



AD-minister

ISSN: 1692-0279

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Colombia

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Adaptation to Climate Change and Integration of Disaster Risk Management in Business

Education: A Case Study in Fundação Getulio Vargas, Brazil

AD-minister, núm. 28, enero-junio, 2016, pp. 91-126

Universidad EAFIT

Medellín, Colombia

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ADAPTATION TO CLIMATE CHANGE AND INTEGRATION OF DISASTER RISK MANAGEMENT IN BUSINESS EDUCATION: A CASE STUDY IN FUNDAÇÃO GETULIO VARGAS, BRAZIL

ADAPTACIÓN AL CAMBIO CLIMÁTICO E INTEGRACIÓN DE LA GESTIÓN DE RIESGO DE DESASTRES EN LA EDUCACIÓN DE NEGOCIOS: UN ESTUDIO DE CASO EN LA FUNDAÇÃO GETULIO VARGAS, BRASIL

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JEL: M14, I23, Q54

RECEIVED: 22/06/2016

MODIFIED: 24/06/2016

ACCEPTED: 29/06/2016

DOI: 10.17230/ad-minister.28.5

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ABSTRACT

The aim of this paper is to discuss improvements for the Master in Sustainability Management of Fundação Getulio Vargas (FGV), in order to incorporate the topic of disaster risk management (DRM). Considering the risks and opportunities that climate change – and more specifically extreme weather events that can lead to disasters – represent to business, it is essential that business schools help prepare managers to deal with this critical sustainability issue. Therefore, it is extremely important to include this topic in management education. Aiming to support companies to assess and address business risks and opportunities derived from climate change, the Business for Climate Platform (EPC) of the Center for Sustainability Studies (GVces) of FGV has developed a framework and a tool for business adaptation strategies for climate change and implemented them with seven large companies in Brazil. Thus, based on EPC's experience, the paper brings a proposal for the inclusion of DRM in the MSM's syllabi, through the lens of climate change adaptation.

KEYWORDS

Climate change; adaptation; business education; disaster risk reduction.

RESUMEN

El objetivo de este trabajo es discutir mejoras para la Maestría de Gestión de la Sostenibilidad (MGS) de la Fundação Getulio Vargas (FGV), con el fin de incorporar el tema gestión del riesgo de desastres (GRD). Teniendo en cuenta los riesgos y las oportunidades que el cambio climático -y más específicamente los eventos extremos capaces de generar desastres- representan a las empresas, es esencial que las escuelas de negocios ayuden a preparar a los gerentes para hacer frente a este problema crítico de la sostenibilidad. Por lo tanto, es sumamente importante incluir este tema en la educación de gestión. Para apoyar las empresas en la identificación y actuación frente a los riesgos y oportunidades de negocio, la

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Plataforma Empresas por el Clima (EPC) del Centro de Estudios de Sostenibilidad (GVces) de FGV ha desarrollado un marco y una herramienta para construir estrategias de negocio para la adaptación al cambio climático y los implementó en siete grandes empresas en Brasil. Así, con base en la experiencia del EPC, este artículo aporta una propuesta para la inserción de GRD en los planes de estudios del MGS, a través de la lente de la adaptación al cambio climático.

PALABRAS CLAVE

Cambio climático; adaptación; educación de negocios; reducción del riesgo de desastres.

INTRODUCTION

According to the latest report from the Intergovernmental Panel on Climate Change (IPCC), released in full on January 30, 2014, there is no doubt about the occurrence of global warming, and that human influence has been its dominant cause since 1950 (IPCC, 2013). One of the main problems related to climate change is that it leads to an increase in the intensity and frequency of extreme weather events, which in turn can lead to disasters.

Disasters can seriously undermine business competitiveness and longer-term economic sustainability. Companies are affected by disaster-related direct losses to their assets and indirect losses in their supply chain, which can often be composed of small and medium enterprises (SMEs). SMEs “are more likely to lack risk awareness or struggle to find the capacity to manage disaster risks, mainly owing to financial, human resource and technical limitations” (UNISDR, 2013, p. 184), and few of them have been able to strengthen their capacities to manage disaster risks.

Seeking to increase resilience, large companies are trying to better understand what impacts of climate change are material, and what risks and opportunities are represented for each sphere of the business. In this context, there is an opportunity to include SMEs (the key suppliers in the risk assessment), and to develop a more robust adaptation plan as part of a business strategy. Therefore, knowledge and tools are needed to assist in the process. It is in this context that the work of The Center for Sustainability Studies (GVces) at the Business Administration School of Getúlio Vargas Foundation (FGV-EAESP) takes place.

Fundação Getúlio Vargas (FGV), founded in 1944 in Brazil, is a nonprofit organization that offers several services to the technical-scientific-business community and the society as a whole. The business school at FGV has three important accreditations: Association to Advance Collegiate Schools of Business (AACSB), the European Foundation for Management Development (EFMD) and the Association of MBAs (AMBA). In 2015, FGV was in 13th place among the global top think tanks and has been considered the best think tank in Latin America, according to the Global Go To Think Tanks Rankings 2015 (McGann, 2016).

The Center for Sustainability Studies (GVces) at FGV, in turn, was established in 2003 as a reference in the study of sustainability-related topics within the corporate and public contexts. The objective of GVces is to provide answers to economic agents to identify, measure and assess risks and opportunities concerning the environment, social responsibility and corporate governance. Four lines of action guide

its programs, which are capacity building, research and knowledge, articulation, and communication and outreach.

Climate change – mitigation and adaptation – is one of the most important research topics at GVces, which seeks to meet the growing interest of private and public sectors regarding the risks that climate change poses and potential opportunities still unexplored. GVces has initiatives related to climate change (Appendix 2), and among them, specifically working with the business sector, there is the EPC (Portuguese acronym for Business for Climate Platform)

Launched in 2009, in partnership with The Prince of Wales's Corporate Leaders Network (CLN) for Climate Action, and supported by its 27 Founding Companies, EPC today is a platform of 35 Member Companies working towards one goal: to mobilize, raise awareness and connect business leaderships for GHG emission management and reduction practices, climate risks management, and to propose public policies and positive incentives related to climate change in Brazil. The EPC platform engages companies not only with discussions and actions related to reduction and management of GHG corporate emissions, but also with the sector's positioning with regards to climate-related issues, and in building proposals for public policies that can contribute towards a low-carbon economy in Brazil. Recently, GVces, along with the British Institution UKCIP, under the Platform, launched a tool to help companies better understand their vulnerabilities and risks to climate change, and also build an adaptation strategy and plan.

Besides the EPC, GVces leads several other projects on climate change in partnership with public and private sectors, producing applied research and supporting and influencing the decision-making processes. At the same time, GVces has a broad range of teaching experience on sustainability and climate change and their connections with business and economics. GVces is the academic coordinator of two fully-operational courses (an undergraduate and a master's degree) and two courses that will be launched in August 2016 at FGV (Appendix 1). All courses are grounded in applied research conducted by GVces. These courses are part of a series of initiatives that responds to FGV's commitment to PRME – the United Nations Principles for Responsible Management Education. The PRME were developed in 2007 by an international taskforce to promote a global engagement platform for academic institutions, setting six principles that lay the foundation for a global platform for responsible management education. In 2009, FGV became one of its more than 500 worldwide signatories.

Concerning the master program that is operational, GVces has been academically managing the Master in Sustainability Management (MSM) for more than ten years. The objective of this program is to engage participants in the sustainability potential as a key strategic factor for achieving and maintaining competitive advantage in an increasingly globalized environment, as well as providing tools for participants to evaluate results, identify risks and opportunities. Furthermore, GVces is academically involved in the development of two other Master's degrees at FGV, one at the School of Economics, and the other at the Business Administration School. The first one, the Professional Master's degree in Economics (MPE) with emphasis

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on Sustainable Development, examines issues regarding environment, society and economy. The second one, the Professional Master's degree in Business Administration (MPA) with emphasis on Sustainable Development, will also involve environmental issues, social responsibility and corporate strategies in order to achieve sustainable development.

Considering the risks and opportunities that climate change – and more specifically extreme weather events that lead to disasters – represent to business, it is essential that business schools help prepare managers to deal with this critical sustainability issue. Therefore, it is extremely important to include that topic in management education. In this context, the aim of this paper is to discuss improvements for FGV's Master in Sustainability Management in order to incorporate the topic of disaster risk management, based on the experience of the Business for Climate Platform, in developing business adaptation strategies for climate change.

The paper is structured as follows: it presents a literature review on management education for sustainability, with particular emphasis on climate change. It also presents the main theoretical approaches towards climate change as risks for companies as well as Disaster Risk Management (DRM). The following section explains the methods used and then it brings the empirical results. This section is divided in two subsections, which, respectively, covers GVces broad research experience with adaptation to climate change and explains in detail the Master in Sustainability Management (MSM). Finally, recommendations to increase adaptation and disaster risk management in MSM based on GVces' broad research experience and on the literature review are presented. Also, it discusses other recommendations to incorporate adaptation and disaster risk management in other FGV courses. Section 6 wraps up with conclusions.

LITERATURE REVIEW

Climate change and disasters: implications to business

The impact that an extreme weather event has on society and the environment depends on the degree of vulnerability and exposure of the system. The greater the magnitude of the impact, the greater the severity of the disaster. Each decision and action taken by society makes it more vulnerable or more resilient to disasters (UNISDR, 2016). In this sense, there are two fronts: mitigation and adaptation. Mitigation seeks less carbon-intensive development paths in order to avoid and reduce GHG concentrations' increase in the atmosphere. Adaptation, in turn, seeks to attenuate the already irreversible effects of climate change on natural and human systems and influence the socio-economic development towards models and arrangements that are more resilient. Disaster risk reduction can be part of both fronts, through systematic efforts not only to analyze and reduce the causal factors of disasters, but also to improve preparedness for adverse events that are likely to occur due to the irreversible effects of climate change.

Disasters affect the lives of millions of people around the world. In recent decades, those phenomena have caused the deaths of several million people, and the average

annual loss of life was estimated at 150,000. In addition, financial losses exceed US\$ 50 billion a year and these costs do not include losses such as unemployment, mental illness and reduced productivity (Keller & Blodgett, 2008). Data released by the United Nations (UN) shows that disasters, only in the twenty-first century, have cost the global economy the equivalent of Brazil's GDP, and the costs in total would reach US\$ 2.5 trillion in the first thirteen years of the century (UNISDR, 2013).

Considering that data and the fact that climate change has already been increasing the intensity and frequency of extreme weather events, the importance of investing in adaptation becomes clear. Since impacts occur in various segments of the economy and public policy areas, without observing social, sectoral or geographic boundaries, adaptation requires the efforts of a wide range of actors, including multilateral organizations, governments, local communities, scientists, companies, and civil society organizations, among others. In this context, the private sector has a great potential to contribute to this agenda: whether in a broader context, in which it generates business value through the provision of knowledge and resources to society, or by developing their own adaptation strategies to manage risks and opportunities to business.

Disasters can seriously undermine business competitiveness and longer-term economic sustainability. Companies are affected by disaster-related direct losses to their assets and indirect losses in their supply chain, causing a fall in output and revenue, which affects profitability. Additionally, considering the context of globally- integrated economies, wider impacts and macroeconomic effects also affect business. Considering that global trade, financial markets and supply chains have become increasingly interconnected, local disasters' impacts are not only felt in the company's own operation, but they also ripple through regional and global supply chains (UNISDR, 2013). A survey on global risk management in 2015 has shown that disaster risk is listed as the eighteenth most important risk out of the top 50, and as the ninth most important driver strengthening risk management (Aon Risk Solutions, 2015). Considering that, in most economies, 70-85% of overall investments are made by the private sector, it is possible to understand that private investment largely determines disaster risk. Because of this, both regulators and investors are increasingly demanding that businesses disclose their hidden risks, which includes disaster risks (UNISDR, 2013). Thus, it is relevant for businesses to invest in disaster risk management.

If, on one hand, businesses are increasingly concerned with disaster-related direct and indirect losses that affect their profitability, on the other hand, disaster risk management can also be a business opportunity. Companies are starting to recognize DRM and invest in the development of products and services – such as new crop-insurance products and more resilient infrastructures –, which leads to the expansion of existing markets and also the creation of new markets (UNISDR, 2013).

The four priority steps brought by the “Sendai Framework for Disaster Risk Reduction” help companies design a disaster risk management strategy (UNISDR, 2015):

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- **Priority 1. Understanding disaster risk:** Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.
- **Priority 2. Strengthening disaster risk governance to manage disaster risk.** Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness, response, recovery, and rehabilitation. It fosters collaboration and partnership.
- **Priority 3. Investing in disaster risk reduction for resilience.** Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment.
- **Priority 4. Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.** The growth of disaster risk means there is a need to strengthen disaster preparedness for response, take action in anticipation of events, and ensure capacities are in place for effective response and recovery at all levels. The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures.

In this context, “embedding disaster risk management in business processes is increasingly seen as a key to resilience, competitiveness and sustainability in an increasingly unpredictable world” (UNISDR, 2013, p. viii). Thus, considering the risks and opportunities that climate change – and more specifically disasters – represent to business, it is essential that business schools help prepare managers to deal with this critical sustainability issue. Therefore, it is extremely important to include that topic in management education.

Sustainability in management education

Sustainability in management education, in general, is a recent phenomenon (Rands & Starik, 2009) that began around 1990. Over the past years and especially in the past decade, attention to business sustainability has expanded and various studies have been published on how to integrate sustainability into business and management education (Rusinko, 2010). The way a business school is going to address sustainability depends on what it considers to be strategic (Lindgren et al., 2006; Scott & Gough, 2006), so it is important to consider the institution’s goals, resource constraints and also the best approach to start with.

Literature recommendations for sustainability’s integration into business and management education include:

- Sustainability needs to be integrated both into management education and across the business school (Rusinko & Sama, 2009).

- The three dimensions of sustainable development (environmental, social and economic) should be addressed simultaneously, not separately (UNESCO, 2004).
- Both curricular and co-curricular engagement is important, once co-curricular options for sustainability allow students the opportunity for additional experiential and applied learning outside the classroom (Ahren, 2009).
- Sustainability can be integrated not only within and across disciplines (Shriberg, 2002), but also beyond the management discipline, into a broader business curriculum (Steketee, 2009).

To assist in the effective integration of sustainability into management and business education, Rusinko (2010) proposes a matrix of options to its implementation (Figure 1): through existing structures or by creating new structures, and through discipline-specific focus or cross-disciplinary focus.

Focus	Delivery	
	Existing Structures	New Structures
Narrow (Discipline-Specific) Curricular	I. Integrate into existing course (s)	II. Create new discipline-specific sustainability course(s)
Co-Curricular Options	Service learning, Competitions, Common experiences, Clubs, Activities, Committees	
Broad (Cross-Disciplinary) Curricular	III. Integrate into common core requirements	IV. Create new, cross-disciplinary sustainability course(s), minor(s), major(s), program(s)

Figure 1. Matrix to Integrate Sustainability into Management and Business Education.

Source: Rusinko, 2010.

The Matrix is divided into four quadrants. In the first one, existing structures do not suffer changes, and sustainability comes punctually in disciplines as a topic, case or module. It is an introductory/trial approach to sustainability. In the second quadrant, a new structure is created, such as a sustainability topic within an existing course. This option distinguishes discipline with respect to sustainability. The third one relates to the theme's integration into existing structures, but in a cross-disciplinary manner. For example: each discipline of an existing course starts to include discussions on sustainability issues within its analyzed content. Here, sustainability is a priority across disci-

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plines. Finally, in the fourth quadrant, the integration of sustainability occurs through new structures, but with a broader, cross-disciplinary focus. In this option, sustainability is integrated across two or more business disciplines and can include non-academic stakeholders. It is especially relevant for business schools that consider sustainability's integration across the curriculum as a strategic goal.

Concerning the integration of ethics, corporate social responsibility (CSR) and sustainability in MBA curricula, Christensen et al. (2007) has shown that from the top 50 global business schools rated by the Financial Times in their 2006 Global MBA rankings, 84.1% of the schools that responded require students to take courses that address one or all of these topics. It is also interesting to note that 65.9% of the respondent schools have a research center connected to these topics, which was considered by the authors as a level of investment in the topic beyond that implied by curriculum content requirements. Research centers imply long-term institutional support, legitimacy and validation for the study area.

Although sustainability has gained attention, it is usually addressed decoupled from economic performance, strategic decisions and day-to-day business operations. Thus, integration is one of the greatest challenges faced by business schools concerning the incorporation of sustainability into management education (Russell, 2006). Disaster risk management is still largely ignored in businesses' economic forecasts and growth projections (United Nations, 2013), which reinforces the role of business management education to integrate the topic into its courses and disciplines, so that managers can be prepared to deal with this critical issue.

Nevertheless, beyond formal education, companies are preparing to deal with climate change and disaster risk through informal learning processes, such as social learning. This process is described as "a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks" (Reed et al., 2010, p. 5). Therefore, informal learning processes – in which a multi-stakeholder dialogue and collective learning processes occur, prompting future leaders to spread the theme in their companies – can complement formal business management education.

METHOD

To achieve the proposed objective, an exploratory study was conducted, which aims to provide greater familiarity with the problem, so as to be able to make it more explicit (Gil, 2002). The intention is to exploit the theme of disaster risk management through the lens of adaptation to climate change, aimed at generating referrals that can contribute to the solution of the problem presented.

Thus, the case study technique was used, which is characterized by the study of one or a few objects in order to allow its broad and detailed knowledge (Gil, 2002). The cases analyzed in the paper are two GVces initiatives: the experience of the EPC within the theme of business adaptation to climate change, and the MSM experience in the education of future leaders within the theme of sustainability.

For the analysis, primary and secondary data were used, related both to the activities and products developed under the EPC initiative as well as the MSM's creation and syllabi development.

Thus, from the analysis of the activities carried out by the EPC for the management of climate risks and opportunities and also assessment of the MSM's syllabuses, the paper brings a proposal to the inclusion of disaster risk management in the syllabi, to, in this way, contribute to the integration of the theme into future leaders education.

RESULTS

GVces and Applied Research on Adaptation to Climate Change

GVces has been actively engaging with governments, businesses and civil society organizations to foster the adaptation agenda in Brazil. Since 2011, the theme Adaptation has been part of the Business for Climate Platform (EPC) agenda, a network composed of 35 multinational companies aimed to mobilize business leaders to manage and reduce GHG emissions, manage climate risks and propose public policies on climate change. In an international workshop in 2011, EPC's member companies were invited to debate adaptation: main concepts and the strategic importance of the subject, the role of the private sector, and to pilot a real case. Since then, EPC has been fostering the adaptation agenda, promoting discussions and practices with its members.

The urgency of the adaptation agenda became clear at COP 17, held in 2011, in Durban. Although it also became clear that its relevance would increase dramatically in the following years, the top players in this agenda were not ready to invest and engage. That was the case of the private sector – not only in Brazil – which believed that adaptation was restricted to policy making and represented only losses that should be avoided or responded to by governments.

Favorable national and international contexts motivated EPC to initiate a consistent work approach in adaptation to climate change. The Brazilian Ministry of the Environment (MMA) was drafting the National Adaptation Plan⁷, and GVces became a partner providing technical background. As an example, we researched motivations, barriers and elements to foster the engagement of private sector companies on adaptation. It became clear that EPC should assist companies in understanding which climate impacts are material and what risks and opportunities are represented for business. Furthermore, access to financial resources to face the impacts from climate change, reducing vulnerabilities and increasing resilience, especially in developing countries, is one of the greatest challenges of the adaptation agenda.

Responding to that context, The Latin America Adaptation to Climate Change Forum, held at FGV on July 26, 2013, brought together more than 150 representatives of the private sector, governments and civil society organizations. From the presen-

⁷ To be launched in 2016. A public consultation is in progress and the draft of the PNA can be found here: <http://www.mma.gov.br/clima/adaptacao/plano-nacional-de-adaptacao>.

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tations about concepts, initiatives and case studies, a collective Framework emerged, with the steps that should be followed by companies in order to elaborate consistent business strategies on adaptation. Moreover, the Forum stimulated participants to create a network to exchange experiences, particularly in Latin America.

In 2014, with the support of the German Agency for International Cooperation (GIZ) and based on the Latin America Adaptation Forum's outcomes, EPC held three workshops. It also created a working group with 25 of its member companies to co-build the Framework⁸ (Figure 2), which brings a step-by-step process to support the development of corporate strategies for climate change adaptation.

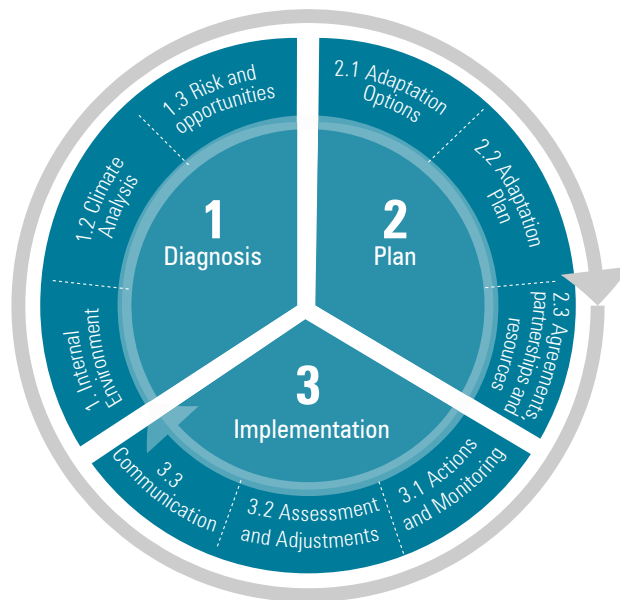


Figure 2. Framework for the Development of Business Agendas in Climate Change Adaptation.
Source: GVCes, 2016.

The Framework is divided into three stages. The first stage – diagnosis – aims to access the internal (e.g. organization's culture, processes) and external (e.g. past climatic events, present and future regulations) context of the company, as well as map and prioritize climate risks and opportunities for the organization. The second stage – plan – involves an action plan to respond to priority risks and opportunities. This stage should include actions and priority investments, deadlines and targets. Finally, the third stage – implementation – involves monitoring, feedback and communication to stakeholders. Thus, by following the steps presented in the cycle, the actions taken occur in a systemic and cyclical way, incorporated in the business reality and in the environmental strategy adopted by the company.

8 Available at: <http://mediadrawer.gvces.com.br/epc/original/framework_a-path-to-elaborate-business-agendas-for-adaption-to-climate-change.pdf>.

To support the Framework implementation, EPC also designed, with this working group, the Tool for Business Adaptation Strategies⁹. Both products were co-developed and improved through an interactive and enriching process with EPC members, who had different opportunities to learn, use and comment on the EPC Framework and Tool.

Studies and tools of the United Kingdom's Climate Impacts Programme (UKCIP), such as UKCIP Wizard and AdaptME toolkit, essentially inspired the Tool's elaboration. In addition, there were talks with INCAE Business School on their "Herramienta de Identificación de Riesgos, Oportunidades y Acciones de Adaptación al Cambio Climático", a tool developed by them.

Many other references were consulted during the process, for example: the "Australian Government Guide on Risk Assessment" helped to develop a risk matrix, while the "AS ANZS" was useful to evaluate opportunities, and the "Adaptation Scotland" contributed to the step of monitoring the adaptation strategy.

The figure below shows all the inputs considered for the development of each one of the Tool's steps.

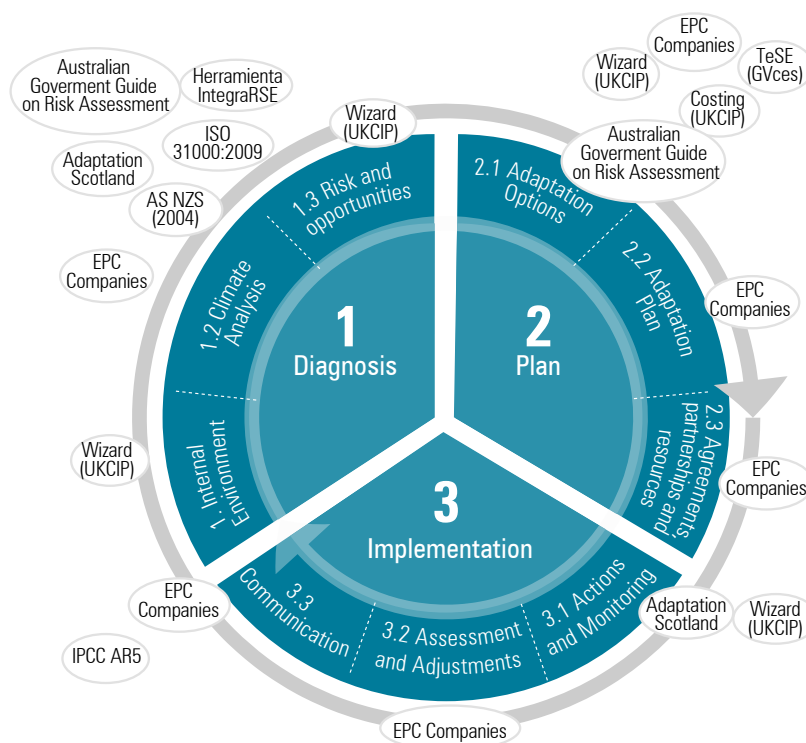


Figure 3. Inputs and References Considered for the Development of the Framework.
Source: Authors

⁹ Available at: <http://mediadrawer.gvces.com.br/epc/original/ferramenta_epc_versao-1-1_ing_final.xls>.

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From 2014 to 2015, five companies applied EPC's business adaptation Tool: Boticario Group, Braskem, CCR Group, the Brazilian National Steel Company (Companhia Siderúrgica Nacional), and Suzano Pulp and Paper. Four of these five companies have published their cases, which are briefly described below:

- The **Boticario Group** produces and distributes personal care products, cosmetics and perfume items. Motivated by historical weather events impacts on its sales points and service centers, the Group sought to develop an adaptation strategy. The analysis covered four Brazilian states vulnerable to flooding, with a time horizon of 2050. Different challenges were faced during the project, such as the access to climate information, lack of internal database on costs and investments and articulation with stakeholders. One of the most important results achieved by the Group was the composition of a multidisciplinary team to participate in the process, and the exchange of experiences with other member companies of EPC. Finally, the pilot project helped the Group to understand that following the steps of an action plan is important to the quality of the final product, and that the method and the Tool applied are also valid for activities within the company.
- **Braskem**, a company in the chemical and petrochemical sector and producer of thermoplastic resins, also chose to develop an adaptation strategy. In order to mitigate risks and exploit opportunities that arose from changes in climate events and to systematize and incorporate climate variables into planning and risk management, the company analyzed its plants in Brazil, the United States and Germany, with a time horizon of 2040. During the process, some challenges were found: the engagement of teams from various areas, long-term planning, obtaining climate scenarios and connecting them with business decision making. Because of the process, the company has incorporated climate variables into their risk management process and has been articulating with key stakeholders to foster this agenda. An important lesson learned in the process was that adaptation actions, unlike mitigation, depend on collaboration with other stakeholders, requiring collective work, from data collection to implementation and monitoring.
- The **CCR Group**, one of the largest infrastructure concession companies in the world, has chosen to develop an adaptation strategy in order to reduce operating costs due to impacts from possible climatic events, and also to identify new business opportunities. Due to the increasing number of engineering projects for maintenance and preservation of heritage, resulting from damages due to weather events, the Group chose to analyze CCR Barcas and CCR Via Lagos concessionaries, both located in Rio de Janeiro. A major challenge, which was also the main result of the adaptation strategy development, was the process of beginning to internalize the climate risks analyses, thanks to training in the subject and involvement of various company areas.
- **Companhia Siderúrgica Nacional (CSN)**, a large steel company in Brazil, decided to develop an adaptation strategy to be prepared to manage risks and

opportunities arising from climate change associated with the use of water resources, since steel production is an industrial activity that requires large water use. The scope considered was the Vargas President Steel Plant, located in Rio de Janeiro, considering the time horizon of 2040. A major challenge of the project was to start building a long-term planning structure, taking into account the inherent uncertainties of climate projections, as well as information collection, such as the estimated costs of climate change impacts and adaptation measures. The main result obtained was the identification of adaptation measures, with the inclusion of the climatic variable in the company's new projects, and in the monitoring of existing projects. The main lesson learned was the importance of the employee's engagement and the integration of different areas inside the company.

Thus, by following the steps proposed by the Tool, companies are able to organize and systematize information to better understand which climate change impacts are material, what risks and opportunities they represent for business, and to elaborate an action plan to avoid or mitigate major risks and develop opportunities.

Other important results are: the engagement of 25 companies in an adaptation agenda, through the creation of a community of practice (Barakat & Campos, in progress¹⁰): a better comprehension about concepts and the amplitude of an adaptation agenda by the business leaders; the strengthening of the managers, involved in the agenda, as leaderships in the companies; identification of collective actions and effective exchange of experiences; in some cases, the composition of multidisciplinary groups, in the companies, dedicated to implement and support the adaptation strategies; and the understanding that for a consistent adaptation strategy it is critical to involve local stakeholders and the supply chain.

In 2015, GVCes worked on the “Economy-Wide Adaptation to Climate Change” project, which was developed with the support of the British Embassy, in partnership with the Brazilian Ministry of the Environment (MMA) and the United Kingdom Climate Impacts Programme (UKCIP). The project purpose was to assist Brazil to improve its National Adaptation Policy and to implement adaptation measures reducing climate vulnerabilities in the public and private sectors.

To contribute to this goal, the “Business Adaptation Framework” and the “Tool for Business Adaptation Strategies” were reviewed and new versions of these documents were launched, considering the feedback from companies and partners and the extensive experience of UKCIP. Moreover, a new material package was attached to the Tool: the engagement toolkit with presentations and dynamics that can be used to mobilize collaborators and stakeholders. Three new pilot projects were developed with the companies Amaggi, Copel and CSN.

10 Paper “Social Learning for Adaptation to Climate Change: Evidence from a Community of Practice” accepted in the 2016 Academy of Management Annual Meeting, which studied the results of the participation on EPC adaptation agenda for the companies through the conceptual framework of social learning and community of practice.

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The figure below shows a summary of all information brought about the work that EPC has been developing on adaptation, in a timeline from 2011 to 2015.

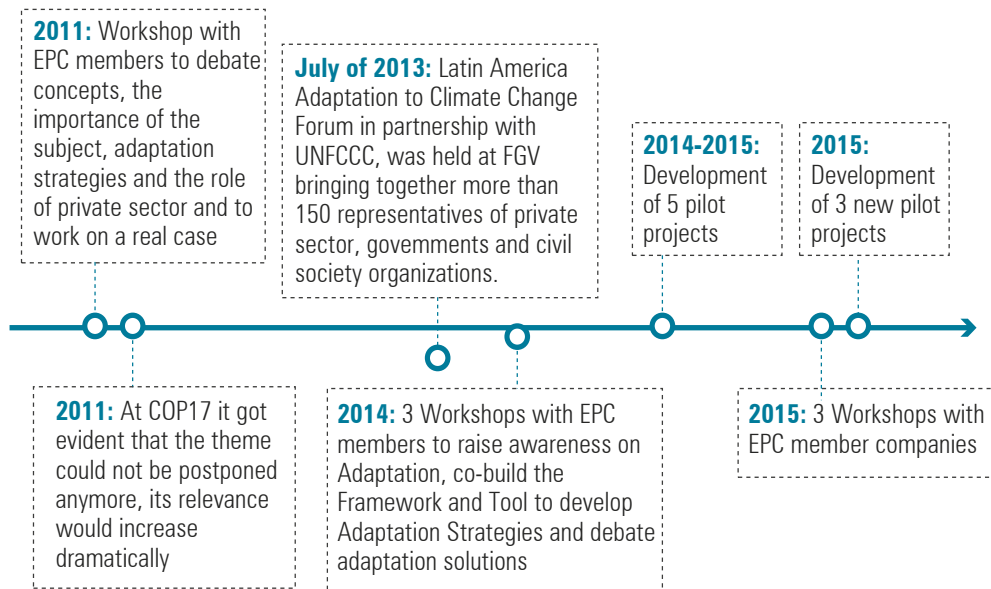


Figure 4. The work of Business for Climate Platform (EPC) on adaptation from 2011 to 2015.

Source: Authors

Complementarily, due to the relevance of civil society organizations working with vulnerable communities and ecosystems, the importance of supporting these organizations in mapping and managing climate risk became clear. Thus, a working group was created with eight civil society organizations, namely: Engajamundo, Boticario Group Foundation, Habitat for Humanity Brazil, Local Governments for Sustainability (ICLEI), Amazon Institute for Environmental Research (IPAM), Research Society for Wildlife and Environmental Education (SPVS), World Resources Institute (WRI), and World Wildlife Fund for Nature (WWF).

Based on EPC's business Tool, UKCIP's experience, academic research and the eight civil society organization's expertise, four products were developed, in a co-construction process with the working group: a Framework, a Tool and tutorial videos to support the development of adaptation strategies for civil society, and an exercise for engagement, called "Climate Game".

Reasons abound not only for governments, but also for companies and civil society organizations to get involved with the adaptation agenda. On one hand, climate change presents risks to the business and interferes with the ability of organizations to develop their work effectively. On the other hand, opportunities are also relevant to business competitiveness and to improve the organizations' essential support to their stakeholders.

However, there are challenges faced by the business sector and civil society organizations in order to draw consistent adaptation strategies, integrate adaptation into their existing strategic plans, as well as practical considerations such as access to climate projections data. One other significant challenge is to engage and work together with local stakeholders and the other companies from their supply chains. From the EPC experience, it became evident that the agenda requires a high level of interconnection, which is not usual for the business sector. Thus, it is important to disseminate ways to develop a business or organizational adaptation plan, and to reinforce the idea that challenges are not a reason for inaction. It is also key to inspire other companies and civil society organizations with real examples of successful implemented solutions.

In this context, academia and formal education have a key role in preparing managers to advance in this agenda, strengthening the contribution of the business sector for the implementation of national adaptation plans, offering instruments to build bridges between stakeholders, and creating and / or leading the adaptation of intra and inter-sectorial networks.

Master in Sustainability Management (MSM)

To respond to current environmental, economic and social challenges, governments and companies have been seeking professionals able to understand and deal with sustainability global challenges, ready to expand and accelerate the adoption of practices and strategies that incorporate sustainability attributes. Acknowledging the importance and urgency of the education of these professionals, the Center for Sustainability Studies at Getulio Vargas Foundation (FGV-EAESP) began offering, in 2005, a *lato sensu* post-graduation course, focusing on management issues regarding sustainability.

Since its inception, the aim of the course has been to demonstrate the potential of sustainability as a key strategic factor for obtaining and maintaining competitive advantage, as well as providing tools for students to evaluate results, identify risks and opportunities.

Students of the MSM generally hold middle management positions in companies and non-governmental organizations and come from different backgrounds, such as Journalism, Media, Marketing, Law, Biology, Business Administration, Economics, Engineering and Environmental Management. In order to join the course, it is necessary to have a minimum work experience of four years, interest in the area of management, oral communication and writing skills, and good understanding of written English.

Between 2005 and 2008 the course was offered as a continuing education program and subjects were organized into four sequential modules, totaling 360 contact hours. Module 1 was about the sustainability bases, modules 2 and 3 focused on sustainability and management issues and, finally, module 4 was about advanced sustainability issues. All modules relied on subjects that addressed environmental,

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economic and social issues, as well as cross-cutting themes of sustainability, such as corporate governance. Once the modules were completed, students had to submit a final research report, demonstrating the application of accumulated knowledge in a structured, systematic and analytical way, supported by scientific method and proper bibliographic references. Additionally, through a partnership between FGV-EAESP and the *École des Hautes Études Commerciales de Paris* (HEC), students could go for an exchange semester in France in the *Master Management du Développement Durable*, an exclusive program for post-degree in sustainability.

The table 1 shows the four sequential modules and their respective subjects:

Table 1. Modules and respective subjects of the Master in Sustainability Management (MSM) from 2005-2008

	MODULE 1 Sustainability Bases	MODULE 2 Sustainability and Management I	MODULE 3 Sustainability and Management II	MODULE 4 Advanced Sustainability Issues
	Context: Business and Sustainable Development	Strategic Management	The Natural Step	Education for Sustainability
Subjects	Business Social Aspects	Company's Relationship Management with its Various Stakeholders	Corporate Governance	Marketing
	Economic and Financial Aspects	From Environmentalism to Sustainability in Business	Long-Term Economic and Financial Management	Economy and Environment
	Environment, Work Relationships and Trade	Organizational Transformation	Environmental Business Management	Research Methodology

Source: Authors

In order to conform to international quality standards, from 2009 on the course was offered in a master degree format, abandoning the division by modules and extending its hours from 380 contact hours to 484 contact hours. In its current format, the 18 course subjects are distributed around three thematic axes – environmental, economic and social – and around a transverse axis, consisting of subjects that cross and connect the themes, contributing to an integrated vision of sustainability. Still, once the disciplines are taken, students must deliver a final research report. Table 2 shows the above-mentioned axes and the subjects that are part of these axes:

Table 2. Thematic axes and respective subjects of the Master in Sustainability Management (MSM) from 2009-2016

THEMATIC AXES			
	ENVIRONMENTAL	ECONOMIC	SOCIAL
SUBJECTS	Economy and Environment	Economy and Environment	Corporate Governance
	Public Policy and Climate Change	Concepts in Accounting	Stakeholder Engagement and Value Chain
	Environmental Business: from Environmentalism to Sustainability in Business	Controllershship	Local Development
	Integrated Management Systems of Corporate Sustainability	Strategic Management	Consumption and Marketing
		Sustainable Finance and Impact Investment	
TRANSVERSE AXIS			
SUBJECTS	State of the World and Answers in the Legal and Institutional Fields		
	Context: Business and Sustainable Development		
	Sustainability and Strategy		
	Systemic Thinking		
	Research Methodology		
	Negotiation Workshop		

Source: Authors

The subjects presented in Table 2 show that the issue of climate change is addressed in the transverse axis and in the environmental and economic axes, strengthening its relevance to the sustainability agenda. This theme is emphasized in the MSM because we understand that the rapprochement between scientific knowledge on climate change and decision-making processes within public and private policies is crucial in order to build a development model in which environmental and social agendas are as relevant as the economic agenda.

The issue of climate change is introduced in the MSM through the transverse axis, in the subject *State of the World and Answers in the Legal and Institutional Fields*, which aims to understand the role of public and private actors in setting normative standards on sustainable development at the global level, as well as current socioenvironmental impact management methodologies embedded in international standards of corporate social and environmental responsibility. The syllabus of the course provides details on the topics:

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“Presentation of the main current of environmental issues. It is intended to demonstrate the relationship between different economic cycles, the use of natural resources, impacts on society and the environment, and major challenges facing humanity to ensure the maintenance and improvement of quality of life, in developed or developing countries. It lists the set of legal and institutional responses at the multilateral level to address these challenges. International conventions and treaties on environment, human rights and labor relations are presented in evolution, as well as their incorporation into the Brazilian legal framework. Finally, the subject relates social and environmental issues to international trade”. (Course syllabus)

In the environmental axis, the issue of climate change is addressed in two subjects: *Public Policy and Climate Change*, and *Environmental Management: From Environmentalism to Sustainability in Business*. In the first subject, there is a focused approach in public policies designed to respond to the challenges created by climate change, as indicated in the syllabus: “The course includes studies of the main problems related to climate change at the international and national level, focusing on the interface between economic development, mitigation and adaptation to climate change and the key challenges and responses generated in the field of public policy”. Still, specifically, this subject covers the following topics: i) international legal regulations on climate change; ii) National Policy on Climate Change; iii) carbon pricing; iv) sectoral plans on climate change; v) adaptation to climate change; and vi) payment for environmental services.

Environmental Management: from Environmentalism to Sustainability in Business presents practices, procedures and management processes used by companies to minimize or eliminate the adverse effects caused by their activities on the environment, as indicated in the syllabus:

“The course introduces environmental concepts necessary for the full understanding of corporate environmental management, such as natural resources, biodiversity, ecosystems, environmental services and pollution. It shows the development of environmental strategies in business organizations, their motivating factors and trends. Key approaches and environmental management tools in companies will be studied, analyzing their potential, weaknesses and major gaps in relation to sustainability management. The following topics will be addressed: i) the environmental impact assessment (EIA); ii) inventories of pollution sources (including greenhouse gases); iii) ecological footprint and derivatives (water footprint, forest footprint, carbon footprint); iv) life cycle analysis (LCA); v) eco-efficiency, pollution prevention, cleaner production (CP), industrial ecology; and vi) environmental management systems”. (Course syllabus)

Connecting the environmental and economic axes, *Economy and Environment* subject explores the climate change issue from an economic perspective, generating reflections on the relationship between the environment and the economic systems. According to the syllabus of the course: “Analysis of the relationship between the

environment and the economic system, based on neoclassical environmental economics and the green economy. Reflection on the main differences and limitations of these approaches. Introduction and discussion of relevant issues in the discussions on economy and environment, for example, environmental policy instruments (instruments of direct regulation and economic instruments) and the mechanisms of environmental management that incorporate economic incentives”.

In the economic axis, the subject *Sustainable Finance and Impact Investment* introduces a discussion about the risks of climate change to investors and insurance companies, as presented in the syllabus: “discussion of the impacts generated by financial institutions in society and examination of how sustainability affects financial institutions, investors and creditors. Historical aspects and a motion analysis in financial institutions in Brazil and abroad, the risks hanging over the banking sector, with special emphasis on the Equator Principles and environmental policies. Discussions about the economic value of socially responsible investments and benchmarks are also included”.

DISCUSSION

From the analysis of the syllabi, in the Master in Sustainability Management, climate change is explored and discussed from different perspectives, offering students a solid background on the subject. However, there is room to improve climate risk management, adaptation and disaster risk management in greater depth. Adaptation demands an interdisciplinary approach, but, more than that, the strengthening of leadership, communication and mobilization skills of the team leading this agenda within the organizations – a process which GVces has been accessing, studying and promoting especially on its Integrated Education for Sustainability (FIS) initiative (Appendix 1).

GVces can bring to the classroom the results of its own research on adaptation. Adaptation is a complex matter and requires a long-term view, dealing with uncertainty and knowledge from a great diversity of subjects. It is a good example of a “wicked problem”¹¹. However, there is no specific focus on adaptation to climate change in the Master in Sustainability Management.

In this context, it is important to make recommendations to mainstream adaptation to climate change and disaster risk management in the MSM. The aim is to: i) promote discussions on theoretical concepts and methods related to these themes in the classroom; ii) consider the matter in all its dimensions (anticipatory and responsive adaptation, smooth and disruptive changes in weather patterns, different categories of risks and impacts); iii) make clear the materiality of these themes for businesses; and iv) foster systemic view and interdisciplinary approach.

11 A “wicked problem” is characterized by three aspects: social complexity, uncertainty, and complexity of its statement. “Surprises, fluctuating conditions, sudden changes and irreducible uncertainties are fundamental aspects of wicked problems” (Termeer, Dewulf & Breeman, 2013: 28-29).

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The recommendations are based on GVces research on adaptation to climate change mentioned in Section 4.1, particularly on the work developed with 25 multinational companies, under the EPC since 2014. As presented in Section 4.1, those companies composed a working group that co-created, with GVces technical support and coordination, a Framework and a Tool for the elaboration of business strategies on adaptation.

This experience is the basis of the recommendations because it proved to be successful in preparing managers to undertake leadership on adaptation to climate change agendas within their companies. These are the reasons:

- It enabled a “community of practice”¹² that facilitated the exchange of knowledge among participants and fostered self-confidence to lead adaptation planning process in their companies (Barakat & Campos, in progress)¹³.
- It promoted change in the perception of the professionals involved about the theme: the participants reported that, by understanding adaptation, they could better assess the business materiality of the subject (Barakat & Campos, in progress).
- It made it clear that stakeholder engagement is key: internal stakeholders as well as local governments, community organizations and the supply chain – for the elaboration of a comprehensive strategy and, especially, for its implementation (GVces, 2015).
- It enabled an environment for peer learning and learning from practice (Barakat & Campos, in progress);
- The process generated information and intermediary results that were effective in raising the interest of the companies’ higher management level in adaptation, showing that the agenda is material for the business¹⁴ (GVces, 2015).

Moreover, EPC’s Framework is aligned to the Sendai Framework for Disaster Risk Reduction’s four priority steps (UNISDR, 2015). Therefore, our recommendation to mainstream adaptation and disaster risk management in the MSM and, afterwards, in other business education programs, consists of the following components:

Recommendation 1. Review EPC Framework and Tool for Business Adaptation Strategy, improving it and strengthening the content of disaster risk management.

The first step is to improve EPC’s Framework and Tool, incorporating theoretical concepts, metrics and examples related to disaster risk management. An initial exer-

12 The community of practice can be defined as “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (Wenger, McDermott, & Snyder, 2002, p.4).

13 Based on the paper in progress “Social Learning for Adaptation to Climate Change: Evidence from a Community of Practice” (Barakat & Campos, in progress) elaborated from interviews with nine companies that took part in EPC adaptation working group.

14 Braskem and CCR cases on adaptation exemplify this statement. Braskem developed a plan considering the two major risk categories for its business, presented the results to the Vice-President and all directors and is expanding the process, inserting other risk categories. After elaborating the adaptation plan for two business units, CCR is adding adaptation to the company strategic planning (for further information, please visit: <http://adaptacao.gvces.com.br>).

cise comparing the concepts and terminology of both areas, adaptation and disaster risks, was made and is summarized in Appendix 3. Based on that exercise, changes will be implemented in the following steps of the Tool for elaboration of business adaptation strategies:

1. Diagnosis

- Step 1.2 (A) | A table to record how climate events are affecting the company – eventual historical disasters will be included here.
- Step 1.3 (A) | Potential impacts for the companies in the short-, medium- and long-terms – disasters forecasted based on climate scenarios will be identified here.
- Step 1.3 (B) | Evaluation of the risks identified previously – the risks of the disasters identified previously will be qualified and prioritized in this step.

2. Planning

- Step 2.1 | Extensive mapping of adaptation options – possible adaptation measures to build resilience and mitigate risk of disasters will be listed here.
- Step 2.3 | Map of agreements, partnerships and funds to be raised – considering also the potential disasters identified and the adaptation measures related to them, the stakeholders to engage and partners will be pointed out.

3. Implementation

- Step 3.1 | Development of the indicators and metrics to monitor the measures and actions of the adaptation plan – it will include indicators and metrics related to the mitigation and management of disaster risks.
- Step 3.3 | Elaboration of a communication plan focused on the achieved results – here the losses avoided and the co-benefits achieved with the adaptation measures implemented will be recorded.

4. General

- Examples that are presented in all steps of the Tool will include common or forecasted disasters in Brazil.
- Glossary, aligning with the “Terminology” presented in PreventionWeb¹⁵, bibliography and additional instructions.

Recommendation 2. Incorporate adaptation to climate change in the **syllabus of the MSM** through an **interdisciplinary and innovative approach** considering the recommendations for sustainability integration in business and management education (Rusinko, 2010).

As presented in Section 5, MSM is consolidated at FGV. Around 20 professionals per year, of different business backgrounds, have attended this course for the last ten years. Reinforcing adaptation to climate change and disaster risk management in the syllabus of the course presents an opportunity to strengthen it. Adaptation is essentially an interdisciplinary subject and requires the articulation among areas and stakeholders. Based on our research experience and on the literature recommen-

¹⁵ <<http://www.preventionweb.net/risk>>. Website visited on March 14, 2016.

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dations on how to integrate sustainability into business and management education, Recommendation 2 is composed by two key steps:

1. Reinforce adaptation and disaster risks content in the disciplines that already cover climate change since the first semester, which, as presented in Session 5, are:
 - *State of the World and Answers in the Legal and Institutional Fields* | transverse axis
 - *Economy and Environment* | Environment and Economy axis
 - *Sustainability Strategy* | transverse axis
 - *Public Policies and Climate Change* | Environment axis
 - *Environmental Management: From Environmentalism to Sustainability in Business* | Environment axis
 - *Sustainable Finance and Impact Investment* | Economy axis.
2. Structure and implement, as part of the MSM syllabus, a new semiannual activity regarding adaptation and disaster risk management with a strong practical approach, which will apply concepts and information discussed in several other disciplines.

This interdisciplinary activity will be composed of:

a. Conceptual and program introduction in a four-hour class. We will present and debate:

- Concepts of adaptation and risk of disasters, national and international history of the agenda and its relevance for the business sector.
- The Framework and Tool for elaboration of business strategies on adaptation will be introduced to the students in this class.
- Case of a company that has implemented the Framework and is implementing an action plan on adaptation.
- The program and the activities planned for the semester.

b. Development of business adaptation plans in groups throughout the semester:

- Organized in groups, the students will choose one company per group for which the adaptation strategy will be developed.
- The groups will run through the EPC Framework, step by step, following the semester working plan:

1. They will study and apply, to fill out the EPC Tool, concepts from most disciplines of the course, not just those that discuss climate change, but especially:

- * *Integrated Systems of Sustainability Management*
- * *Concepts in Accounting*
- * *Controllershship*
- * *Strategy Management*
- * *Corporate Governance*
- * *Stakeholders and Value Chain Management*
- * *Local Development*
- * *Sustainability Strategy.*

2. Gather information in the company, with different collaborators, and in the field, with company's stakeholders.
3. Debate, make decisions and record the process.

Although each group will draw their specific working plan in the beginning of the process, they may stick to the following general timeline:

Step1 | Diagnosis – 2 months

Step 2 | Planning – 2 months

Step 3.1 | Actions and monitoring – 1.5 month

- During the semester, the EPC Tool will be the foundation for the work, supporting the implementation of the Framework and recording information, discussions and decisions.
- At the end of the semester, they will consolidate the adaptation plan and the recommendations for its implementation.

c. Presentation of the adaptation plans in the final class and in the companies:

- A final class will be dedicated to the presentation and debate of the adaptation and disaster risk management plans developed by the groups.
- Groups will present and debate the plans and the recommendations in a meeting with internal and external stakeholders of the companies.

Appendix 4 presents examples of concepts discussed in 12 subjects of the Executive Master's degree that are important inputs for EPC Framework.

Through the implementation of this proposal component, the four recommendations presented in literature (Rusinko, 2010) will be addressed, notably the work on the three dimensions of sustainable development (Unesco, 2004), curricular and co-curricular engagement (Ahren, 2009) and sustainability integration within, across and beyond the management discipline (Shriberg, 2002 and Steketee, 2009).

Recommendations 3 and 4 are not aimed at the Master in Sustainability Management (MSM), but to new courses FGV is launching.

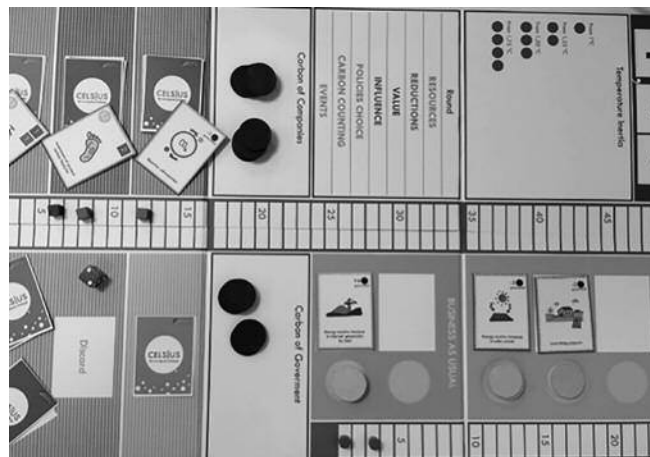
Recommendation 3. Systematize the experience and lessons learned and **expand the project to the Professional Master in Sustainability (MPA)**, to be launched in August 2016.

Once the proposal is implemented and tested in MSM, the plan is to adjust and replicate it to the new course, MPA. Also, there is the potential to expand the application of EPC's adaptation tool to other post-graduation programs at FGV.

Recommendation 4. Develop a board game on adaptation to climate change and disaster risk management based on the academic program, in order to condense the key concepts and foster learning through a **playful experience**.

In an effort to disseminate complex concepts and foster the discussion and reflection on sustainability subjects, GVces has been developing different learning tools. A board game is one of them. To work on the climate change agenda, with special focus on mobilization and engagement of stakeholders, GVces developed in 2012 the game *Celsius: The Two-Degrees Challenge* (Figure 5).

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Figures 5. Board game “Celsius: The Two-Degrees Challenge”
 Source: Authors

Since then, *Celsius* has been played with at least 36 companies, three of them applied it with their suppliers, 100 post-graduation students at FGV, 20 MBA students at Duquesne University, and 200 undergraduates at FGV. Moreover, the game was presented at a conference at the Duquesne University.

The game has proved to be effective in providing an enriching experience when played with groups with all levels of knowledge in the matter, from youths that have just heard about climate change to experts in the field. Throughout the rounds, the players, each one representing a company, decide in which projects to invest to generate value to their business considering at the same time, the greenhouse gas emissions that have to be reduced though coordinated efforts. In every occasion that *Celsius* was played, it fed great discussions about the political and economic challenges intrinsic to the climate change agenda, the relevance to partner with

and influence the public sector, and the roles and responsibilities of the private sector, government and society.

Inspired by this experience, the last component of this proposal is to develop a board game about adaptation to climate change and disaster risk management that leads players to try, in a short period of time, the reflections and decisions involved in the adaptation planning and management of climate risks.

The Figure below (Figure 6) summarizes the recommendations:

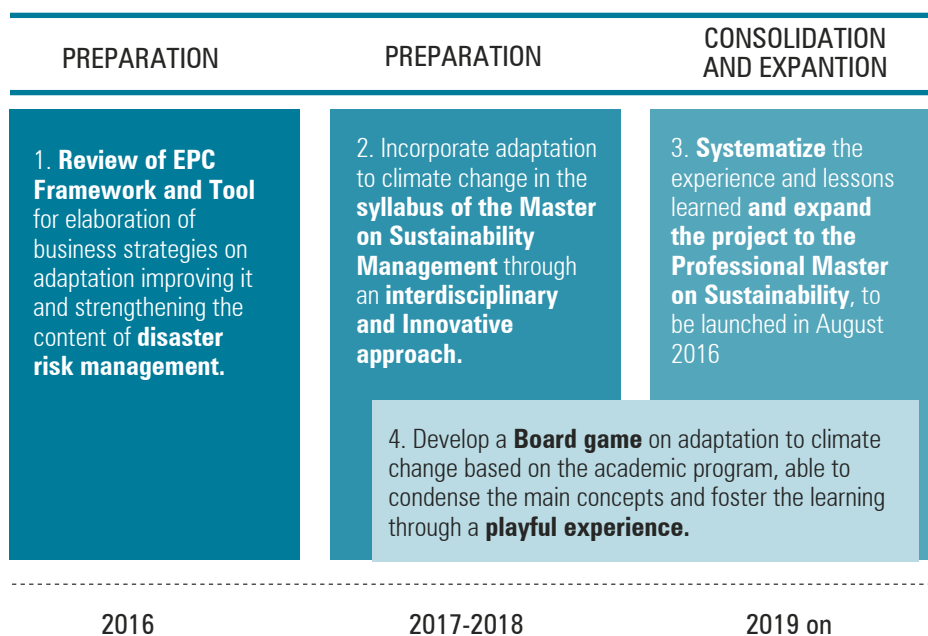


Figure 6 Summary of recommendations

Source: Authors

CONCLUSIONS

This paper sought to present the current status of adaptation to climate change and disaster risk management content in FGV´s Master in Sustainability Management, as well as make a series of recommendations to increase this content into this existing program and in new offerings. The recommendations presented here are in line with the literature review. By inserting content developed through the research center, FGV indicates long-term institutional support, legitimacy and validation for the study area (Christensen et al, 2007). Moreover, the three dimensions of sustainable development (environmental, social and economic) should be addressed simultaneously (UNESCO, 2004). In addition, adaptation and disaster risk management content would be connected to economic performance, strategic decisions and business operations, in an integrated manner (Russell, 2006).

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The recommendations would also favor social learning because the discussions resulting from the application of the Framework and the Tool would be expanded so that participants are challenged to include and consider a wider stakeholder network (Reed et al., 2010). Specifically, Recommendation 2 will fall into Rusinko's (2010) fourth quadrant, in which the integration of sustainability occurs through new structures, but with a broader, cross-disciplinary focus, including non-academic stakeholders.

Thus, the recommendations of this paper are based on GVces' own research experience on adaptation and climate change risk within the business sector, as well as on the literature review on management education and sustainability and disaster risk management. Considering the important role that FGV plays on the research and educational topics on climate change and sustainability, the opportunity to make the proposed adjustment in the existing offering – MSM – will hopefully contribute to prepare business managers to successfully manage and reduce climate change related disasters, thus reducing overall losses due to inaction and/or mismanagement.

For future research projects, the importance has been recognized of addressing more directly with SMEs, which are currently indirectly reached by the recommendations through the work with large companies, whose value chain usually includes SMEs, as evidenced by the projects run with seven large companies to elaborate their strategies on adaptation to climate change. Therefore, future research is needed to explore how to transfer the knowledge accumulated while working with large companies to local business and SMEs. The experience so far shows that the challenges faced by large companies are potentiated in the context of more limited resources of the SMEs. In this way, it is imperative to offer specific support to engage this group in the agenda and to prepare leaderships to actuate in these organizations. This could result in the adaptation of EPC's available tool in a flexible manner to ensure that even small companies can be integrated within the Climate Change framework.

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APPENDICES

Appendix 1. GVces' initiatives related to climate change and sustainability

In addition to the Business for Climate Platform (EPC), GVces has several other initiatives on the issue of climate change, which are described below:

- **Brazil GHG Protocol Program:** In 2008, the GHG Protocol methodology for corporate greenhouse gas emissions inventories was adapted to the Brazilian context by GVces and the World Resources Institute (WRI), in partnership with the Ministry of the Environment, the Brazilian Business Council for Sustainable Development (CEBDS), the World Business Council for Sustainable Development (WBCSD) and 27 Founding Members. The Brazil Program aims at stimulating corporate culture in order to elaborate and publish GHG emissions inventories, allowing participants access to tools and international quality standards. It also organizes workgroups with participating companies for the improvement of the methodology and for the development of new tools to account for GHG emissions according to the prevalent reality in Brazil. Currently, approximately 100 companies are participating.
- **GHG Emissions Public Registry:** This is a pioneer online platform in Brazil that helps organizations to produce and disclose their GHG emissions inventories. Its goal is to increase transparency in the disclosure of data, establishing sector benchmarks and sensitizing the public towards the issue of climate change.
- **The Climate Observatory:** GVces is part of the Climate Observatory, a network of NGOs that aim to discuss advances in climate change policies. The Observatory promotes meetings with business professionals and articulates

with the public sector so that the Brazilian government takes on its commitments and creates effective public policies for climate mitigation and adaptation. The network has an important presence at COPs and in the preparation of documentations for a consistent climate policy in Brazil.

- **Financial Sector and Climate Change:** Over the last few years, GVces has published several studies on the interaction between the financial sector and climate change. In 2010 and 2011, two studies were published analyzing banks' strategies and practices to manage climate change challenges: *Privately-Owned Banks and Climate Change*, and *Brazilian State-Owned Banks and Climate Change*. In 2012, GVces published the study "How to Advance in the Financing of a Low-Carbon Economy in Brazil". The report identifies products and services offered by the financial sector, as well as government incentives and regulations that support low-carbon practices in the agriculture and energy sectors, and points to the gaps that exist between the supply and demand of those funds. In early 2014, UNEP (the United Nations Environment Programme) launched an "Inquiry into the Design of a Sustainable Financial System" seeking to discuss innovation in public policies, regulatory framework and successful international initiatives capable of speeding up the allocation of resources by the global financial system to the Green Economy.
- **Supporting Climate-Friendly Public Policies:** At the request of the Secretary of the Environment and supported by UNEP, GVces produced a first draft of the Municipal Law on Climate Change in Sao Paulo, in partnership with ICLEI – Local Governments for Sustainability. Also, at the request of the Ministry of Development, Industry and Trade, GVces developed the technical background papers to support the design of a Low-Carbon Industry's Sectorial Plan, which is part of the Climate Change National Plan.
- **Green Credit:** GVces, in partnership with the British Embassy and the Brazilian Development Bank (BNDES), developed a tool to promote green credit in Brazil, by supporting the Brazilian Climate Fund (Fundo Clima) to account for and report GHG emission reductions from the supported projects. The tool is being used by BNDES as part of its decision-making process in funding projects under the fund's six subprograms, thus assuring that climate and environmental issues are taken into account.

Concerning GVces' broad teaching experience on sustainability and climate change and their connections with business and economics, in addition to the Master in Sustainability Management (MSM), there is also an **elective course for undergraduate students**, which is called "FIS – Formação Integrada para a Sustentabilidade" (Integrated Education for Sustainability).

The course is aimed at a practical sustainability challenge, which is decided based on GVces experience of the relevant sustainability agenda for the country and corporations operating in Brazil. Therefore, the sustainability content is driven by

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an empirical problem. Although a real sustainability challenge is at the center of the course, the course also aims at challenging participants to see reality through different perspectives. FIS is a transdisciplinary course and as such its content explores what is between, across and beyond disciplines. It favors the articulation of imagination and feelings, experience and tacit knowledge and concepts, theories, methodologies, contents. Other theories and approaches are used, such as Resilience Theory, Theory U, and Design Thinking. The learning process is based on a transdisciplinary approach that favors dialogue among disciplines, different areas of knowledge, academic and non-academic knowledge, and traditional wisdom. Also, it considers multiple dimensions of reality.

Furthermore, GVces is academically involved in the development of **two other Master's degrees at FGV**, one at the School of Economics, and the other at the Business Administration School. The first one, the Professional Master's degree in Economics (MPE) with emphasis on Sustainable Development, examines issues regarding environment, society and economy. Extremely impactful environmental issues to the economy, such as carbon economy, sustainable project financing and the formulation of public policies will be presented to the students. The workload includes Mathematics, Statistics, Microeconomics, Macroeconomics, Public Policies for Sustainable Development, Climate Change and Climate Economy. The second one, the Professional Master's degree in Business Administration (MPA) with emphasis on Sustainable Development, will also involve environmental issues, social responsibility and corporate strategies in order to achieve sustainable development.

Appendix 2. FGV Master in Sustainability Management, Subjects and Syllabuses

State of the World and Answers in the Legal and Institutional Fields

Presentation of the main current environmental issues. It is intended to demonstrate the relationship between different economic cycles, the use of natural resources and impacts on society and the environment, and the major challenges facing humanity to ensure the maintenance and improvement of quality of life, in developed or developing countries. It lists the set of legal and institutional responses at the multilateral level to address these challenges. International conventions and treaties on environment, human rights and labor relations are presented in evolution, as well as their incorporation into the Brazilian legal framework. Finally, the subject relates social and environmental issues to international trade.

Context: Business and Sustainable Development

The discipline aims to discuss the different conceptions of development and sustainability, as well as present the foundations of social and environmental responsibility in the context of business organizations.

Economy and the Environment

Analysis of the relationship between environment and economic system based on neoclassical environmental economics and the green economy. Reflection is on the main differences and limitations of these approaches. Introduction and discussion of relevant issues about economy and the environment, for example, environmental policy instruments (instruments of direct regulation and economic instruments) and the mechanisms of environmental management that incorporate economic incentives.

Sustainability and Strategy

Analysis of the influence of aspects associated with sustainability in business competitiveness, from the internal scenario of the organizations to the operation in international supply chains, through an – incremental and disruptive – innovation agenda in products, production processes and business models. Presentation of models that combine the increasing demand for sustainability with business competitiveness.

Systemic Thinking

Presentation of a planning method based on systems dynamics and scientific and socio-economic principles. Definitions of sustainability principles will be presented, using basic science, the ABCD methodology of The Natural Step and backcasting, as well as case studies.

Corporate Governance

Examination and discussion of concepts and practices of good corporate governance and its relationship to the strategy and business performance. Reflection about the relationship between sustainability issues and decision-making processes at the companies' senior management.

Public Policies and Climate Change

The subject includes studies of the main problems related to climate change at the international and national levels, focusing on the interface between economic development, mitigation and adaptation to climate change and the key challenges and responses generated in the field of public policy.

Accounting

Accounting importance: conceptualization and objectives; corporate and managerial accounting; postulates, principles and conventions. Financial statements: introduction; accounting mechanics; balance sheet; statement of changes in equity.

Controllershship

Review of significant accounting reports published: Balance Sheet, Profit and Loss Statement, and Cash Flow Statement. Presentation of the Value-Added Statement. Application of financial analysis techniques to a publicly-traded company, exempli-

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fying the use of indicators obtained from accounting reports. Use of value creation indicators (economic profit). Description of assets and liabilities not recorded. Presentation of the Balanced Scorecard, which allows the incorporation of goals and sustainability indicators into the management of organizations.

Stakeholder Engagement and Value Chain

Presentation of all the models and standards of sustainability management, focusing on the management of relationships with stakeholders. Examination and discussion of ways to assess the materiality of sustainability issues, with tools such as social auditing and standardization of sustainability management. Overview of standards and certifications, such as AA1000 and ISO 26000. Models and stakeholder engagement processes: AA1000 and AA1000SES.

Environmental Management: from Environmentalism to Sustainability in Business

The course introduces environmental concepts necessary for the full understanding of corporate environmental management, such as natural resources, biodiversity, ecosystems, environmental services and pollution. It shows the development of environmental strategies in business organizations, their motivating factors and trends. Key approaches and environmental management tools in companies will be studied, analyzing their potential, weaknesses and major gaps in relation to sustainability management. The following topics will be addressed: i) the environmental impact assessment (EIA); ii) inventories of pollution sources (including greenhouse gases); iii) ecological footprint and derivatives (water footprint, forest footprint, carbon footprint); iv) life cycle analysis (LCA); v) eco-efficiency, pollution prevention, cleaner production (CP), industrial ecology; and vi) environmental management systems.

Strategic Management

Examination and discussion of sustainability issues that can be placed in strategic business decisions. The results of such decisions will be discussed based on the financial analysis of companies, with an emphasis on business viability in the long run. It begins with an introduction to the concept of strategy, its historical evolution and the industry analysis model. It then covers a resource-based view, the evolution of that view, the issue of creating shareholder value and sustainability, cost of capital, discounted cash flow, and finally, valuation of companies.

Integrated Management Systems of Corporate Sustainability

Identification of the key elements in the planning and implementation of integrated management systems of corporate sustainability; comparative analysis of consolidated management models with emerging models or in diffusion process (Sigma Project, Global Compact Management Model, ISO 26000 and others). Development of skills necessary for selection and integration of models, methods and tools for sustainability management.

Local Development

Introduction to local development concepts. Analysis of the integration of large enterprises into small towns. Reflection on dynamics and strategies of interaction between business, government and local communities. Opportunities, tools and conditions for local development.

Consumption and Marketing

Presents the history of the consumer society, its evolution into a hyper-consumption society and the impact on life quality and the environment. Discusses the concepts of green consumption, conscious consumption and sustainable consumption. Develops the debate on the role of consumers, non-governmental organizations, governments, businesses and social movements as transformation actors of the current model of economic development, with a view to promoting sustainable consumption actions. Discusses the role of Marketing in modern society, in relation to ethics and environmental issues, green, social, environmental marketing. It introduces the concepts of creating niche markets for sustainable products and goods. Develops the architectural concepts of brands that use environmental sustainability as an additional brand value.

Sustainable Finance and Impact Investment

Discussion of the impacts generated by financial institutions in society, and examination of how sustainability affects financial institutions, investors and creditors. Historical aspects and a motion analysis in financial institutions in Brazil and abroad, the risks hanging over the banking sector, with special emphasis on the Equator Principles and environmental policies. Discussions about the economic value of socially responsible investments and benchmarks are also included.

Research Methodology

The rules for developing a final research report; brief history of scientific research; the scientific method; the components of a scientific work; the structure and formatting of an academic work.

Negotiation Workshop

Introduction to negotiation; mutual gains approach; public dispute resolution; negotiation features. Consensus building: approaches to consensus building; positional bargaining and impasse; managing difficult conversations, joint fact finding, competition and game theory.

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Appendix 3. Initial exercise comparing the concepts and terminology of disaster risk management and adaptation to climate change.

4. Which disasters¹⁶ can be caused or intensified by climate change?

Hazards – PreventionWeb	Can be intensified by climate change?	Category as it appears in EPC Tool
Avalanche	Yes	Climate event
Cold snap	Yes	Climate event
Cyclone	Yes	Climate event
Drought	Yes	Climate event
Earthquake	No	-
Epidemic and Pandemic	Yes	Impact
Inundation (Flood)	Yes	Climate event
Heat wave	Yes	Climate event
Insect Infestation	Yes	Impact
Landslide	Yes	Impact
NBC – Nuclear, Biological, Chemical Disaster	No	-
Storm Surge	Yes	Climate event
Technical Disaster	No	-
Tornado	Yes	Climate event
Tsunami	No	-
Volcano	No	-
Wild Fire	Yes	Impact

5. Comparison between terminologies in EPC Tool and PreventionWeb¹⁷.

Some terms in the EPC Tool glossary	Terminology in PreventionWeb
Adaptation	Yes
Adaptive Capacity	As “capacity”
Exposure	Yes
Impact	No
Danger	Yes
Resilience	Yes

¹⁶ Source: <http://www.preventionweb.net/english/hazards/>. Visited on March 16, 2016.

¹⁷ Source: <http://www.preventionweb.net/english/professional/terminology/>. Visited on March 16, 2016.

Some terms in the EPC Tool glossary	Terminology in PreventionWeb
Risk	Yes
Sensitivity	No
Vulnerability	Yes

Appendix 4. Inputs from MSM's subjects to the adaptation to climate change planning Framework that will be implemented in the interdisciplinary activity proposed

Executive Master on Sustainability Management		Adaptation to Climate Change planning process	
Subject	Axis	Inputs to adaptation planning	Steps of adaptation Cycle
<i>Concepts in accounting</i>	Economy	- Financial statements: introduction; accounting mechanics; balance sheet; statement of changes in equity	1.3 Risks and opportunities 2.1 Adaptation options 3.1 Actions and monitoring 3.3 Communication
<i>Controllershship</i>	Economy	- Value creation indicators (economic profit) - Assets and liabilities not recorded - Balanced Scorecard, which allows the incorporation of goals and sustainability indicators in the management of organizations	1.3 Risks and opportunities 2.1 Adaptation options 3.1 Actions and monitoring 3.3 Communication
<i>Strategic Management</i>	Economy	- Financial analysis of companies, with an emphasis on business viability in the long run - Elements of industry analysis model: creating shareholder value and sustainability, the cost of capital, the discounted cash flow, and finally, the valuation of companies	1.3 Risks and opportunities 2.1 Adaptation options
<i>Sustainable finance and impact investment</i>	Economy	- How sustainability affects financial institutions, investors and creditors - Risks hanging over the banking sector	1.3 Risks and opportunities 2.1 Adaptation options
<i>Environmental Management: from environmentalism to sustainability in business</i>	Environment	- Environmental impact assessment - Industrial ecology - Environmental management systems	1.2 Climate scenario 1.3 Risks and opportunities 3.1 Actions and monitoring

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Executive Master on Sustainability Management		Adaptation to Climate Change planning process	
Subject	Axis	Inputs to adaptation planning	Steps of adaptation Cycle
<i>Public policies and climate change</i>	Environment	- Problems related to climate change: interface between economic development, mitigation and adaptation to climate change	1.2 Climate scenario 1.3 Risks and opportunities 2.1 Adaptation options 2.3 Agreements, partnerships and resources 3.3 Communication
<i>Economy and Environment</i>	Environment and economy	- Environmental policy instruments (instruments of direct regulation and economic instruments) - Mechanisms of environmental management that incorporate economic incentives	1.3 Risks and opportunities 2.1 Adaptation options 3.1 Actions and monitoring
<i>Corporate Governance</i>	Social	- Concepts and practices of good corporate governance and its relationship to the strategy and business performance. - Relationship between sustainability issues and decision-making process in the senior management of companies	1.3 Risks and opportunities 2.1 Adaptation options 2.3 Agreements, partnerships and resources 3.3 Communication
<i>Local Development</i>	Social	- Reflection on dynamics and strategies of interaction between business, government and local communities	1.3 Risks and opportunities 2.1 Adaptation options 2.3 Agreements, partnerships and resources 3.3 Communication
<i>Stakeholder engagement and value chain</i>	Social	- Models and standards of sustainability management, focusing on the management of relationships with stakeholders	1.3 Risks and opportunities 2.1 Adaptation options 2.3 Agreements, partnerships and resources 3.3 Communication
<i>State of the world and answers in the legal-institutional field</i>	Transversal	- International and national conventions and treaties that concerns the economic activity - Brazil legal framework	1.3 Risks and opportunities 2.1 Adaptation options
<i>Sustainability Strategy</i>	Transversal	- Aspects associated with sustainability in business competitiveness. - Innovation agenda - incremental and disruptive - Models that combine the increasing demand for sustainability to business competitiveness	1.3 Risks and opportunities 2.1 Adaptation options