company on climate change) and learn new tools such as life cycle assessment methods. They are summarised in table 5.1 and are discussed in this section.

Lever	Description
Employee training	Environmental awareness training; Environmental skills training
Recruitment and selection	Attraction of environmentally concerned candidates; Selection of applicants with required environmental skills

TABLE 5.1: Preparing the workforce for the implementation of climate change strategies: synthesis of existing literature

5.1.1 Employee training

Providing training to employees is the first lever that we identified in the literature to equip employees with the necessary skills and knowledge to participate in GHG emissions reduction programmes. As noted above, the purpose of employee training in the context of environmental endeavours is dual (Shaw et al., 1999, p. 142). The first aim of training programmes should be to *raise awareness* on environmental issues, that is, to understand the potential negative effects of climate change on the firm’s performance, the contribution of the company to the warming of the planet (i.e. its current GHG emissions), what its plan is to mitigate this adverse impact and what the role of employees is in this organisation-wide effort (Perron et al., 2006, p. 553-554). The second objective of environmental training in the context of climate change strategies is to *provide the competence and know-how* for employees to participate to emissions reductions projects and in general, to “complete their jobs in an environmentally responsible manner” (Shaw et al., 1999, p. 142).

Effectiveness

Advantages of environmental training programmes are numerous and include enhancing environmental performance (Daily et al., 2012, p. 642) and innovation (i.e. leading employees to suggest improvements leading to emissions reductions) (Sarmiento et al., 2007, p. 925). More specifically, environmental awareness trainings have been identified as essential to produce the necessary changes in organisational cultures to engage in environmental strategies and to reduce resistance from employees against the transformations required by those strategies (Perron et al., 2006, pp. 553-554). Reduced employee turnover, enhanced work motivation, satisfaction, pride and “ability to attract high achieving graduates” are other benefits of green awareness programmes for companies (Perron et al., 2006, p. 554).

Limitations

A major limitation to this lever is the high costs of enterprise training (Miller, 2014) (Cermak and McGurk, 2010, p. 108), which implies that a great share of small and medium enterprise may not afford to provide necessary training for carbon emissions reductions to their employees (Wagner, 2011, p. 167). Moreover, effectively conducting training programmes is a very delicate task, as many potential obstacles can prevent the good delivery of the content to employees. Failure is bound to occur if employees are not motivated enough by the training, and that must be prevented by ensuring that managers grant visible support to the programme and that the content is not too complex and delivered in an engaging way (Perron et al., 2006, p. 559).

Key Performance Indicators

The existing literature greatly underlines the importance of evaluating the effectiveness of training programmes. To do so, researchers prompt companies to assess the environmental knowledge of employees prior to the programme in order to establish training needs and to reassess those competences after a certain period of time following the training (Perron et al., 2006, p. 560) (Shaw et al., 1999, p. 141). In this context, firms engaging in climate change strategies should compare the performance (e.g. on written tests) of employees before and after conducting training programmes on climate change (awareness) or on emissions reductions in practice

(skills and know-how). A key performance indicator of the effectiveness of such training programmes would therefore be the average grade variation to those tests before and after the training programmes. Companies can also assess the effectiveness of carbon emissions training by measuring desired outcomes, for instance the increase in employee reports of GHG emissions in the firm's production process or facilities.

In summary: $\frac{\text{average grade to emissions reductions test before training}}{\text{average grade to emissions reductions test after training}}$ (10. 1); $\frac{\text{number of employee reports of emissions sources}}{\text{number of employee reports of emissions sources Y-1}}$ (10. 2)

5.1.2 Recruitment and selection

The second lever for the sourcing of employee skills and knowledge about emissions reductions that we identified is related to the hiring activities of firms. We found in the literature that recruitment and selection of new employees could support companies' climate change strategies in two steps. First, in their efforts to attract applicants for vacant positions, companies should indicate their preference for candidates demonstrating genuine concerns about climate change and environmental issues in general (Jabbour et al., 2010, p. 1057). Second, while selecting candidates to join and work in their organisations, firms should pick applicants showing a commitment to solve environmental issues—in particular, global warming—and able to contribute to the emissions reduction plan of the company (Jabbour et al., 2010, p. 1057).

Effectiveness

There are several advantages for companies openly aiming to recruit environmentally concerned candidates. Not only are those companies likely to attract a particularly important share of highly qualified applicant, these are even bound to accept working for such an environmentally conscious company for a lower salary (Renwick et al., 2013, p. 3).

Limitations

However, as Aiman-Smith et al. (2001, p. 232) noted, potential candidates might be strongly attracted by firms showing great concerns for environmental issues but, at the same time, not willing to work for those companies. This rather paradoxical finding stresses that key success

factors for the attraction and the selection of potential employees can be different and that companies should not base their entire recruiting strategy on the promotion of their environmental efforts. Other factors, such as pay or other elements of the compensation packages, should not be neglected by recruiters to hire high-potential candidates (Aiman-Smith et al., 2001, p. 233).

Key Performance Indicators

Assuming that the objectives of organisations willing to decrease their carbon footprint are to attract the highest number of applicants per vacant position and to hire the candidates that they have identified as most qualified for those positions (Jabbour et al., 2010, p. 1057), we can think of two performance indicators for recruiting and selection policies. Companies can, for instance, monitor the average number of applications they receive for vacant position and the ratio of selected applicants accepting their job offers.

In summary: $\frac{\text{job offer acceptances}}{\text{total of job proposals to applicants}}$ (11. 1); Average number of applications received per vacant position (11. 2)

5.2 How can companies encourage their employees to actively participate in their emissions reductions efforts?

Employee involvement and empowerment were identified as complementary levers to support the participation of employees to the reduction of companies' carbon footprints. Table 5.2 summarises those levers and the present section examines their advantages, limitations and proposes potential key performance indicators for managers to track their effectiveness in real-world applications.

Lever	Description
Employee involvement and empowerment	Involving employees in efforts towards organisational goals; Granting employees the necessary autonomy and developing required skills for environmental improvements

TABLE 5.2: Encouraging employees to participate in emissions reductions efforts: synthesis of existing literature

Employee involvement and empowerment

Employee involvement and empowerment are two complementary approaches empowering employees to have a positive contribution to the reduction of GHG on the workplace. On the one hand, “employee empowerment” refers to the idea of developing workers’ skills and granting them the necessary autonomy (i.e. responsibilities, trust) in order for them to be able to identify emissions-related problems in the workplace and (propose ways to) solve those issues (Govindarajulu and Daily, 2004, p. 367). On the other hand, the aim of employee involvement is to involve all employees in the efforts of the organisation to reach its objectives (here, the reduction of carbon emissions) by leveraging their creativity and know-how (Bullock, nd).

Effectiveness

In general, EE and EI have been associated by a number of studies to increased environmental performances (Govindarajulu and Daily, 2004, p. 367)(Kaur, 2011, p. 217)(del Brio et al., 2007, p. 514). In particular, the importance of EI for the generation of critical tacit knowledge for environmental efforts has been established. Indeed, having employees involved in the reduction of GHG emissions allows them to detect the sources of carbon emissions, rapidly take the necessary measures in case of emergency such as a sudden and sharp increase in emissions and provide relevant input for the elaboration of preventive solutions to carbon emissions (Boiral, 2002, pp. 301-306).

Limitations

A number of factors limit the effectiveness of employee involvement. First, some authors see the opportunity given to employees to propose solutions to organisational problems as an illusion, and they argue that “direct employee voice mechanisms provide opportunities to make changes *only* at the margins of managerial decision-making” (Bratton and Gold, 2012b, p. 452). Second, it can be argued that a tension exists between the apparent independence granted to employees in the context of EI programmes and their unavoidable subordination to superiors and team leaders (Bratton and Gold, 2012b, p. 453). Lastly, there has been reports of EI schemes in which employees, instead of being given independence of decision-making, were subtly directed in their decision-making process by the management of their company (Bratton and Gold, 2012b, p. 453).

Key Performance Indicators

Building on Boiral's input on the role of employee involvement in environmental management, key indicators of performance can be designed for EI in the context of carbon reduction strategies. Firms could, for example, track the number of employee-submitted reports of previously unknown sources of GHG emissions in the value chain. Another possibility is to monitor the evolution of the average number of carbon emissions incidents over the years.

In summary: $\frac{\text{number of employee reports of emissions sources}}{\text{number of employee reports of emissions sources } Y-1}$ (12. 1); $\frac{\text{number of carbon emissions-related incidents}}{\text{number of carbon emissions-related incidents } Y-1}$ (12. 2)

5.3 How can companies control the performance of their employees in the context of a climate change strategy?

In this final section, we will discuss the two levers that we were able to identify in the literature to manage the performance of employees in a carbon emissions reductions context. Those levers are presented in table 5.3.

Lever	Description
Performance management systems	Appraisal interviews; employee performance feedbacks (formal/informal); environmental audits
Pay and reward schemes	Monetary, non-monetary and recognition-based rewards; Variable compensation based on environmental performance

TABLE 5.3: Motivating employees and managing their environmental performance: synthesis of existing literature

5.3.1 Performance management systems

We first have identified performance management systems in our research for levers contributing to the management of performance and motivation in the context of climate change strategies. Applied to such strategies, the purpose of performance management schemes is to coordinate

the organisation-level emissions reductions goals with the objectives of employees (Bratton and Gold, 2012a, pp. 252-253). To do so, managers conduct *appraisal* interviews, which are meant, in this case, to assess the employee's competences relevant to the reduction of GHG emissions. Building on this information, the worker's goals, potential rewards and training programmes will be determined in cooperation with their supervisor (Bratton and Gold, 2012a, p. 259). Complementary to this appraisal process, giving *feedback* to employees regarding their contribution to emissions reductions goals is another fundamental component of performance management systems. This feedback can take the form of a face-to-face interview or a written report. Aside from communicating the assessment of their environmental efforts, feedbacks should also inform employees of the progress made towards organisational-level carbon emissions reduction goals and of the subsequent changes in objectives and responsibilities (Govindarajulu and Daily, 2004, p. 369). Lastly, measuring environmental performance often being problematic (Renwick et al., 2013, p. 5), internal and external *audits* can be conducted in order to assess the progress of emissions reduction strategies at the company level, identify achievements and shortcomings, subsequently reviewing goals and priorities and providing this valuable information to managers for feedback purposes (Govindarajulu and Daily, 2004, p. 370).

Effectiveness

Performance management systems include a number of benefits for employees and organisations. Those systems in general have been found to enhance the overall organisational effectiveness and to "increase employee engagement" in the firm's environmental efforts (Bratton and Gold, 2012a, pp. 252-253). Moreover, appraisal interviews are essential to motivate employees and improve their performance as defined by personal goals (Bratton and Gold, 2012a, p. 259). Also, the main advantage of giving feedback to employees regarding their environmental performance is to enhance their motivation, and more precisely their enthusiasm and interests for environmental strategies such as GHG emissions reductions (Govindarajulu and Daily, 2004, p. 369).

Limitations

Some limitations regarding this lever have to be noted, however. The effectiveness of performance management systems has been the subject of much debate. In fact, appraisal and feedback processes can lead to the *demotivation* of employees in at least two ways. In case of

negative feedback by their supervisors, employees, instead of accepting their shortcomings, can react by denying the existence of performance issue and adopting a defensive posture. Such reactions are common and can involve negative psychological consequences for employees (e.g. impacts on self-esteem and confidence), leading to declines in individual performance (Bratton and Gold, 2012a, pp. 256-257). Also, issues have been identified regarding the fairness of performance assessments conducted by some managers. Indeed, biases are common and include performance stereotypes with regard to employees' sex (e.g. women and the "glass ceiling" problem) or ethnicity (Bratton and Gold, 2012a, pp. 257).

Key Performance Indicators

It is clear, from what has been said above, that for a company to be able to monitor the environmental performance at the organisation and employee levels, indicators of that performance must be defined. In the case of carbon emissions reductions, relevant indicators include the ratio of emissions reductions achieved relative to a predefined emission reduction goal or the amount of surplus carbon allowances that the firm managed to generate over the year.

In summary: $\frac{\text{company-level carbon emissions reductions achieved}}{\text{company-level emissions reductions goal}}$ (13. 1) ; $\frac{\text{company-level carbon emissions}}{\text{company-level carbon emissions quota}}$ (13. 2)

5.3.2 Pay and reward schemes

Another lever to manage employee performance and motivation while pursuing GHG emissions reductions is the design of compensation packages and the attribution of rewards for employees participating in the efforts. We have found in the existing GHRM literature that managers can offer rewards of many forms to employees achieving progress towards the emissions reduction goals of the company. Those can be of monetary (e.g. attribution of bonuses, share of corporate profits) or non-monetary (e.g. paid holiday, gifts, parking privileges) nature, or be based on the recognition of peers and superiors (e.g. management praise, awards for individual/team achievements) (Govindarajulu and Daily, 2004, p. 368). Compensation packages—usually those of managers and executives—can also be designed to be tied to indicators of performance related to the emissions reduction goals of the company.

Effectiveness

Reward schemes “can motivate and reinforce employees to be environmentally responsible” (Govindarajulu and Daily, 2004, p. 368). In particular, even though monetary rewards are usually considered as very potent, recognition-based rewards have been found to be the most effective at motivating employees in a number of studies (Govindarajulu and Daily, 2004, p. 368). In addition, supervisory encouragement and other forms of rewards based on recognition appear to promote initiatives to solve environmental problems by employees (Ramus, 2001, p. 93). Also, “negative” rewards, such as suspending an employee following a serious mistake leading to large GHG emissions, are sometimes necessary to prevent unwanted behaviours. Those negative rewards, however, are often regarded as less effective than their positive equivalents when it comes to motivating employees (Govindarajulu and Daily, 2004, p. 369). Finally, it has been established that linking line managers’ compensation to environmental indicators of performance (e.g. the amount of CO₂e emissions reduced over a year) led to superior environmental performance (Cordeiro and Sarkis, 2008, p. 306).

Limitations

There are a number of limits to the effectiveness of rewards systems in the context of environmental management. First, linking top executive compensation with indicators of environmental performance has not been found to yield significant results in terms of environmental performance improvements (Cordeiro and Sarkis, 2008, p. 311). Also, using negative rewards can have perverse effect, with reported cases of employees quitting or their job, skipping shifts or reacting by hiding environmental problems, as they fear potential punishments (Govindarajulu and Daily, 2004, p. 369).

Key Performance Indicators

Although it is difficult to accurately assess the motivation of employees, we can think of a number of indicators reflecting the effectiveness of pay and rewards systems in the context of corporate carbon emissions reductions plans. First, if the company regularly surveys the well-being of its employees, their motivation can be assessed by prompting them to rate their job satisfaction and motivation on Likert-type scales. Reviewing the average employee motivation score can be an indicator of the effectiveness of the schemes we discussed. Also, the number of

emissions reduction achievements eligible to receive company awards per year, or the amount of voluntary initiatives from employees aiming to reduce existing emissions are other options.

In summary: average employee motivation score in workforce surveys (14. 1); number of emissions reductions achievements eligible to receive company awards (14. 2); total of voluntary emissions reduction initiatives (14. 3)

5.4 Key takeaways

Our analysis of the potential contributions of the field of human resources management to climate change strategies taught us that:

- knowledge about climate change and competences to mitigate corporate carbon emissions should be developed in the company's workforce by providing environmental training to employees and by using the recruitment and selection policy of the firm to hire candidates concerned by global warming issues and motivated to solve them.
- the active participation of employees towards emissions reductions goals can be promoted by granting them autonomy, trust and responsibility to identify emissions sources and propose solutions to reduce those emissions.
- performance management systems can conduct regular assessments of the performance of employees and of the organisation with regard to emissions reductions goals; different types of rewards and pay packages can be designed to maintain employee performance and motivation in the context of emissions reduction plans.

Chapter 6

A Dashboard of Indicators of Carbon Management

This chapter introduces a synthesis of our findings regarding the contributions of strategic management and HRM to corporate GHG emissions reductions. Tables [6.1](#) and [6.2](#) present a synthetic view of the 14 levers that we have identified to answer our six research questions as well as their respective advantages, limits and possible key performance indicators.

Research Question	Levers	Effectiveness	Limitations	Key Performance Indicators
“What are the different modalities of carbon-reducing strategies?”	(1) GHG Reductions	Large potential scope of application; costs reductions; generation of carbon credits	Requires large financial resources, R&D capabilities and trained workforce	product carbon footprint carbon footprint Y-1 (1. 1) ; facility energy consumption facility energy consumption Y-1 (1. 2) ; renewable energy consumption (KWh) (1. 3) total energy consumption (KWh) (1. 3) compensated emissions (2. 1) ; carbon credits purchased through cap-and-trade schemes amount of purchased carbon allowances (2. 2)
	(2) GHG Compensation	Cost effectiveness; ease of implementation	Merely implies a transfer of emissions reductions; effectiveness of cap-and-trade systems has been questioned	revenues from new low-carbon products/services (3. 1) ; sales of low-carbon products/services (EUR) (3. 2) sales of low-carbon products/services Y-1 (EUR)
	(3) Company reorganisation	High potential for emissions reductions; prepares company for potential major markets shifts induced by climate change	Very risky; demands huge organisational and financial capabilities	
“How can companies support the implementation of their climate change strategies?”	(4) Leveraging internal support	Very critical factor for managing organisational change	High failure rates of change management projects	employee dismissals related to change process agreed maximum number of dismissals (4. 1) ; budgeted expenses for the change management project (4. 2)
	(5) Leveraging external support	Adds significant pressure for the firms to reduce their emissions	Companies have limited influence on their environments	industry's total emissions quota (current) ; (5. 1) industry's total emissions quota Y-3 ; (5. 1) suppliers' products average carbon footprint suppliers' products average carbon footprint Y-1 (5. 2) ; revenue from low-carbon products total sales income (5. 3)
	(6) Product differentiation	Potential to address the fast-growing demand for low-carbon products	Barriers to entry in existing industries; political and commercial uncertainties	low-carbon product/service's profitability alternative high-carbon product/service's profitability low-carbon product/service's sales (EUR) (6. 1) ; total size of the market (EUR) (6. 2)
	(7) Influencing climate change regulation	Puts pressure on competitors; increases barriers of entry; easier adaptation to new regulation	Only limited influence on regulatory processes is possible	current industry's GHG emissions quotas company's emissions levels (7. 1); amount of fines for non-compliance with GHG regulations in industry (EUR) (7. 2)
	(8) Carbon emissions trading	Planned rise of carbon credits costs; expertise development in fast-growing carbon markets	Hard to sustain over time (rising MAC); current inefficiency of carbon markets to increase prices for carbon allowances	carbon trading revenue (8. 1); total income total carbon emissions (CO2e) company's emissions quota (CO2e) (8. 2)
	(9) Improved corporate reputation	Hard to replicate; linked to enhanced financial performances	Reputation is also dependent on other factors; reputation is hard to measure	total number of sustainability newsletters/reports published (9. 1) ; total number of visits on website's CSR page (9. 2); total number of presentations/ conferences given on emissions reductions efforts (9. 3)

TABLE 6.1 : Strategic management levers for carbon emissions reductions: summary of our findings

Research Question	Levers	Effectiveness	Limitations	Key Performance Indicators
“How can companies prepare their workforce for the various changes inherent to GHG reduction strategies?”	(10) Employee training	Improved environmental performance and innovation; reduced employee resistance to change; others	High costs of training programmes; several obstacles to proper communication of training contents	average grade to emissions reductions test before training average grade to emissions reductions test after training (10. 1); number of employee reports of emissions sources number of employee reports of emissions sources Y-1 (10. 2)
	(11) Recruitment and selection	Enhanced attraction of highly qualified candidates; reduced salary expectations from applicants	Attraction does not always mean willingness to work for a company	$\frac{\text{job offer acceptances}}{\text{total of job proposals to applicants}}$ (11. 1); Average number of applications received per vacant position (11. 2)
	(12) Employee involvement and empowerment	Increased ability to detect sources of emissions, to control emissions spills and to build preventive solutions to GHG emissions	Employee autonomy and suggestions may be undermined by managers	number of employee reports of emissions sources number of employee reports of emissions sources Y-1 (12. 1); $\frac{\text{number of carbon emissions-related incidents}}{\text{number of carbon emissions-related incidents Y-1}}$ (12. 2)
	(13) Performance management systems	Improved employee engagement, motivation and performance in emissions reductions efforts	Defensive reactions to management feedback and appraisal; issues related to biases in employee assessment	$\frac{\text{company-level carbon emissions reductions achieved}}{\text{company-level emissions reductions goal}}$ (13. 1) ; $\frac{\text{company-level carbon emissions}}{\text{company-level carbon emissions quota}}$ (13. 2)
“How can companies control the performance of their employees in the context of a climate change strategy?”	(14) Pay and reward schemes	Increased environmental performance, employee motivation and initiatives to reduce emissions	Limited effectiveness of tying executive compensation to firm's environmental performance; perverse effects of negative rewards	average employee motivation score in workforce surveys (14. 1); number of emissions reductions achievements eligible to receive company awards (14. 2); total of voluntary emissions reduction initiatives (14. 3)

TABLE 6.2: Human resources management levers for carbon emissions reductions: summary of our findings

Discussion

A brief study of tables 6.1 and 6.2 allows the reader to identify the various complementarities between the levers that we identified. For instance, there are numerous ways in which HRM practices can support the implementation of GHG emissions reductions strategies by private companies.

First, employees training is virtually applicable to all levers of strategic management and can be used, for instance, to develop the necessary skills of product designers to reduce the carbon footprint of current products (lever 1), to foster the internal support of the organisation towards climate change strategies through environmental awareness training (lever 4) and to prepare financiers to enter carbon trading markets (lever 8). Recruitment and selection, another lever of HRM, may support GHG emissions reductions strategies by hiring marketing experts or product developers with the necessary competences to develop differentiated low-carbon products, a way for companies to gain competitive advantages (lever 6). Also, as can be seen in section 5.2, employee involvement and empowerment, by granting employees responsibilities and trust to work towards the emissions reductions goals of the organisation, is an important tool to raise internal support for climate change strategies (lever 4). Finally, performance management systems and pay and reward schemes can be designed to support the successful implementation of carbon strategies (levers 1-3) by managing the performance of employees with respect to emissions reductions goals and by rewarding desired behaviours.

Complementarities also exist among levers of strategic management. Indeed, levers 1-3 are central and correspond to different types of corporate strategies to reduce GHG emissions. On the one hand, the implementation of those strategies can only be made possible with appropriate support from internal and external stakeholders (levers 4-5). On the other hand, there exist different ways of generating competitive advantages (levers 6-9) in order to ensure that strategies aiming to reduce carbon emissions make financial and business sense.

Chapter 7

An Overview of the Contributions of Other Functions of Management

The aim of this chapter is to briefly outline the ways in which the fields of accounting, marketing and supply chain management can contribute to carbon emissions reductions in private companies. In particular, we will formulate possible research questions and their corresponding levers for each field covered in this part.

7.1 Accounting

Carbon accounting, defined by [Stechemesser and Guenther \(2012, p. 36\)](#) as “the recognition, the non-monetary and monetary evaluation and the monitoring of greenhouse gas emissions on all levels of the value chain and the recognition, evaluation and monitoring of the effects of these emissions on the carbon cycle of ecosystems” has very important and complementary functions making the implementation of carbon reduction strategies possible in private companies. Those functions are reflected by the two following interrogations: “How can GHG emissions sources be identified throughout firms’ value chains?” and “How can carbon accounting support emissions reductions in companies?”.

Life cycle assessment tools and their variants are widely used methods to determine the baseline carbon emissions of companies, on which emissions reductions can be based. Those assessments can be applied at a number of levels and determine the carbon footprint of, e.g. “production processes, production sites, products, the company as a whole and their supply chains” (Schaltegger and Csutora, 2012, p. 8).

Other levers can be useful for companies to monitor the effectiveness of carbon emissions reductions along various dimensions. Physical measurements, such as the “carbon payback period” (i.e. the time needed for a new carbon reducing equipment, such as a wind turbine, to generate enough emissions reductions to compensate for the emissions generated by its own production) can evaluate the effects of measures implemented to reduce GHG emissions (Schaltegger and Csutora, 2012, p. 9). Monetary calculations also have a role to play in carbon reduction projects, in particular to maximise their emissions reductions while controlling expenses. By performing profitability estimations of projects alternatives, carbon accounting can help firms selecting the most cost-efficient emissions-reducing investments (Schaltegger and Csutora, 2012, p. 9).

Indeed, such contributions are essential for the successful implementation of climate change strategies described by levers (1) and (3) of the present work.

7.2 Marketing

The marketing function of companies also has an important role to play in their emissions reduction efforts. Its scope of application allows it to address two critical questions for the success of climate change strategies. On the one hand, “How can products be redesigned to lower their carbon footprint?” is a central question for strategies such as those described by levers (1) and (3). On the other hand, “How can consumers be influenced to increase their demand for low-carbon products and services?” is a crucial question to answer for a company aiming to develop low-carbon competitive advantages such as those described by levers (6) and (9).

Potential levers to increase products’ carbon efficiency include “design for environment” techniques and the redesign of production process, as mentioned by Peattie and Charter (2003,

pp. 746-747). Redesigning products to reduce their carbon footprint might involve modifications that facilitate their reparation, reconditioning, reuse, recycling and re-manufacture. In addition, packagings may also be modified to be composed of materials with lower carbon intensity or to have their weight reduced (Peattie and Charter, 2003, p. 747).

Also, there exist a number of marketing levers that can be used to attempt to change consumers' preferences towards products and services with lower carbon footprints. For example, the promotion policy of companies may be modified to communicate their efforts to reduce their impact on GHG emissions and the importance to do so. In this context, advertising, labelling of products and public relations should be precious aides (Peattie and Charter, 2003, pp. 748-749). Partnership programs with NGOs and alliances with other firms can also support low-carbon communication strategies (Peattie and Charter, 2003, pp. 748).

7.3 Supply Chain Management

Indeed, a central interrogation for the supply chain management function of firms engaged in carbon emissions reduction plans would be "How can companies reduce the impact of its logistics scheme on carbon emissions?". A number of potential levers are available to answer such a question.

A notable modification of logistics systems to reduce the carbon footprint of companies would be include the recovery of used products and materials in their value chain, an idea embodied in the concepts of "reverse logistics" and "closed-loop supply chain management" Thiell et al. (2011, p. 336). Other, more common efforts include the modernisation of the trucks involved in the forwarding of products for enhanced fuel-efficiency, various types of warehousing processes optimisation aiming to reduce the steps needed to dispatch goods to clients and retailers, and using packaging technologies that reduce the amount of material needed to protect products during their transportation Thiell et al. (2011, pp. 337-343).

Again, those levers would bring valuable contributions to the emissions reductions strategies of levers (1) and (3) presented in the work at hand.

Chapter 8

Conclusion

More frequent, visible and devastating consequences of climate change and an increasing number of international agreements to cut CO₂ emissions are putting more and more pressure on private firms to reduce their own emissions. In this context, we chose to explore the role of management science in such emissions reductions efforts.

Throughout our work, we thus have presented a synthesis of the ways in which management science could contribute to achieving carbon emissions reductions in private companies. To do so, we started our inquiry by analysing a corpus of case studies relating the emissions abatement efforts undertaken by a number of organisations. We concluded from that initial inquiry that management measures had a significant role to play in those efforts and that all the main management fields (i.e. strategic management, human resources management, accounting, marketing and supply chain management) had special contributions to bring.

Based on the observation that strategic management and HRM seemed to have a more significant contribution towards GHG emissions reductions efforts, we decided to conduct a detailed research on those two fields. More precisely, three research questions were formulated for both fields and a number of “levers” were found to answer those six interrogations.

Regarding strategic management, we first found that, in order to develop a GHG-reduction strategy, companies could engage in the reduction of the carbon intensity of their products and services (lever 1), compensate their emissions through carbon markets (lever 2) or develop new low-carbon products and services to address a growing demand for such solutions (lever 3).

Second, we determined how internal (lever 4) and external (lever 5) support of stakeholders could help in the implementation of the climate change strategies of firms. Third, we analysed the potential sources of competitive advantages for companies engaging in emissions reduction strategies and identified differentiation through the offering of low-carbon products and services (lever 6), influencing climate change regulations (lever 7), developing an expertise in the trade of carbon allowances (lever 8) and the improvement of corporate reputation (lever 9) as ways to develop those competitive advantages.

As we moved on with our investigation, the contribution of the HRM function of firms was also analysed. First, we determined that providing training to employees (lever 10) and modifying the recruitment and selection policy of companies (lever 11) could prepare their workforce for the main changes inherent to carbon reduction strategies. Also, employee involvement and empowerment (lever 12) was found as an optimal lever to develop an active participation of employees towards emissions reductions goals. Finally, we identified performance management systems (lever 13) and pay and rewards schemes (lever 14) as preferred means of managing employee performance in the context of climate change strategies.

A summary of each levers, presenting their respective effectiveness and limitations as well as the KPIs we elaborated and propose to monitor their performance was then suggested. Building on this, we underlined the main complementarities between strategic management and HRM levers. Lastly, a quick presentation of the issues existing in other fields of management, as well as potential solutions were proposed.

8.1 Limitations of the Work

The key performance indicators that we propose are mere suggestions for managers to monitor the effectiveness of the implementation of the levers that we have identified. Indeed, other approaches to gauge our levers' efficacy exist, notably qualitative methods such as interviews with personnel and studies by internal or external consultants. Also, professionals must be aware that KPIs should be adapted to the specificities of the firms that engage in climate change strategies, their organisational cultures and their industry context.

8.2 Directions for Future Research

Although we briefly discussed the role of other fields of management (i.e. accounting, marketing and supply chain management) in the efforts of companies to reduce their GHG emissions, these discipline should also be the subject of a more detailed analysis, such as the one we performed with strategic management and human resources management. Indeed, those components of our proposed carbon management framework need to analysed in details, with an emphasis on the various levers that can specifically be used to achieve carbon emissions reductions in companies.

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Appendix A

An empirical analysis of current GHG reduction practices

(1) Definition of the coding criteria for the identification of emissions reduction measures, (2) database of identified and classified measures and (3) data analysis.

