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Tesi di Laurea
Adaptation to Climate Change as
"Strategic Fit"

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CHAPTER 1

Understanding the Role and the Status of Adaptation to Climate Change

1.1 Climate Change

Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity (Bernstein, 2007).

More practically Climate Change implicates the set of long lasting and high complex phenomena like ice caps and glaciers' melting, sea level raise, changes in precipitation patterns, ocean acidification, variations in the frequency, intensity and spatial distribution of extreme weather events such as storms, floods, droughts and so on that we have become used to hear about or deal with (IPCC, 2012).

Most commonly when we refer to these changes in climate we are also used to trot out "global warming". Probably this is a well-chosen terminology to identify that the real cause of Climate Change are the current raising temperature's levels. Today, our world is hotter than it has been in two thousand years (<http://www.greenpeace.org/usa/en/campaigns/global-warming-and-energy/>), as it can be seen in *figure 1* both Land and Ocean's temperatures are on average rising worldwide at levels never touched before. The question if this was "whether due to natural variability or the result of human activity" (Bernstein, 2007) sparked the attention of scientific bodies of national and international standing in the past years.

The leading scientific opinion on this matter recognizes that even if sudden climate changes due to natural climate variability have already occurred in a distant past (United Nations Framework Convention on Climate Change, UNFCCC art 1.2; Elders, 2001), there would be no reason to not believe that raising temperatures, would not be liked in any way to anthropogenic emissions of GHGs which is inevitably charging human activity with global warming and climate change.

Rising fossil fuel burning and land use changes have emitted, and are continuing to emit, increasing quantities of greenhouse gases into the Earth's atmosphere. These greenhouse gases include carbon dioxide (CO₂), methane

(CH₄) and nitrogen dioxide (N₂O), and a rise in these gases has caused a rise in the amount of heat from the sun withheld in the Earth's atmosphere, heat that would normally be radiated back into space. This increase in heat has led to the greenhouse effect, resulting in climate change (UNFCCC, 2007).

Holding this firm belief in mind we have shifted the environmental conversation from the question if climate was changing to the quest of understanding how much or how quickly is changing (World Economic Forum, 2013). Plenty of scientific reports have already been published on this matter. The main position is that the rate of GHGs in the atmosphere, which has been steadily increasing since the Industrial Revolution, has seen an unprecedented increase of 70% only in the period between 1970 and 2004 (Solomon et al., 2007). Although this increase has deemed to be not sustainable by the Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), still there is no consensus on how fast is climate actually changing. However what we know is that climate attribution's science, which causally connects Climate Change and extreme weather events is also advancing rapidly so that we have achieved a sufficient understanding of what we can expect in the years to come (<http://www.newscientist.com/article/mg21528723.500-as-freak-weather-becomes-the-norm-we-need-to-adapt.html>). We know already "almost certainly" that the 21st century will see increases in the frequency and magnitude of warm daily temperature extremes and decreases in cold extremes together with augmented frequency of heavy precipitation or the proportion of total rainfall from heavy rainfalls over many areas of the globe (IPCC, 2012). Besides there are indications that our weather would be becoming even more extreme than climate scientists predicted (<http://www.newscientist.com/article/mg21528723.500-as-freak-weather-becomes-the-norm-we-need-to-adapt.html>) which at the most ground to ground level means that the world's main economic sectors should be already experiencing most of the projected impacts of Climate Change expected for the years to come (Table 1). Since this is already the case it seems hard to think that Governments around the world would not know about Climate Change's serious implications. They certainly have understood that without undertaking adequate actions these issues will be every day worse and worse, moreover they are also aware that with grass roots people inevitably starting to realize themselves that we are really not talking anymore about a distant and abstract threat the pressure on making decisions on this regard will be everyday more significant. However policy makers

need to take decisions in a landscape where Climate Change is only one, although one of the greatest challenges (World Economic Forum, 2013).

Figure 1: Land and Ocean's temperatures rising on average worldwide

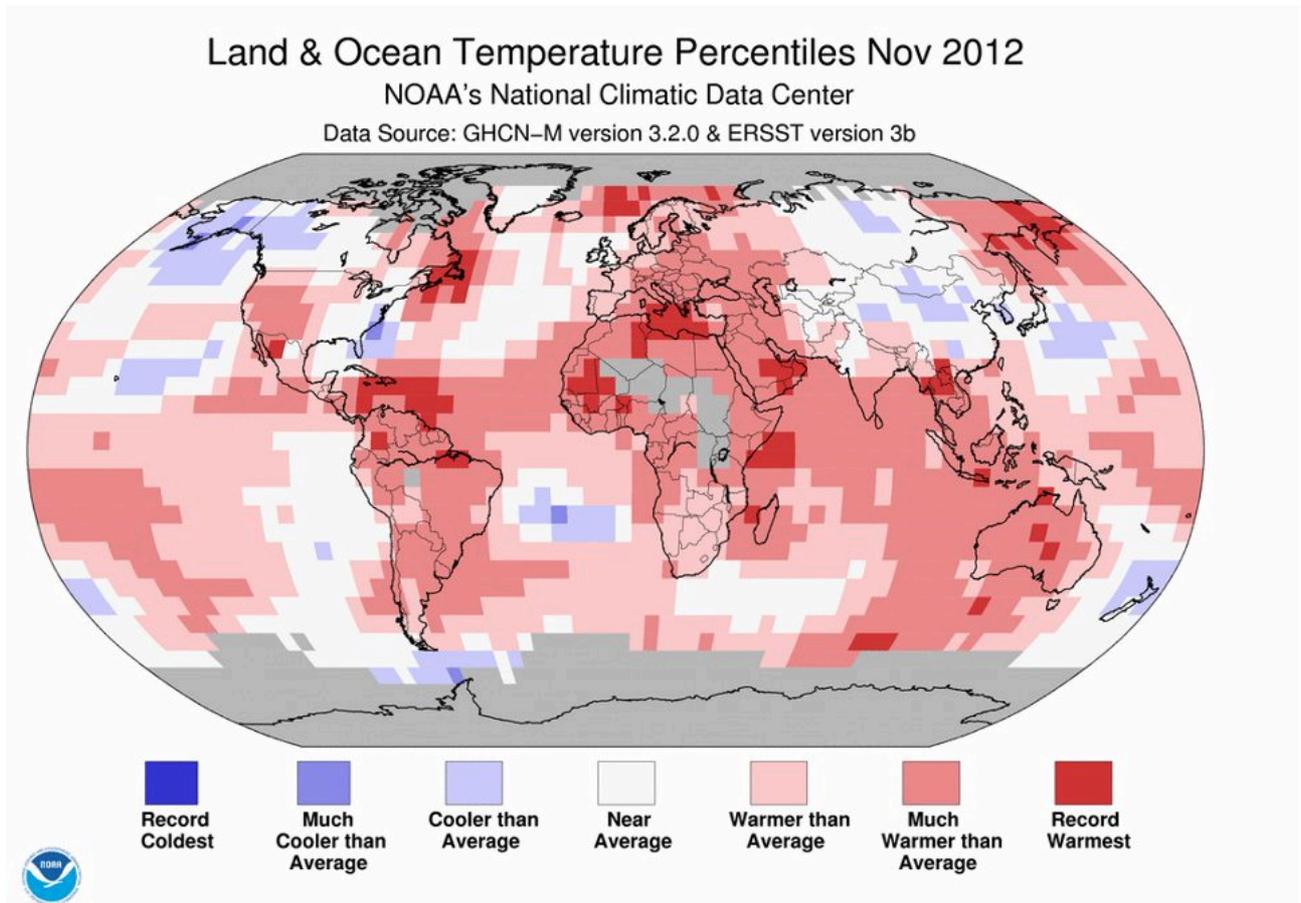


Table 1: Sectorial Impacts of Climate Change

Agriculture	<ol style="list-style-type: none"> 1. Raising temperature might reduce yields in some areas and favour the increase of insect populations. It is also true that raising temperature have the potential to increase yields in some areas, but in the long run it is estimated that almost everyone will be a net loser from climate change (SEI, 2011). 2. Increasing salinity resulting from sea level raise and storm surges might reduce the quantity and quality of land available for agriculture. 3. Increasing frequency of droughts and floods might disrupt agricultural production leading to production shortfalls. 4. Changes in ocean currents, sea level, water temperature, salinity and wind speed and direction may substantially alter fish breeding habitats and food supply. <p><i>Source: "Sector Briefing on Climate Change Impacts and Adaptation". Agriculture (ADB)</i></p>
Water supply and sanitation	<ol style="list-style-type: none"> 1. Changes in precipitation pattern have the potential to affect water supply availability and quality: precipitations' reduction decrease the availability of surface water and groundwater while precipitations' increase might led to floods and the overwhelming of existing drainage infrastructures. More generally any substantial change in the amount of rainfall is likely to affect the performance of water systems. 2. Changes in ambient air and water temperatures are harming water's quality and availability. Higher temperatures reduce surface water availability by decreasing runoff and increasing evaporation from lakes and reservoirs. The increase in temperature will led in the short run to a faster snow's melting which in turn will increase water availability in the winter-spring seasons and decrease it in the summer. Over the long run glaciers' retreat will initially increase water availability and then reduce it for downstream users. Higher temperature and increases in periods of extreme heat will push up agricultural water demand due to decreasing soil moisture. At the same time also domestic/ industrial water demand is expected to increase. 3. Changes in the frequency, duration and distribution of extreme weather events can affect water supply, services and infrastructures. For example an unexpected precipitation pattern or a flash flood might led to the breakdown of water distribution pipelines. 4. Sea level raise and storm surges put water supply at risk: saline intrusion in low lying coastal areas might contaminate aquifers, but also corrode materials. <p><i>Source: "Sector Briefing on Climate Change Impacts and Adaptation". Water Supply and Sanitation (ADB)</i></p>

Energy	<ol style="list-style-type: none"> 1. Changes in water availability affect hydropower generation. For example changes in water precipitation might affect the hydrological cycle and river runoff leading to changing outputs from hydropower projects. The retreat of glaciers might increase water availability and so power generation but only in the short term and in the winter/spring season whereas in the summer and over the long run there will be in general a significant reduction in term of power generated. 2. Changes to air and water temperature affect thermal power generation efficiency. For example increasing water temperature might adversely affect the operation of the cooling systems of thermal and nuclear power plants. 3. Sea level raise, changes in wind speed and of the intensity and distribution of extreme weather events have direct impacts on energy infrastructures. Outputs of wind and solar photovoltaic projects can be affected as well. Energy infrastructures in low-lying coastal locations are increasingly at risk of damage, disruption and imply higher maintenance costs. <p><i>Source: "Sector Briefing on Climate Change Impacts and Adaptation". Energy. (ADB)</i></p>
Transportation	<ol style="list-style-type: none"> 1. Extreme events can reduce mobility causing damages to critical infrastructures. 2. In coastal areas, storm surges and sea level raise put critical infrastructure at risk by corroding materials and inducing collapse of embankments. 3. Changes in temperature and precipitation pattern might reduce water availability to compact materials and lead to roads' damage by increasing runoff. 4. Increase wind strength can also damage the transport infrastructure. <p><i>Source: "Sector Briefing on Climate Change Impacts and Adaptation". Energy (ADB)</i></p>
Health	<ol style="list-style-type: none"> 1. Raising temperature and poor air quality in the populous areas are likely to cause widespread smog and induce cardiovascular and respiratory illness. 2. Warmer temperatures, heavy rainfall, and more frequent floods will increase the geographical habitat of disease vectors and the incidence of waterborne infectious diseases. 3. Reduction in crop yields will likely to pose the threat of malnutrition. <p><i>Source: "Sector Briefing on Climate Change Impacts and Adaptation. Health (ADB)</i></p>

1.2 Policy and Injustice of Climate Change

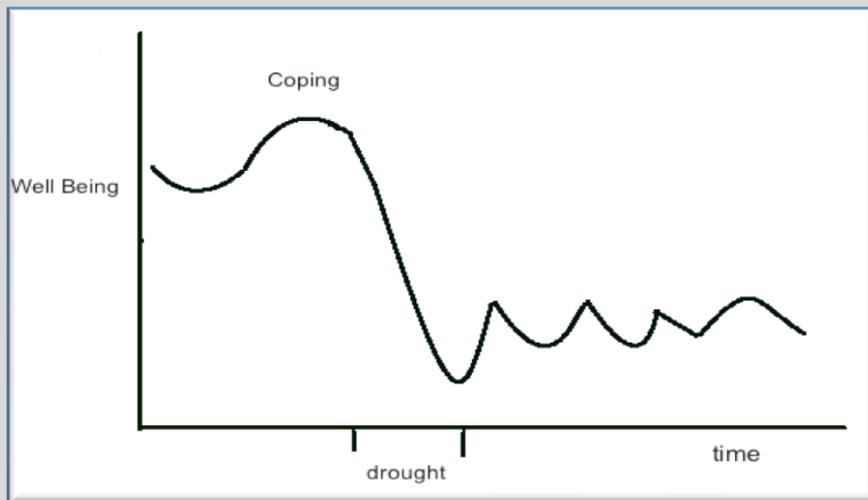
Although Climate Change is certainly a global problem and affects everyone, it does not affect everyone in the same way (Pettengell, 2010). Policy makers often rely on economic models that display the risk of climate change for the world as a whole, but the fault of these models lie in the aggregate figures they produce which do not reflect the severity of impacts on some people. It is important to get to the point that the wide range of climate outcomes are related not only to the place where individuals live, but also on their income, on how they earn their livelihoods and other key vulnerabilities (Stanton et al., 2011) as it is underlined in Box 1. This to clarify that even if the effects of climate change are likely to be felt on a global scale, certain populations and especially some people are deemed to suffer more from its consequences: the poor and marginalized people in the least developed countries have less means to cope with its most adverse impacts, on top of that are also the ones that historically contributed the less to emit green house gases. This explains why climate change has raised issues of global justice and fairness. "The huge injustice of climate change is that it is those who have done the least to cause the problem – the most vulnerable, from the world's poorest communities – who are hardest hit" (Salmond, <http://www.guardian.co.uk/global-development/2012/jun/06/scotland-climate-justice-fund-poorest?INTCMP=SRCH>) said the Scottish First Minister during the launch of the Scotland's Climate Justice Fund (<http://www.scotland.gov.uk/News/Releases/2012/05/climate-justice-fund31052012>).

Box 1: Unevenness of climate impacts

Some people are hit harder by changes in climate. The poorest households are the most at risk because are those which rely on climate sensitive assets for their livelihood. In general people that depend on agriculture, livestock and fisheries are more at risk (Heltberg et al., 2008) so that a flood or a drought might mean hunger or homelessness for them. Here are presented two graphics that depict as many representative households' well-beings. Both households are supposed to cope with climate events, i.e. they deal with climate change using their capacities and resources. Coping strategies are short-term responses to events that might threaten livelihoods and may have a positive or negative impact on the future sustainability of the individual that carries them out (FAO, 2010). In general coping strategies vary from country to country, but in rural areas and for poor communities usually there are common responses such as *income coping strategies* (e.g. selling livestock for extra cash, growing illegal substances, trying to get extra work), *cutback strategies* (e.g. pulling children out of school, eating cheaper, avoiding the expenses of going to the doctor) and other *agricultural coping measures* (FAO, 2010).

Let both households in our example be farmers that eat the food they grow. The only difference between them is the initial endowment of resources: for simplicity we name the household in *graphic 1* "poor" and household in *graphic 2* "rich". As usual on the x axes is represented the independent variable "time" whereas on the y axes is the dependent variable, i.e. "well being". Well being usually goes up-and-down as it can be perceived at the beginning of each graphic, but for a farming household that eat the food they produce a drought could really decrease their well being and make the difference (in both graphics the well being abruptly decrease with the drought). However in some cases this difference can be permanent (*graphic 1*) if the "poor" household have to sell important assets, e.g. animals or some of their tools, or even pull their children out to school to survive the drought, recovery from the shock might be slower and incomplete (Heltberg et al., 2008) with the risk that they might not even return back to the original level of well being because they have lost important assets they used for their livelihood. In this case the drought keep the household in poverty. Long-run impacts might not only include poverty and might fall disproportionately on vulnerable individuals such as children, women, elderly and disabled (Heltberg et al., 2008). In the case the household had been forced to pull their children out to school this might have resulted in child labour and permanent withdrawal from schooling

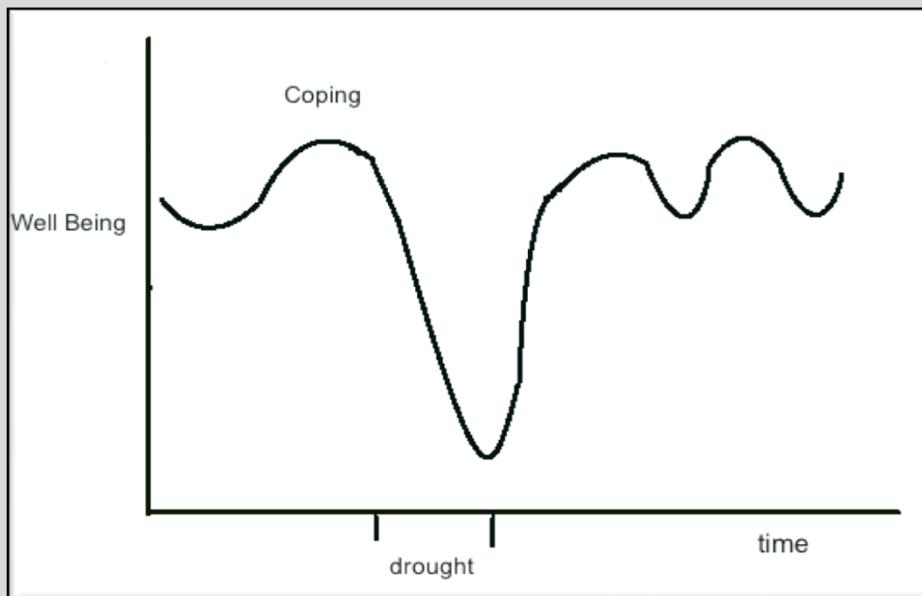
for example.



Graphic 1: Impacts of a drought on a "poor" household's well being.

Source: World Research Institute (<http://www.wri.org/project/vulnerability-and-adaptation>)

The "rich" household (*graphic 2*) instead, was able to buy a insurance, or store a necessary amount of food, so that they did not have to sell their assets or pull their children out to school to survive the drought and they can return more quickly to the original level of well being. Usually the higher the income, the higher the resilience to climate hazards.



Graphic 2: Impacts of a drought on a "rich" household's well being.

Source: World Research Institute (<http://www.wri.org/project/vulnerability-and-adaptation>)

It is estimated that the cost to recover from climate related disasters would pick 19% of GDP in some of the least developed countries by 2013¹ and it would be trivial to forecast that such a strong incidence might definitely undermine the prompt development of these already fragile economies. The awareness that climate change must be ascribed mainly to anthropogenic green house gases emissions has inspired public opinion, academics and international organizations to reaffirm the need to share this responsibility especially among developed world's countries, the ones which contributed the most to endanger the interplay between human systems and earth system up to the current unsustainable levels. Before climate change took definitely the colours of a North-South dispute with Southern countries asking for reparations for a climate change they did not cause, the development community taught to admit its own responsibilities and devised a plan to "staunch" the inexorable climate change under way. On the matter of responsibility developed countries agreed to provide funding for the full incremental cost of climate change in developing countries (art. 4.3 UNFCCC) in accordance with their common but differentiated responsibilities and respective capabilities (art. 3.1 UNFCCC). Even though the notion of incremental cost of climate change is per se ambiguous and its total difficult to assess, the developed world has shown unwary optimism for its high-flying and too often flaunted aim of providing the additional cost of climate change. It is nowadays agreed that this incremental cost is the cost that is needed to transform business as usual fossil fuel led growth, into a sustainable, low emission, climate resilient, economic development (Schalatek and Bird, 2010) and as a consequence it deals with capital investment as well. To promise such a consistent change must imply an effective climate policy that cannot aside from a huge financial availability. As for climate finance the Climate Policy Initiative gives the best picture of the current financial landscape suggesting that despite the USD 97 billion per annum already provided to support climate activities are close to the USD 100 billion target promised by developed countries in the Copenhagen Accord, still these funds are not additional to the climate finance available prior the Copenhagen Accord and include as well some developing countries domestic sources, although to a limited extent (Buchner et al., 2011). As for the climate policy devised to pursue the promised sustainable development transformation, this involves a portfolio of diverse adaptation and mitigation actions (Klein, 2007) which, by tackling the problem from completely different angles (Bosello et al., 2009), are meant to reduce the

¹ K. Batten (US-AID), ADAPT Asia-Pacific 1st Annual Forum. 2012

main source of climate change by lessening the impact of human activities on global warming and cushioning its effects at the same time. This double response is by now consolidated on a practical ground by addressing a two-pronged approach:

- ❖ Management, reduction and improvement of greenhouse gas emissions.
- ❖ Making adjustments to existing activities and practices to build the resilience to the expected impacts of climate change.

In order to facilitate the comprehension of these two action's packages it could be said that the first and historically more prominent option (Fankhauser, 2009), i.e. mitigation, deals with the causes, whereas the second, i.e. adaptation, with the consequences of climate change (<http://www.defra.gov.uk/environment/climate/adapting/>). The two responses are also grounded into polarized approaches: while economics consistently explains the need for mitigate, the fairly more complex issues posed by adaptation require a different language for cognition and problem solving which is the language of management.

1.3 The Economics of Climate Change Mitigation

Mitigation is broadly intended by the UNFCCC as the effort to reduce emissions to achieve the stabilization of green house gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (http://unfccc.int/methods_and_science/mitigation/items/3681.php). We could say that mitigation is meant to assure a "sustainable landscape" coming from pollution's abatement. In practice it deals with investments in low carbon emissions, which means cuts on the global emissions of green house gases, nonetheless there is no single method or technology through which mitigation is meant to be achieved (Baca, 2010). More recently it has been recognized that the change in land use (principally deforestation) is also responsible to a great part of global emissions (http://www.unep.org/forests/Portals/142/docs/Reporting_REDD-Media_Pack.pdf) which has lead to investments in forestry such as the so called Redd+ investments which are meant to reduce emissions from deforestation and forest degradation. Redd+ is a specific "gill" of mitigation with a promising future development; by now its actual impact in financial terms is roughly between one fifth to one sixth of the overall mitigation effort (<http://www.climatefundupdate.org/themes>).

Mitigation is primarily driven by international agreements and possibly complemented by responsible countries' voluntarily actions (Klein et al., 2007). International agreements are meant to address specific issues, possibly grounded into political, ethical and economic considerations. Their outcomes are the results of international cooperation whose relative success ordinarily depends upon the economics of the underlying problem and the design of the treaty intending to remedy it (Barret, 1999). When it comes to environmental international agreements on pollution's abatement, i.e. on mitigation, the economics of the problem is the economics of global public goods.

According to economists mitigation is a global public good because it is a global issue with the classic features of public goods. More precisely the appellative global derives from the fact that the environment is unlimited by national boundaries, but cross over into sub regional, regional and global spheres (Gardiner and Le Goulven, 2002); it is also a public good because it presents two critical properties: non rivalrousness and non-excludability (Samuelson, 1954) which can most naturally be explained in terms of consumption (Stiglitz, 2006). Mitigation is: non rivalrous because the consumption of clean atmosphere of one individual does not detract from consumption in others; non-excludable because it is difficult or impossible to exclude any individual from enjoy the good in question once it is provided (Stiglitz, 2006). Clean atmosphere, i.e. atmosphere containing less green house gases, once it is provided, it is free and everyone can enjoy it worldwide.

For the sake of precision the name public good is often referred to activities with positive utility including positive externalities as in the case of mitigation; when a public disutility is involved the appropriate term would be "public bad". Therefore if one wants to focus on emissions of green house gases, it is clear that these are public bads involving negative externalities. Externalities are third party effects that arise from production and consumption of goods and services for which no adequate compensation is paid (http://tutor2u.net/economics/content/topics/externalities/what_are_externalities.htm). As mentioned above they can be both positive and negative, which is an appealing distinction to identify their positive or negative utilities to third parties.

This passage was not meant to generate confusion, but to suggest that examples of public goods and externalities really tend to overlap, so it is sometimes hard to say what is a public good and what is an externality (<http://www.hks.harvard.edu/nhm/notes2006/notes8.pdf>). Sometimes public goods can be actually thought as a special case of externalities (Cornes and Sandler, 1996), hence the

reader who wants to compare different studies should be familiar with both terminologies when it becomes a matter of preferences to choose one or the other.

We chose the language of public goods/bads, which makes important to have understood clearly the difference between mitigation as a public good and pollution as a public bad. Public goods/bads face in general provisional problems: while public goods tend to be under produced, public bads tend to overproduction. These are often referred as cases of market failures. From a collective point of view this "sub optimality" might be disastrous (Kaul et al., 1999). Let's clarify this by looking at the reasons why the public good "mitigation" should be under produced.

The provision of mitigation by any country benefits every country because it is non excludable and non-rivalrous in consumption, but only the countries that provide the good pay for its provision (Barret, 1999). Sometimes one forgets to point out that there is no way to restrict countries' emissions without altering their production and consumption's patterns, hence decreasing carbon emissions might have a significant impact on the ability of one economy to produce and trade (Heal, 1999). The premise that cutting emissions is costly is necessary to understand why each country might prefer that others would provide the public good. Of course the theory of international cooperation tells that if all countries would mitigate altogether they would enjoy a better climate, but because of the incentive to free ride this goal is not likely to be attained with the result that the good "clean atmosphere" would be under produced (Barret, 1999). As a consequence we are increasingly likely to experience the negative impacts of climate change.

Mainstream economists use public goods and externalities (often interchangeably) as very powerful tools to address how society should rethink its responsibility on these matters and to provide the rationale for an international collective action (Aldy et al., 2001). This rationale is found in the argument that managing environmental problems "efficiently" requires well designed public policies to mitigate the failure of the market economy due to the presence of public goods (Ambec and Ehlers, 2010).

Here is the heart of the matter behind the rationale to support government interventions addressed to reduce this failure. The logic is straightforward: mitigation is naturally under produced, hence we need more mitigation, but this will be costly.

At this point it is legitimate to try to answer a basic question: Who should pay for the provision of the public good? Or better, which countries should cut back emissions and by how much (Heal, 1999)? This choice is not only going to affect the distribution of wealth between countries, but also within countries. It is likely that each government will

reformulate the same question in relation to the firms inside the country and perhaps this will be done at a smaller scale also for firms that belong to the same sector. Although the economic implications of these choices might be difficult to be analyzed *a priori*, economists usually suggest three basic response options (Heal, 1999):

1. Command and control approach, i.e. take the total desired pollution level and divide it in some way among actors.
2. Introduction of a carbon tax to bring pollution down to a desired level using the tax rate.
3. Introduction of a market system with allocation of pollution rights and allowing them to be traded.

Economists claim that the last two options are more cost effective which means that the same reduction might be achieved at a lower cost and that between the two, the market is preferable for the obvious reason that one can pick up the desired pollution level and issue pollution rights for an amount equal to that level (Heal, 1999).

Among OECD countries the issue is most commonly solved by putting a price on GHGs emissions through pricing mechanisms as carbon taxes, emission trading systems or a combination of both (OECD, 2009). Ideally these measures would send a signal to polluters that our environment is valuable and it is worth protecting. Despite having a global carbon price, i.e. a global carbon tax seems still political fantasy, many countries have already introduced carbon pricing schemes at the national level (Flannery et al., 2012) which demonstrates that cutting emissions is not only a matter of economics, but that interests and concerns, as priorities and preferences, might vary and that every country may find its appropriate regulation that fit its national priorities (if mitigation became a priority).

Back when most of these countries that nowadays are implementing national climate regulations "did not realize" yet the gravity of the issue, negotiations were going straight toward the reaching of an international agreement. However lacking an international public authority the discourse on mitigation was necessarily grounded into elements of common sense. For instance at the international level mitigation has involved and it still does considerations on sustainable development inasmuch it is agreed that global emissions originated in developing countries will grow to meet their social and development needs and that a cut in emissions should come first from historically responsible countries, i.e. OECD countries above all (Bird and Brown, 2010; Schalatek, 2011). On this matter the

United Framework Convention on Climate Change, the international mitigation tool par excellence (Baca, 2010), made a first clear distinction between developed and developing countries already in 1992. Developed countries and Europe's transition economies, included in annex I, decided voluntarily to limit their anthropogenic emissions, though choosing different targets. These commitments were made more consistent with the Kyoto Protocol in 1997 by inclusion of annex B where the extent of the emissions' reductions was clearly quantified. In the case in point annex I countries agreed to reduce their overall emissions by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012 (art 3.1 Kyoto Protocol), though not all the parties ratified it.

The Kyoto Protocol contemplates flexible market mechanisms for achieving these mitigation's targets or "assigned amounts". These are decomposed into "assigned amount units" (AAUs) that are tradable pollution rights or quotas worth one tonne CO₂-equivalent, with a market value. Hence the incentive to cut emissions is provided by the fact that quotas in excess can be sold. The flexible market mechanisms include the *Clean Development Mechanism* (CDM), the *Joint Implementation* (JI) and the *International Emission Trading* (IET).

- ❖ The *Clean Development Mechanism* allows parties with emission reductions commitments to meet their reduction targets earning certified emission reduction credits (CERs) by implementing projects aimed at reducing anthropogenic emissions in developing countries (art. 12 Kyoto Protocol). Every credit earned allows annex B countries to pollute one tonne CO₂-equivalent more than their reduction targets.
- ❖ The *Joint Implementation* allows parties with emission reductions commitments to meet their reduction targets earning Emission Reduction Units (ERUs) by implementing an emission-reduction or emission removal project in another Annex B Party (art. 6 Kyoto Protocol). As for the CERs, every ERU allows Annex B countries to pollute one tonne CO₂-equivalent more than the established target. The main difference between the CDM and JI lies in their application, as JI projects can only be hosted by countries with emission reduction or limitation commitments ([http://einstitute.worldbank.org/ei/course/clean-development-mechanism-and-joint-implementation-navigating-kyoto-project-based-mechanism - the main difference between](http://einstitute.worldbank.org/ei/course/clean-development-mechanism-and-joint-implementation-navigating-kyoto-project-based-mechanism-the-main-difference-between)).

- ❖ The *International Emission Trading* allows countries that have assigned amount units (AAUs) to spare, i.e. emissions permitted them but not "used", to sell this excess capacity to countries that are over their targets (art. 17 Kyoto Protocol). Since carbon dioxide is the principal greenhouse gas, people simply speak of trading carbon when trading emission units, which is the reason why we commonly talk about the "carbon market" (http://unfccc.int/kyoto_protocol/mechanisms/joint_implementation/items/1674.php). Moreover the IET also permits to transfer under the same scheme CERs, ERUs and Removal Units (RMUs) that are another kind of credits that can be earned on the basis of land use change (http://unfccc.int/kyoto_protocol/mechanisms/emissions_trading/items/2731.php).

It is argued that this system, and in particular the combination CDM and IET scheme should assist developing countries in achieving sustainable development by means of improved living conditions and technological transfer (http://cdm.unfccc.int/about/dev_ben/index.html), and at the same time be a flexible instrument for developed nations to meet their reduction targets.

Unfortunately all that glitters isn't gold: a global market established by government fiat has never been successful for any commodity and it would welcome sharp and corrupt practices (Prins and Rayner, 2007). For instance it would seem that the emission trading scheme would forgive increasing pollution in the North if this was offset by dubious projects in the South (Bond et al., 2012), moreover estimating the emission reduction due to the implementation of a certain project is something that can never be done precisely and besides it involves transaction costs (Barret, 1999). Since many sites of emissions in the developing world require urgent attention, this would have fostered the proliferation of "false solutions" to the climate crisis (Bond et al., 2012), e.g. solutions connected with negative social and environmental impacts. Projects for the construction of large dams, already recognized by the UN for their human rights abuses and often criticized by the European Union for their environmental impact, certainly fall in this category (Haya, 2007). More generally the leading criticism is the CDM would have worked as an instrument to subsidize many dangerous for profit activities, making them more advantageous for multinational organizations and at the same time has let the same organizations polluting above their assigned targets (Bond et al., 2012).

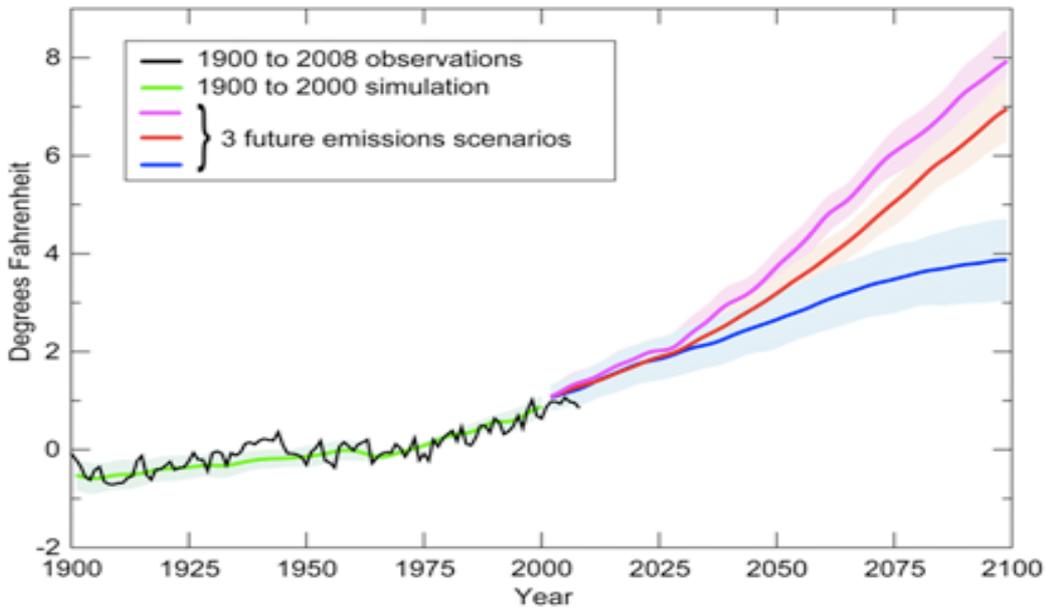
Even though the post of 1 billion CERs has recently been passed (<http://cdm.unfccc.int/about/index.html>) these issues have raised few concerns on the easiness to obtain a project to be labelled as clean, though its negative ancillary impacts. The attitude of the CDM Board to let the CDM market going, must be framed into the overall trend of climate change negotiations whose core is the non binding nature of the Kyoto Protocol, from the very beginning the bone of contention between developing and developed countries.

Effective mitigation requires the participation of major global emitters. On this regard is symbolic the position of the United States that once agreed on the amount of emissions' reduction, signed the Protocol, but never ratified it, arguing that the cost to the economy would have been too consistent if compared to uncertain data on potential benefits (Barret, 1999). However it is noted that the cost of global cooperation might be less when countries are asymmetric (Barret, 1999), which means that if large countries accept to provide the public good it would not matter too much what small countries would do. But if conversely large countries do not accept to provide the public good, the impacts on global cooperation are terrific. For this reason another criticism is that the Mitigation has started on false premises, i.e. dodging the challenges of increasing pollution in India and China (Prins and Rayner, 2007). If there is no question that the absence of the international diplomacy's leader of the recent history (as well as the history's largest polluter) from the key climate change diplomacy's document, would have slowed down the negotiations for a legally binding climate agreement and reduced the motivation of other key polluting players like China, India and Russia to undertake more consistent unilateral actions, still not all the responsibility can be ascribed to the US.

Recent discussion in Doha have confirmed that today GHGs emissions, sea level rise, and global temperatures are in line with the highest projected scenarios in the 4th IPCC Assessment Report fostering major concerns on the irreversible consequences caused by changes in "extremes" and the increasing socio-economic pressures on natural resources for food and energy production (http://belfercenter.ksg.harvard.edu/files/carraro-side-event_mit-adapt.pdf). This inevitably should push countries to reduce emissions soon and cooperatively. We have also acquired more knowledge on the costs-benefits side of the "operation" so that if it was since always known that mitigation's costs raises if action is delayed, now it has been found that if an immediate global price of \$20 a ton on carbon emissions were set, which would give anyways only roughly 60 percent chance of limiting warming below 2 °C (3.6 Fahrenheit equivalent as clarified by *figure 2*), waiting until 2020

would imply that the carbon price would have to be around \$100 a ton to retain that 60 percent chance (<http://www.reuters.com/article/2013/01/02/us-climate-costs-idUSBRE9010HU20130102>). Despite this the results of the UN Climate Change Conference closed in Doha shows that although the "determination" of the countries to reach an agreement applicable to all by December 2015 the international negotiations toward the "most challenging energy transformation the world has ever seen" are progressing, albeit too slowly (<http://economictimes.indiatimes.com/opinion/comments-timetoabandonblamegamesandbecomeproactive/articleshow/17621136.cms?intenttarget=no>). The conference has already gone beyond the limit initially established by the parties, a new climate agreement has not been found and it seems that there would still be a long path to go between now and 2015, i.e. when the parties expect to be able to reach a new post-Kyoto agreement. However according to recent discussions it seems quite likely that no universal agreement would be possible until and unless there would be sufficient domestic legislation regulating emissions worldwide in place (<http://climatechange-tv.rtcc.org/un-climate-chief-figueres-says-domestic-laws-vital-for-global-deal/>). The argument is that by adopting the climate legislation that is appropriate for every national reality the top-down approach entailed by a universal agreement would only harmonize many bottom up initiatives. (<http://climatechange-tv.rtcc.org/un-climate-chief-figueres-says-domestic-laws-vital-for-global-deal/>). It seems that only recently we have realized that mitigation could be improved also by changes in people's behaviour, but still the development community is quite reluctant to recognize the issue of climate change as a matter of complex social interactions. To us the solution to climate change should certainly start from the grassroots level where traditionally public confusion about the urgency of reducing greenhouse gas emissions has produced a "wait and see" approach (Sterman, 2008) and where the prevalent argument was that there was no sense for an household to unilaterally reduce its emissions because its contribution would have been too small to make the difference (<http://www.apsc.gov.au/publicationsandmedia/archive/publicationsarchive/tacklingwicked-problems>). The fact that the drafter of the KP are nowadays claiming that governments should start to take more decisive steps in this direction, i.e. with national initiatives, also clarifies that we have perhaps understood that path we have been following for about fifteen years was fatally flawed and that it only gave the public illusion of concrete action rather than factually solve the underlying problem (Prins and Rayner, 2007).

Figure 2: Global average temperature 1900-2100 based on emission scenarios



1.4 Adaptation to Climate Change

1.4.1. Defining Adaptation: A Multidimensional Problem

The environmental community has started to deal with climate change's response strategies already since two decades, but the interest on adaptation has bloomed only in the last decade:

Just a decade ago, "adaptation" was something of a dirty word in the climate arena — an insinuation that nations could continue with business as usual and deal with the mess later. But greenhouse-gas emissions are increasing at an unprecedented rate and countries have failed to negotiate a successor to the Kyoto Protocol climate treaty. That stark reality has forced climate researchers and policy-makers to explore ways to weather some of the inevitable changes (Haffernan, 2012) Source: <http://www.nature.com/news/adapting-to-a-warmer-world-no-going-back-1.11906>

However the interest in adaptation has been so lively that we have seen an exponential growth in the number of chapters of the IPCC's assessment reports directly related to this theme. So much soaring attention in such a short period has made that the importance of

climate change Adaptation became self-evident. Hence small wonder it is considered a really hot topic.

What we often forget to point out is that Adaptation still remains a young science. In a certain sense it is still in its infancy and so its conceptualizations and analytical approaches are still in evolution (Smithers and Smit, 1997). The UNFCCC itself has not been able to give an explicit definition of Adaptation (Burton et al., 2006) so that it has been subjected during the course of the time to a wide set of not always coincident explanations (Bosello et al., 2009) which have, at times backed sound-scientific (e.g. Burton, 1992; Smit, 1993; Smithers and Smit, 1997; Füssel and Klein, 2003) at others sound-politic arguments (e.g. European Environment Agency, 2005; UNDP, 2005). This has highlighted adaptation's ability to take the most diverse forms (Bosello et al., 2009), which represents both a challenge for the attainment of a conclusive definition and an impulse to look for a more comprehensive explanation able to conciliate both views. However the extensive usage that is made out of a particular definition let us think that adaptation would be nowadays widely conceived as the adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate. To be more precise it involves adjustments to reduce the vulnerability (see Box 2) of communities, regions, or activities to climatic change and variability (<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=643>).

Box 2: What is Vulnerability?

Vulnerability stands in manifold relationships with geography, political science, economics, ecology, environmental science, psychology, archaeology and mathematics (Janssen et al., 2006). More recently it has even been coupled with terrorism, computer viruses, radiation and financial collapse (Klein, 2009). So that it is almost useless to talk about vulnerability without contextualizing it (Füssel, 2010).

The term derives from the Latin word "vulnus" that means wound and has its roots in the study of natural hazards (Janssen et al., 2006) dealing with "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete and identifiable

event in nature or in society"(Blaikie et al., 1994). Generally speaking a household's vulnerability is the expectation of falling below a benchmark level of well being should this event occur (Heltberg et al., 2008).

From the 1990's the effort to frame it has been increasingly influenced by research on Climate Change and Disaster Risk Reduction but it has suffered from both intra (Brooks et al., 2011) and inter (Heltberg et al., 2008) disciplinary incompatibilities. Nevertheless these differences are more semantic than real because a large majority of these studies is aimed at understanding the causes of vulnerability in order to reduce it (Heltberg et al., 2008). Vulnerability can nowadays be intended as the reduced ability or inability of communities, households or some people in general to cope with climate change (Pettengell, 2010). This inability might be due to a wide range of factors, at large it encompasses all the characteristics of a certain community or the social system in question that make it susceptible to be damaged by climate effects (Pettengell, 2010). It is widely agreed that vulnerability can be conceptually classified along two main dimensions (e.g. Eriksen and Kelly, 2004; Preston*, 2011; Wheeler, 2011)

- ❖ *Biophysical vulnerability* deals with the level of natural capacity to resist or absorb a hazardous event. It is a natural property common to human systems, e.g. the concentration of pigment cell in the skin is a physical characteristic that makes an individual more suitable to live in sunny regions without causing skin cancer. For countries and places in general it works in a similar way, so that geographic location is a key vulnerability factor because some areas are more likely to be affected by climate change rather than others through their physical characteristics and the interaction between local climate systems making people that inhabit them more vulnerable (Pettengell, 2010), e.g. a specific topography might make a given community more or less prone to be affected by climate change events like floods during the raining season. The likelihood to be damaged due to inherent contextual characteristics discloses the level of biophysical vulnerability.
- ❖ *Socio economical vulnerability* deals with non-natural characteristics that might positively or negatively affect the capacity to cushion the impact of weather related events. The idea is that socio-economic features such as demography, education, health, poverty and all development related policies might strengthen the ability to adapt to climate change. While past studies on vulnerability relied only on poverty and GDP, it is found that the inclusion of other facets such as the level of corruption,

Governance, but also communities' habits, contributes to draw a more realistic picture on what is ultimately relevant to facilitate the reduction of vulnerability. However at the community level these broad "measurements" may still provide a very poor picture of some people's vulnerability fostering the consideration of the processes that led to inequalities, capabilities or opportunities that some people may have and other may not to recover from the impacts of climate change (Pettengell, 2010).

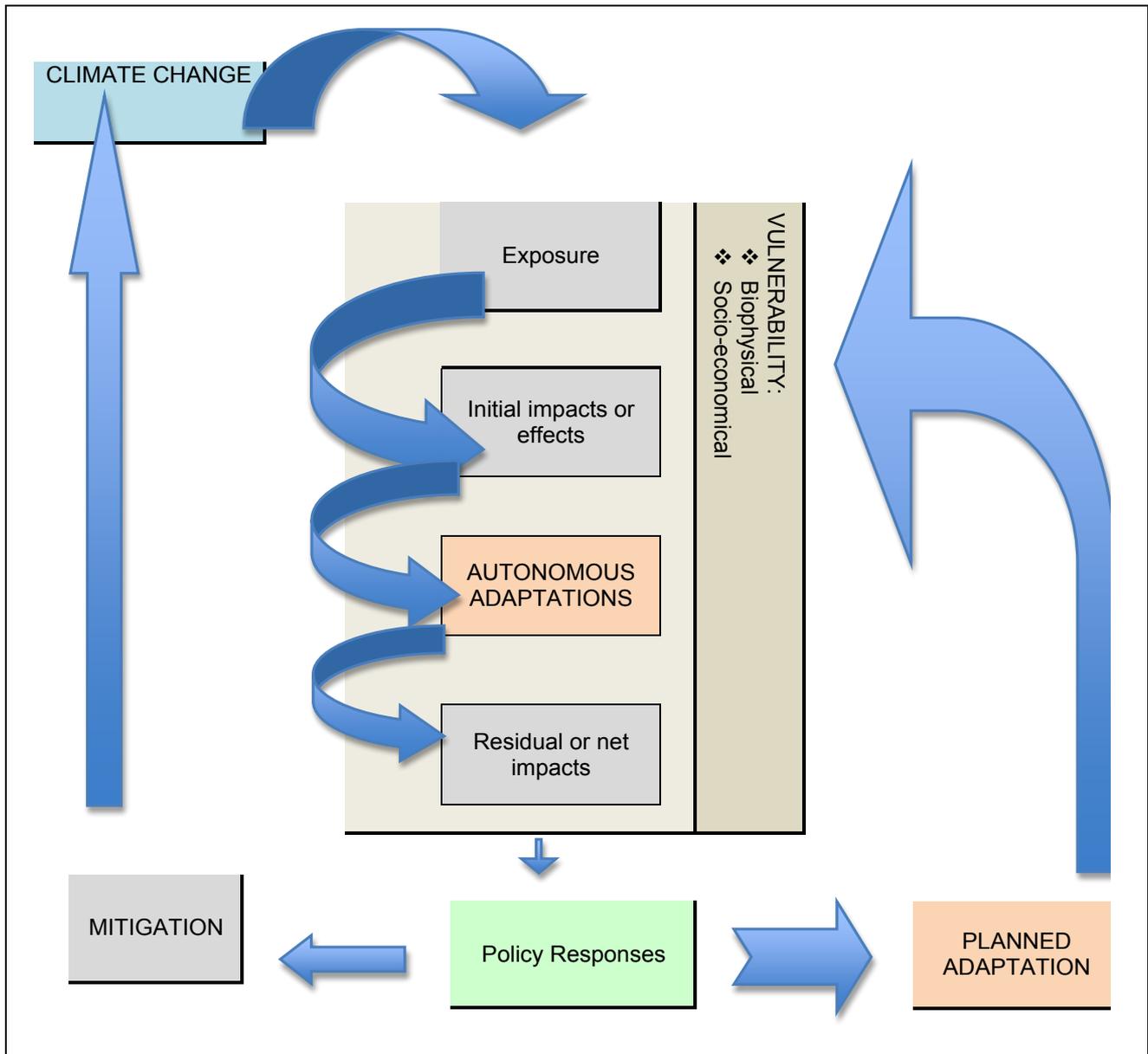
However this adjustment in practices, processes, or structures to take account of changing climate conditions (<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=60>) does not thoroughly look like a new challenge (Burton et al., 2006; Fankhauser, 2009; Bosello et al., 2009; OECD¹, 2009). It has been recognized that the need to adapt to climatic conditions has been a feature of human life since the beginning of time (Burton et al., 2006; Fankhauser, 2010) because societies have naturally adjusted their behaviors (albeit imperfectly) to the conditions they find themselves in, and constantly adapt to changes as soon as these are perceived (Brown et al., 2011). Private actors, triggered by changing circumstances (Adger, 2001) as ecological or welfare modifications in natural or human systems (<http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>), when perceive these changes as problematic want to find solutions themselves and so they react spontaneously by taking certain decisions or adjusting behaviours on the base of their perceptions. They spontaneously deal with climate changes in their own ingenious way. The adaptation that normally occurs in this way has been named autonomous, because it is taking place without the direct intervention of a planned strategy designed by a public agency (Smit and Pilifosova, 2007; Bosello et al., 2009). Autonomous adaptation has also been "economically" defined "market-driven adaptation" because unplanned reactions in private agents might be a response to scarcity signals provided by changes in relative prices (Bosello et al., 2009), but in order to avoid confusion it is important to understand that autonomous adaptation is mainly triggered by past or current events (Adger et al., 2004), and it can be classified on a "timing" dimension as a reactive response inasmuch it occurs after the impacts are already manifest. Autonomous adaptations are largely extensions or intensifications of existing risk-management or production-enhancement activities (http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch5s5-5-1.html). Practices such as crop diversification, water management, disaster risk management and insurance (Adger et. al., 2007) are examples of adaptations to climate which are also embedded in building construction, agriculture, transportation systems, leisure and other elements of everyday

life that are designed to take account of prevailing climatic conditions (Smithers and Smit, 1997). Considering that households' asset portfolios and livelihood choices, especially in rural areas and for low-income households, have always been shaped by the need to manage climate risks (Heltberg et al., 2008), adaptation cannot be considered either a new concept or a new activity (Fankhauser, 2010). Hence optimists are still convinced that since social systems have always adapted to their climate, regardless of the specification and the nature of their environment, there is a strong chance they will continue to do so (Simonet, 2010). Regardless this almost abiding confidence in human adaptability, which for some others have little or no basis (Smithers and Smit, 1997), adaptation is nowadays more challenging because the scale and the speed of the adjustment required are unprecedented (Fankhauser, 2010). Moreover the number of climate risks is growing, and these new unmanaged issues, e.g. as glaciers' retreat, droughts and heat waves (Adger et al., 2007) come along with the increasing severity of habitual issues (IPCC, 2012). There are already impacts that fall outside the range of experiences societies have shown which is demonstrated by losses and damages associated with extreme events. We are not even comforted from climate scientists predictions, which affirm unanimously that even if the quantity of green house gases in the atmosphere will be significantly reduced, global temperatures are expected to continue to increase; other changes, especially in climate extremes, are likely and phenomena such as sea level raise will not suddenly stop (Burton et al., 2001). To put it more simply, much of the change is already in the pipeline (Fankhauser, 2009). Hence if every effort must still be made to stabilize greenhouse gases emissions, we must also accelerate efforts to be prepared for these unavoidable changes. A climate policy based on mitigation alone can not be sufficient to tackle climate change, as it does not offer solutions for these unavoidable climate related issues, which appears unprecedented in scale and partly in type (Biermann and Boas, 2010). Although there is evidence that a consistent part of adaptation results from unplanned private decisions, autonomous adaptation alone will not, most of the times, be able to ensure the achievement of an acceptable adaptive level. The perceived importance of climate changes and the impetus they provide for human systems depends on the availability and attainability of response options (Smithers and Smit, 1997). The translation of perceptions into actions requires in fact the availability of sufficient capacities and resources to be successful. For a poor country these capacities and resources might often be missing. This might be a barrier that makes difficult and often impossible to autonomously adapt. In

many instances, in fact, where response is more urgently needed, it is also where it is more constrained (Smithers and Smit, 1997).

The rising of adaptation as one of the two International Environmental Policy's building blocks places it into the broader political discourse meant to address what we called the "injustice of climate change". On one side this is the recognition that autonomous adaptation presents some features required to complement mitigation, on the other that it can be better integrated, fed and improved only if it occurs within the appropriate planning process. If based on some assessment of conditions in the future (Adger et al., 2004), adaptation becomes proactive (<http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>) or anticipatory, i.e. may take place before impacts are observed (http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch5s5-5-2.html). Usually this feature is a characteristic of planned or policy-driven adaptation, i.e. adaptation that results from a deliberate political decision, which can be also reactive, but most of the time comes in an anticipatory fashion (Smit and Pilifosova, 2007).

Figure 3: Adaptation's role in the Climate Policy



Source: Adapted from Smit et al., 1999

For the sake of completeness, adaptive options can also be distinguished on the base of the temporal or spatial scopes hence we can read about short term vs. long term adaptations and localized vs. regional adaptations (Bosello et al., 2009; OECD¹, 2009). Another distinction can be made on the base of the means used to adapt so we can have technological, behavioral, financial and institutional forms of adaptations. Moreover not every adaptation is inspired by the same strategy. Independently from the timing, the scope the implementing entity and the already mentioned classification's criteria, adaptations are further categorized on the base of their desired effects or strategies (OECD¹, 2009).

- ❖ *Bear or tolerating losses.* Losses in general occur either when the implementing entity has no resources to adapt or when it consciously decides not to adapt perhaps because adaptation would not be cost effective. In general all adaptations can be compared with respect to the baseline of doing nothing, i.e. of inaction.
- ❖ *Spreading or sharing losses.* Implies the distribution of the burden of impacts over a larger region or a population beyond those directly affected. There are many well-rooted mechanisms of this type that are commonly in place among communities around the World. Such practices are usually connected to rehabilitation, public relief and reconstruction paid using public funds. Another way to share losses is represented by weather related insurance schemes that falls into the category of market driven adaptation.
- ❖ *Prevent the effects or modify the threat.* Practices connected to the prevention of climate change variability deal mostly with taking actions to reduce the exposure of climate impacts. For some expected impacts of climate change it is possible to act in such a way that a certain degree of control can be exercised upon the environment, e.g. building dikes and dams can be an effective way to control floods. In other cases prevention is achieved through changing in management practices and the implementation of early warning systems. In general it is agreed that the best way to deal with longer-term impacts is through mitigation.
- ❖ *Change use or activity* is a form of adaptation that must be taken seriously when climate change makes difficult carry on the economic activity pursued by means of the structure whose use can be switched to another one better suited to changed climate. For example changing land use from agriculture to pasture might be an alternative to respond to estimated reduced yield, but more in general this adaptation involves the consideration of new business opportunities.
- ❖ *Change location* is a fairly more extreme response that involves the relocation of the activity, i.e. the migration to an area that is more suitable under the changed climate. Although this might represent, in some cases, a first best option it might foster speculations when information is asymmetrically distributed among actors.
- ❖ *Research.* Investing in R&D and knowledge is a particular form of anticipatory adaptation that makes adaptive responses more effective (Bosello et al., 2009). Even if the excessive power of agribusiness and pharmaceutical companies have made that public attention was mostly channeled to these sectors, this practice is of great potential for every sector.

- ❖ *Encourage behavior* through education, information or regulation. The dissemination of knowledge through education and public information campaigns is a great instrument to raise awareness and to spread knowledge whereas regulations assure that adaptive actions would not occur in an institutional vacuum. These forms of adaptation, which has been given a low priority in the past, are likely to go hand by hand with the recognition that adaptation greatly depends from communities' information and institutional arrangements at the local level.

Table 2: Possible criteria for classifying Adaptation

Classification	Adaptive Options
<i>Adapting Agent</i>	Private - Public
<i>Purposefulness</i>	Autonomous - Planned
<i>Timing</i>	Reactive - Anticipatory
<i>Temporal Scope</i>	Short Term - Long Term
<i>Spatial Scope</i>	Local - Regional
<i>Form</i>	Technological, Behavioral, Financial, Institutional
<i>Adaptation Strategy</i>	Bear or tolerating losses, spreading or sharing losses, prevent the effects or modify the threat, change use or activity, change location, research, encourage behavior

Source: Adapted from Smit et al., 2000

1.4.2. Adaptation's locality misfits top-down economic rationale

Even if adapt to climate change is normally framed as a global challenge; adaptation is unquestionably a local concern. Impacts of climate change are felt locally and even if climate issues would look similar, if compared on a global scale, local impacts greatly depend on the specific characteristics of the affected context (Klein et al., 2007). This unquestionably requires that response measures should be tailored to local circumstances (Burton et al., 2006) so that, unlike mitigation, adaptation takes place from local to national levels, at most regional; it involves private actions of the affected entities, public arrangements of impacted communities and national and regional policies (Klein et al., 2007). Even if adaptation can be facilitated through international measures (Burton et al., 2006), these are unlikely to represent the decisive element to arrive at it, as it has made the case of mitigation. The atomistic level at which adaptation needs to be implemented involves a broad number of stakeholders (Bosello et al., 2009), hence if it is undisputable that there is a role for public policy in the climate change adaptation's context (Adger, 2001; OECD¹, 2009), it seems not very likely that it would fit the already existing climate Governance's structures, which are mainly focused on economic issues and top-down aggregate modelling (Ayers et al., 2010). A better fitting Governance mechanism for adaptation would most probably be localized rather than at the global commons' level (Adger, 2001), thereby an economic approach akin to the mitigation market system, even with the most clearly designed schemes, would not be feasible for, at least, three obvious reasons (summarized in *table 3*):

1. *There is no global public good rationale.* While mitigation benefits, i.e. reduced emissions, are public because a cleaner atmosphere is non rivalrous and non excludable in consumption, and global because carbon dioxide strives for being distributed evenly around the globe regardless of where emissions have been originated (http://www.ipcc.ch/publications_and_data/ar4/wg1/en/faq-11-1.html), adaptation benefits can be classified along three dimensions: whom they accrue to (public vs. private), their geographical scale (local vs. global), and whether they are direct or indirect (Persson, 2011).

- ❖ Global public benefits are the kind of benefits that everyone can enjoy; they are usually associated to the protection of biodiversity and R&D in general. However a separate mention should be made especially for R&D in "climate ready" crops, i.e. drought or flood resistant species of crop, which have

raised few concerns because they are privately owned and profited upon by agribusiness giants

(<http://www.guardian.co.uk/commentisfree/2012/nov/06/hurricane-sandy-america-disaster-capitalists?fb=naive&CMP=FBCNETT9038>)

- ❖ Local public benefits come from adaptation measures that advantage primarily the local communities targeted, e.g. building seawalls or implementing climate proofing infrastructures lead obviously to localized benefits because only local people can enjoy them.
- ❖ Local private benefits are instead privately owned by individuals, e.g. the value of saved crops for a single farmer due to the implementation of a seawall that prevented him to experience a flash flood. More generally local private benefits are wherever the improvement in knowledge (due to any intervention) bring value within a certain social system that can be a community or just some of its members. For instance projects aimed at enhancing livelihood's practices through the implementation of enhanced agricultural techniques or new water management practices can lead to substantial local private benefits for a household in terms of increased agricultural productivity or improved water storage. However as already pointed out in the case of R&D for climate "ready crops" private benefits can also be obtained by the providers of such knowledge. In this specific case users, i.e. the targeted beneficiaries, and providers, i.e. mostly large agribusiness corporations, share benefits. Since these kind of interventions often come with a cost for "beneficiaries" it seems that at times, i.e. when the improved crops do not bring a sort of breakthrough in people's livelihoods, would be more directed to feed large corporations' appetite for profit. However it is not the objective of this study to go too much into the "ethics" of this trade.
- ❖ Indirect benefits are the ancillary benefits or positive externalities produced through the implementation of adaptations, e.g. lower price volatility on climate sensitive agricultural products.

Hence adaptation produces mainly localized private and public benefits (Bosello et al., 2009; Cimato and Mullan, 2010), more seldom it provides global public goods (Persson, 2011). Some may argue instead that global public benefits would be

always be generated by adaptation because when actions are taken at the local level people can learn from each other; experiences can be shared and past actions can inform future decisions that may need to be taken in other places. Basically there is always a high potential for learning lessons. According to this view the global public benefit underlying adaptation could be the knowledge generated by it or more simply the lesson learned. However this argument seems not fully convincing because the peculiarity of each local context would make more likely that the gain in knowledge summed up with other global public benefits would still be outweighed by the value of local benefits (Persson, 2011). So that if the reason for public intervention in the case of mitigation was triggered by the well-known incentive to free ride for the provision of a public good, this should not be the case of adaptation because local people keep most of the benefits deriving from their adaptive decisions (Bosello et al., 2009) therefore to adapt should be in principle in their own interest. We will better clarify this later on.

2. *There are no signs of commodification.* In order to create a market, one needs a commodity to be traded. While in the carbon market the commodity in question is legally and technically defined: emission reduction credits measured in ton of CO₂ saved (Persson, 2011); for a purported adaptation market it would be less clear what the "adaptation commodity" would look like (Persson, 2011). It is not possible to trace adaptation back to a single action as for mitigation, but several kinds of actions can be categorized as adaptations. Adaptation involves selecting and designing projects, activities, programs which are meant to address given issues, but considering the number of issues to address and the contextual specificities and nuances involved, it is normal that there would be no universal single best adaptation (Ahmad and Rodgers, 2012). It follows that it would make more sense to evaluate each project separately rather than in a standardized way, but this results in having no single metric for adaptation measurement (Cimato and Mullan, 2010). Not only the comparison between different adaptation's efforts may be difficult (Klein et al., 2007), but also benefits' measurement itself. Adaptation benefits are typically quantified in term of avoided potential impacts (Adger et al, 2007), but while some of them can be explicitly converted in monetary terms (e.g. damages on the coastline or crop saved), some other cannot (e.g. lives saved, social and cultural facets). Moreover it is per se difficult to capture the value of all the benefits

occurring at different scales. Hence it is more likely that adaptation would be contextualized rather than abstracted into one unit (Persson, 2011).

3. *There is lack of demand to finance or subsidize adaptation.* For what concerns emission reduction credits, their demand is politically created through emission reduction's obligations stated by annex B of the Kyoto Protocol and, more recently, by other regulations at the national level, but overall it is only complemented by demand on the ground, e.g. individual ethics and corporate social responsibility. For what concerns adaptation instead, a market is already present on the ground and it is fed by people's autonomous actions. However it has been pointed out that modelling and quantifying this "market driven autonomous adaptation" would be extremely challenging so that most of the studies which attempted to do this have felt short in integrating the underlying numerical exercise with the interdisciplinary consequences of climate change ending up either analyzing climate impacts in a static framework, or considering only a very limited number of impacts (Bosello et al., 2009). A further clarification is then needed with respect to autonomous adaptation which is claimed to be mostly fed by insurance companies and R&D firms producing "climate ready" crops or other technologies: unfortunately most "environmentalists" forget that only better-off people can afford them. This element of inequality not only clashes with the real aim of adaptation which should come as "restitution" from developed countries to address the injustice of climate change, but it is also likely to further exacerbate this injustice. Since autonomous adaptation, especially for poor people living in the least developed countries, is clearly insufficient to deal with climate impacts the International Environmental Policy should intervene to address this unfair situation by creating demand at the international level to finance or subsidize adaptation and allowing vulnerable people to successfully adapt. However since adaptation does not involve direct benefits for a distant sponsor this demand is more likely to be linked either on indirect benefits (e.g. perceived moral gains or international reputability), or on altruism or ethics (Persson, 2011). For this reason adaptation finance comes mainly in form of assistance even if it is not so clear how this should be distributed between recipient countries (this issue and its consequences are further discussed in box 3).

Table 3: Why is a regulated market not feasible for Adaptation ?

	Mitigation	Adaptation
<p>Types of benefits</p> <p>➤</p>	<p>Global public benefits</p>	<ul style="list-style-type: none"> ❖ Global public benefits (e.g. protection of biodiversity, R&D and lessons learned); ❖ Local public benefits (e.g. building seawalls or implementing climate proofing infrastructures); ❖ Local private benefits (e.g. the value of saved crops or enhanced productivity for a farmer, improved water storage for an household); ❖ Indirect benefits (e.g. lower price volatility on climate sensitive agricultural products).
<p>Commodification</p> <p>➤</p>	<p>Feasible.</p> <p>The commodity is clear and agreed upon: mission reduction credits measured in ton of CO₂ saved</p>	<p>Unfeasible.</p> <p>It is more likely that adaptation would be contextualized rather than abstracted into one unit.</p>
<p>Demand</p> <p>➤</p>	<p>Politically created.</p> <p><i>International level:</i> Annex B, Kyoto Protocol</p> <p><i>National level:</i> national regulations</p>	<p>A market is already present, but only better off households can access it.</p> <p>The only way to create demand at the international level is linking it either to indirect benefits, or altruism or ethics.</p> <p>➤ Assistance</p>

BOX 3: How should Adaptation finance be distributed?

❖ *The International Environmental Law on Adaptation prioritization*

Although there is no internationally recognized definition of climate expenditure (Bird et al., 2011), which represents a challenge for any study related to adaptation, climate finance decisions are not taken within a normative vacuum (Schalatek, 2011). The International Environmental Law governs adaptation to climate change. This includes the provisions of the UN Framework Convention for Climate Change (UNFCCC), the Kyoto Protocol, and the decisions of the Conferences of the Parties (Verheyen, 2002) which address the issue of how should adaptation assistance be distributed among recipient countries claiming the need to prioritize the world's *particularly vulnerable countries* (UNFCCC, 19th preambular paragraph, Article 3.2 and Article 4.4). However the International Environmental Law does not provide further guidance in defining who should be seen as "particularly vulnerable" if not mentioning a vague set of countries:

a) Small island countries; (b) Countries with low-lying coastal areas; (c) Countries with arid and semi-arid areas, forested areas and areas liable to forest decay; (d) Countries with areas prone to natural disasters; (e) Countries with areas liable to drought and desertification; (f) Countries with areas of high urban atmospheric pollution; (g) Countries with areas with fragile ecosystems, including mountainous ecosystems (UNFCCC art 4.8).

Considering that to provide a fair allocation of resources is a mean to (partially) address the "injustice of climate change", this represents more than a simple distributive challenge for the Climate Change Policy. It is widely recognized the potential role of adaptation as a way to help people, institutions and societies to secure development in the face of changing climatic conditions (Brooks et al., 2011) therefore finding out who really needs this help, i.e. who is particularly vulnerable, would be essential for the accomplishment of this political goal. On the other side it is easy to understand that when funds are raffled off every country is somehow interested in being targeted as particularly vulnerable. All this together explains why the calls for a quantitative measure of vulnerability have largely been policy driven (Eriksen and Kelly, 2004)

❖ ***Looking for an algorithm or a magic formula to compute vulnerability***

Designing a theory on vulnerability is a non-trivial activity because it implies a judgement about a non-observable phenomenon so that the features considered, are more fruits of a "sociological imagination" rather than objective elements (Mills, 1959). So it involves tests (Tol and Yohed, 2006) to establish how these features, which are themselves not fully understood, work in relation one to another as if they really were mechanisms of a precise model (Friedman, 2003). The real aim of vulnerability assessment is actually give a forecast on the risk that society, communities, groups of people in general are facing for being living in a certain place under certain conditions. Such task does not end when the contemporary climate trends and future exposure are outlined by crossing historic data and climate change projections, but needs to provide exact information on what the potential human impacts will look like requiring a further extension of the research effort toward the understanding of socio-economic conditions' (Wheeler, 2011). However once the assessment includes social features, it enters the field of social science where phenomena are multivariate and encompassed by a certain degree of uncertainty (Preston et al., 2011). So that it would be obvious that there would be no algorithm or magic formula to compute vulnerability, but that the only way to overcome this uncertainty would be to undertake moral decisions on how to put together and weight different social elements.

❖ ***How helping vulnerable has become a chicken-egg question?***

Vulnerability assessment might represent only the next attempt of a failed science-policy communication (Hinkel, 2011) because naive implementations of this strategy might lead to unintended consequences. The implicit reward of poor Governance is the most prominent (Füssel, 2010). As the assessment of vulnerability cannot abstract from its socio-economic dimension so well this socio economic dimension cannot abstract from the inclusion of the "element" Governance according to the irrefutable principle "the more valuable is the Governance the lower the country's vulnerability" (Wheeler, 2011). If resources were given away like during an auction where who is more vulnerable gets the most, there would be disincentives toward the development of effective Governance. To avoid this, in a view of resources' scarcity, any allocative framework might not only entail considerations about vulnerability, but also include other parameters or judgements about

efficiency, effectiveness and feasibility (Brooks et al., 2011) that makes more likely that resources would not be "wasted away". However putting into the distributive discussion sound-economic requirements will have the main consequence of preventing vulnerable countries to be the first recipients of adaptation funds just because "guilty" to be less capable in fulfilling these requirements.

❖ ***The harsh reality of adaptation funds***

If the International Environmental Law came up with an exact definition of particularly vulnerable countries, the problem of adaptation finance distribution would be solved because the level of certain parameters would define the "particularly vulnerable threshold" and everyone would stick to the rule. It is very unlikely that this would be done because vulnerability design is per se an hazardous practice with the potential to undermine the rights of million of people. Therefore the governance of adaptation is, at the moment, left in chief of single funds. This results in a foggy landscape made of different requirements and conditions settled by each fund while local institutions, countries and regions, which have often no means to earn their livings, are asked to identify needs and formulate adaptive projects accordingly which ultimately require having people in charge of doing this, i.e. leaders.

1.4.3. Adaptation's "different vocation"

It is always worth to remember that the problem we face is only one, i.e. anthropogenic climate change that has many implications for society. We strengthen here our conceptualization of Adaptation as a process fundamentally different from the way Mitigation has given attention to climate change so far. To do this we have referred to as *Adaptation's "different vocation"* in the title of this paragraph not only to highlight that the implications that Adaptation is meant to address are different from the ones addressed by Mitigation, but that it that it is the whole language and method that Adaptation requires that should be different. We start from the premise that only by reframing the issues that should be solved we could chose and use the appropriate language and problem solving techniques, i.e. the right mechanisms and instruments leaders should use for influencing social change and direction (Ison, 2010) to reduce present day impacts, but at the same

time increase the resilience to future ones (<http://unfccc.int/adaptation/items/4159.php>). Honestly we see these as characteristics of climate change in general, but given that it is not the purpose of this study to recommend how Mitigation should be addressed we try to give an interpretation of these issues only in the way they are related to Adaptation.

- ❖ **Uncertainty:** Even the challenge to be adapted to a stable climate, usually referred as the *status quo*, would already include a great level of uncertainty because decision-makers would need to take account of prevailing climatic conditions, including extremes, which would require some technical knowledge on threats and opportunities, i.e. vulnerabilities (Brown et al., 2011). Unfortunately this simplified situation, which already includes a considerable level of uncertainty, is no longer available for a credible development plan (Brown et al., 2011). Adaptation must in fact relate as much as current climate variability as much to longer-term changes. If it is undisputable that Earth is warming, the chaotic nature of the climate system makes that there are still deep uncertainties on the timing and the magnitude of climatic changes especially at a regional or local scales (Schneider and Sarukhan, 2001).

"Impacts might be more or less evident, sometimes subtle, but nonetheless significant, and their consequences difficult to identify, let alone quantify, in part because of the nonlinear nature of climate change itself" (Schneider and Sarukhan, 2001).

It has been found that impacts are not only different among economic sectors (<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=60>) or geographic areas (Bernstein et al., 2007), but also among different members of the same community for example (<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=60>). While the extent of global climate change is certainly becoming better understood, the understanding of climate impacts in a given location remains somewhat elusive because of the great level of uncertainty embedded in the science of climate models (Box 4) which is further exacerbated by the lack of local data collected in the past that are relevant to understand ongoing local trends (Pettengell, 2010). Given these uncertainties a "predict and adapt" technique would risk to mislead decisions so that we need that adaptation would not be so dependent upon the information provided by climate models (Pettengell, 2010). Uncertainty does not only regard the limited knowledge

on precise local data and projections, but also the assessment of adaptation costs and benefits. Cost/benefit analysis are for the most part evaluating adaptation costs in monetary terms, whereas benefits are still typically quantified in term of avoided potential impacts (Adger et al, 2007) which cannot be exactly quantified for the same reason as we have not sufficient knowledge on the extent of local impacts. Moreover CBAs' attempts remain *per se* quite fragmented in terms of sectorial and regional coverage (Adger et al, 2007). Although it argued that adaptation would carry "massive net benefits" (Fankhauser, 2009) and even that these might be around 5% to 20% of the world's total GDP with respect to inaction (Stern, 2006), there are no sufficiently credible regional or country based studies to address this issue. The only information provided in the matter of this is that inaction would cost several times adaptation (Katofsky et al., 2011; European Environment Agency, 2007). It is also argued that every dollar invested into disaster preparedness saves seven dollars in disaster aftermath (http://www.undp.org/content/undp/en/home/ourwork/get_involved/ActNow/). These "informative bogeymen" have fully justified the tendency to frame adaptation as a "no regret" option. The tendency to look for no regret measures, i.e. measures that have immediate co-benefits such as to reduce energy consumption or natural resources use, or which yield benefits regardless of future trends in greenhouse gas emission and climate scenarios (<http://www.preventionweb.net/english/professional/news/v.php?id=19623>) is a smart way to show "environmental activism", but might also be a way to tackle the climate problem giving to its solution a wide berth, i.e. acting to a limited extent because we are not sure about the effectiveness of adaptive responses. However no regret measures are certainly valid, but further understanding of what measures can stimulates more the potential to adapt are needed too. These widespread uncertainties make that adaptation would still be conceived as a trial and error process that is why a good way to effectively evaluate adaptation's projects, is still testing a variety of adaptation's actions and than share the outcomes which makes clear how learning from each other experiences is an essential part of adaptation. The difficulty in the quantification of potential impacts and in the assessment of adaptation's costs and benefits are central to understand that decisions are taken in a state of uncertainty and that we are taking decisions today for a future where

none has been. Hence decisions are taken sometimes employing probability, but more often on the basis of heuristics (Smithers and Smit, 1997).

Box 4: What are climate models?

A climate model is a system of differential equations that describes the interactions between the atmosphere, oceans and land that are used to predict future changes in climate. Climate models may vary a lot in their complexity and accuracy. The most common operate at a large scale and give indications on broad changes, e.g. variations in average temperatures or precipitation patterns. To make valuable predictions on local situations global projections need to be "downscaled" in such a way to produce an output at a much finer scale, usually 25-50 km². Unfortunately downscaling is per se an expensive practice so that it is not always carried out. It is pointed out that although models can be an important tool to give an interpretation of the future climate they are not "magic bullets", i.e. they clearly carry a great level of uncertainty (consider that it is not unusual that many models would present discrepancies and even contrast with each other). To be more accurate in making predictions we need to run many models starting from the same emission scenario. Despite this models remain useful if utilized in the right way, i.e. when the uncertainties they carry are interpreted correctly and decisions taken accordingly.

Source: Levine et al., 2011

- ❖ **Complexity:** Adaptation to climate occurs in the context of demographic, cultural and economic change (Adger et al., 2004), hence it does not occur in insulation from other forces, but it is embedded into a whirlwind of economic, social and institutional circumstances (Smithers and Smit, 1997).

"Climate change exacerbates existing problems, including global food prices, insecure land tenure, inequality and marginalization, gender disparity, lack of access to financing, lack of access to modern energy supplies, soil degradation, competing demands for water resources, and deforestation; and compounds them with glacier melt, sea-level rise, increased frequency and/or severity of

storms, droughts and floods, increased temperatures, and the spread of diseases into areas previously not exposed" (Pettengell, 2010).

For a poor community where the households' level of well being is already not adequate, as in many parts of Africa, Latin America and in poor parts of Asia, adaptation cannot be the end in itself. In the view of scarce resources allocation adaptation investments might look as alternatives, with respect to other political options which might not be linked to climate at all, but which are merely focused on development. Hence try to make these communities and countries more resilient to climate change through adaptation, but at the same time raise their well-being is particularly challenging. It is even harder to think how longer term climate change might be a priority issue for countries or regions where floods, droughts and other climate related events bring on massive loss of life, human dislocation and suffering because "the challenge to cope with the current climate variation might not admit the opportunity to look several decades hence" (Smithers and Smit, 1997). National and local governments, especially in the least developed countries are increasingly facing complex climate related issues that are difficult to tackle for policymakers at every level (World Resources Institute, 2011). Under conditions of deep complexity, decision making around risk necessitates the deliberation over values and preferences about the scope and scale of the adaptive responses, i.e. express preferences about whom or what should be protected and what is acceptable not to protect given available resources (Brown et al., 2011). This might also entail a trade-off between economic and environmental goals (Jones and Preston, 2010) and perhaps might lead to maladaptation driven by short term goals such as dwellings' construction in flood prone areas or the planting of moisture sensitive crops in drought prone areas (Smithers and Smit, 1997). The issue of Maladaptation is further conceptualized in Box 5 below, but what should be kept in mind is that in order to avoid it an "adaptation-development continuum" must be established (Pettengell, 2010). This means that the real challenge would not be choosing between adaptation and development, but rather addressing our efforts toward the reduction of what prevent people to adapt or develop, i.e. vulnerability (Pettengell, 2010). On this regard the role of development to address climate change vulnerability should be fully recognized and at the same time climate issues should be fully considered while planning for development (Pettengell, 2010).

Another issue is that decision-makers at every level are embedded into established internal environments made up by Governance and legislative frameworks and "while these structures might be more or less suited to enable adaptive responses, in some cases they might even inhibit them" (Brown et al., 2011). Therefore adaptation must address all this range of issues that would otherwise hinder the ability to take action (Pettengell, 2010). For these reasons it must be recognized once and for all that climate change is not merely an environmental issue, but it is a more complex sustainable development issue.

Box 5: Maladaptation

The attempts to measure somehow the success of adaptation not only mean that adaptation would not be "an easy matter" (<http://www.iied.org/how-can-we-measure-adaptation-monitoring-evaluation-entry-point>), but they are more to be seen as the implicit admission that adaptation can fail (Barnett and O'Neill, 2009). However there is a substantial difference between unsuccessful adaptation, i.e. the adaptive decision that fails to meet its objective and maladaptation that should be regarded as the "action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups" (Barnett and O'Neill, 2009). Starting from this definition other authors have noted a similarity with the concept of "risk shifting" or "risk displacement" that would happen when, in the context of multiple vulnerabilities, an adaptation directed to reduce one vulnerability has the effect to increase the exposure to other vulnerabilities (Mc Dowell et al., 2010). This should give us pause for thought that if in principle development activities can reduce vulnerability to climate change, it may also happen that "new roads might be weatherproofed from an engineering standpoint, even taking future climate into account, but they might trigger new human settlement in areas highly exposed to particular impacts of climate change, such as coastal zones vulnerable to sea-level rise" (OECD¹, 2009) By adopting this point of view we deem as "non influential" the requirement that the initial action that led to maladaptation was directed to reduce vulnerability to climate which ultimately implies that every decision that increases vulnerability to climate change or overlook the opportunities for adaptation directly or indirectly must be termed "maladaptation"(OECD¹, 2009)

- ❖ **Urgency:** As we are in the infancy of adaptation and we are still experimenting adaptive strategies to cope with climate changes, our ignorance on the ways to cope with this issue does not lessen the urgency posed by it.

The key level impact of weather related disasters affects availability of resources and the capacity of communities to respond to future disasters as well (IPCC, 2012)

Climate Change poses an issue of urgency for policymakers because it makes likely that a wait and see approach toward adaptation will inevitably further exacerbate the need to adapt in the future and surely lay the life of million of people on the line for the years to come, so it is not an alternative.

Governments and policy makers have traditionally provided to be backward looking and short time thinking, undertaking decisions grounded on certainty and predictability (Eyben, 2005). They often relied on empirical information and accounted only for closer term expected impacts (Brown et al., 2011). Ideally they would only act backed by scientific evidence in terms of numbers which would be the daily bread of indisputable political decisions, and try to put into practice conventional maximum utility types of decisions based on technically efficient answers (Ludwig, 2001). These approaches alone might be appropriate to address "tame" problems, which are not necessarily simple, e.g. they include putting a man on the moon or devising a cure for diabetes (<http://www.newyorker.com/online/blogs/comment/2012/06/something-wicked-this-way-comes.html#ixzz2Ai7TqxDX>), but can be tightly defined and a solution fairly readily indentified or worked trough (<http://www.apsc.gov.au/publications-and-media/archive/publications-archive/tackling-wicked-problems>).

For the characteristics that adaptation exhibits, it resembles more to a wicked problem (Brown et al., 2011) or even to a "mess" (Sorgenfrei and Wrigley, 2005) that are the kinds of challenges that cannot be clearly defined as the time and the level of resources required to address them. Moreover if adaptation looks globally like a wicked problem for its manifest uncertainty and complexity, its inherent locality makes more likely that we would have to deal with many unique wicked problems which would surely be even more challenging to tackle for society. Their resolution would require a mixture of considerations ranging from various sources of knowledge because we need to be able to understand all points of information from climate trends and projections to local perceptions and be able

to evaluate the potential impacts these changes may have on the dynamic socio economic contextual reality we wish to adapt.

This could only be obtained by means of experts' judgements and the involvement of local knowledge that represents the essential benchmark for adaptation design. Who should gather existing knowledge to provide this benchmark are local leaders (<http://niccd.wordpress.com/tag/leadership-and-adaptation/>) that are certainly the best people to enable the process of change because they have a better understanding of local needs, values and other socio economic dynamics of the community they are part of (<http://niccd.wordpress.com/tag/leadership-and-adaptation/>). In their position they can motivate and influence other members by stimulating their willingness to act and innovate because they are trusted members and so their technical advices are highly listened (<http://niccd.wordpress.com/tag/leadership-and-adaptation/>). In this local leaders should be helped by other people, i.e. other Adaptation's leaders, maybe coming from a higher institutional level, from the non-governmental world or as well from the private sector. In the end it does not matter where these people should come from as long as they had the requisite of being "social innovators", i.e. people that can bring new knowledge to the community and enhance its adaptive potential so that local leaders can function as "catalyst" of this new knowledge and disseminate it in the manner more appropriate to the local context (<http://niccd.wordpress.com/tag/leadership-and-adaptation/>).

However when we talk about adaptation we must understand that since there is neither a single objective way to frame an adaptation's problem nor a clear solution for it, also experts' judgements might be difficult to legitimize and who is in the position to decide is inevitably taking decisions on the on the base of assumptions and personal judgements (Brown et al., 2011). A case in point is provided by the example of climate models that, although scientifically relevant, have limits that need to be understood for interpreting projections correctly. As a consequence solutions, which are rarely simple or wholly attainable, can never be deemed as true or false, but instead might be seen by different stakeholders as better or worse relying upon subjective levels of acceptance (<http://www.swemorph.com/wp.html>). In two words different people might reach very different conclusions on the base of the same evidence (Brown et al., 2011).

This provides us only a snapshot of what is the current adaptation's slippery state and perhaps explains why there would be no definitive answer to what should be regarded as "good adaptation" (<http://adam-digital-compendium.pik-potsdam.de/learning-examples/>) and why is not often possible to clearly establish cause-effects relationships between

interventions and results (Sorgenfrei and Wrigley, 2005). In the end it must be recognized that since there will never be a single objective adaptation's way of thinking, the destiny is in the hands of leaders, who can influence the process of change and transformation.

If who is in the position to decide, enable and facilitate adaptation, i.e. every leader: policy makers at every institutional level, NGOs, private sector's leaders, local leaders (no matter if they are part of the institutional context, the civil society or the private sector), would deal with this issue as if it was a normal challenge with relatively clear solutions and resources implications, perhaps relying on consolidated decision making techniques which do not question the underlying assumptions on which are grounded, e.g. economics, it would be impossible to acknowledge the full range of complex, uncertain and dynamic social, political, environmental, ethical context where adaptation occurs (Sorgenfrei and Wrigley, 2005). Any economic consideration made of specified functions to maximize as in a sterile algebraic exercise would surely help to make certain judgements, but would never be the end in itself of the wider adaptation discourse. It is amply recognized that our decision making process is already affected by fixes as economism, i.e. the placing of an exceptional emphasis upon economic values, which, together with scientism and technocracy, is one of the most common (Ludwig, 2001). We are not arguing that we should not have fixes, but since these operate below the level where decisions are taken by continuously feeding our (more or less) agreed political values, we should recognize their role in destroying values conflicts by branding not sound-scientific arguments as "ill informed sentiment" thus depoliticizing and reducing complex issues to simple calculus (Ludwig, 2001).

As a consequence, adaptation challenges our Governance structures to peremptorily reformulate some of the traditional ways of working and problem solving techniques in such a way to acknowledge for uncertainty of climate information, recognizing the complexity in which societies are embedded and explicitly encompassing disagreements between different groups (Brown et al., 2011) imposing the need to "switch from an optimal approach (often based on cost-benefit analysis) to a robust approach (assessing success against a wider range of parameters and incorporating the precautionary principle if appropriate)" (Pettengell, 2010).

Management has certainly the flexibility needed to deal with uncertainty and complexity, but still to provide needed clarity of direction and coordination to achieve desired results. It is the "ambiguous nature of messes" that requires an understanding of the systemic complexity in which civil society is operating (Sorgenfrei and Wrigley, 2005) calling for

such a leadership able to recognize this complexity, i.e. able to see the "big picture", including interdependencies among different actors, their various constraints and possibilities (<http://www.apsc.gov.au/publications-and-media/archive/publications-archive/tackling-wicked-problems>). It is true that when "the initial planning boundaries" are "drawn too narrowly, important aspects of the issue might be neglected" (<http://www.apsc.gov.au/publications-and-media/archive/publications-archive/tackling-wicked-problems>). This is the reason why other authors affirm that only using system thinking might help to include as many relevant considerations as possible (Sorgenfrei and Wrigley, 2005). However at the same time we need to acknowledge that decision making in complex systems is always confronted with the "impossibility of ever understanding the totality of a system that is in constant flux" (Eyben, 2005). We are talking about multiple relationships occurring within and beyond the system (Sorgenfrei and Wrigley, 2005) for which we have some data but the ability of these data to explain the reality they are referred to remains still far from a good approximation. For instance by trying to predict the effects of future climate changes on the base of uncertain projections on a certain number of socio economic interactions (which are dynamic) using traditional quantitative approaches would be like calculating the trajectory of a bird using the law of physics that might be a very suitable tool to calculate a trajectory if this was the one depicted by a thrown stone.

The question is whether policy-makers can embrace this shift in perspective, and redefine their role as supporters of adaptive processes of change. They need to stop pretending they are throwing stones, and acknowledge that the management of public services is far more akin to throwing birds (Bantley and Wildson, 2003).

Moreover last but not the least the approach we are asking for must also allow for testing ideas in various contexts and learning through experience. Because if learning happens in a conscious way, then it can be incorporated into new managerial practices so that adaptation to change becomes more informed (<http://adam-digital-compendium.pik-potsdam.de/learning-examples/background/>).

1.4.4. The Adaptation "bottleneck"

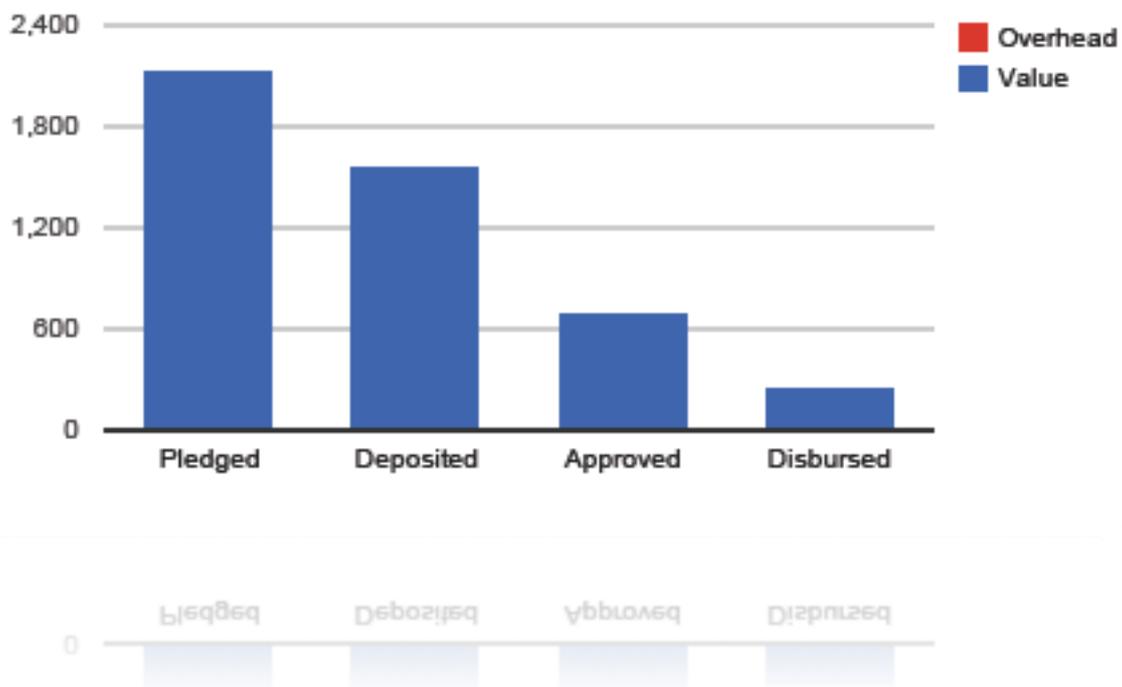
Institutions at different geopolitical scales have recognized Adaptation's important role in reducing current and future climate risks. Adaptation planning has traditionally been a characteristic of developing nations and it has been, for the most part, represented by the drafting of National Adaptation Programs of Action (NAPAs) that provide a vehicle for developed countries to prioritize adaptation needs. This practice is found to be valued in recent years not only for developing countries but for developed nations as well. It is observed that the number of publicly released adaptation plans in four developed countries (i.e. Australia, Canada, United Kingdom and United States) has increased in the past decade from approximately 1 or 2 in the early 2000s to at least 62 by the end of 2009 together with the proliferation of adaptation policies at smaller spatial scales including state/province and municipal policy adaptation planning (Brown et al., 2011; Preston et al., 2011). Consequently to this rate of development in adaptation thinking it has been argued that Adaptation can no longer be considered the "Cinderella" of climate change (Brown et al., 2011).

However an international climate policy of quality would have been able to find the right balance between mitigation and adaptation but this "optimal mix" is difficult to be made operational (Klein et al., 2007). Resources are scarce so that it follows that if some are used for mitigation less remain available for adaptation (Bosello et al., 2009). Despite developed countries highlighted that adaptation is as important as mitigation, following an established rhetoric in climate change negotiations which suggest that climate finance should be split 50:50 between mitigation and adaptation, the latter seems to represent a less undertaken option among climate strategies (Buchner et al., 2011). It is observed that Mitigation alone attracted so far the large majority of climate finance: USD 93 billion out of USD 97 billion (Buchner et al., 2011). This would have made sense in a world where climate change could have been still avoided, thereby investing all climate finance on mitigation would have implied "acting rationally". Adaptation investments are a necessity only once the consequences of climate change becomes unavoidable. Unfortunately this is the case, and as we pointed out we are already experiencing the effects of climate change in a measure greater than we expected. More plausible reasons for this balance issue are coming from the fact that many mitigation activities like investments in renewable energies can be justified in the view of energy security concerns rather than global climate change concerns (Buchner et al., 2011) and also for the greater private sector involvement

which characterize Mitigation whose market system has stimulated an increasing rate of patented climate change technologies among developed countries (Dechezleprêtre, 2008).

The disproportionately small share of finance devoted to Adaptation has stimulated an ongoing debate regarding how much should be the global need for Adaptation. The World Bank estimated that the cost of adapting to an approximately 2 °C warmer world by 2050 is in the range of USD 70 billion to USD 100 billion a year (World Bank, 2010), that is already all the current climate finance available. Nevertheless there is not full agreement on these figures. Other studies for example suggest that these numbers are too low (Fankhauser and Schmidt-Traub, 2010) and that the actual cost could be further higher (Parry et al., 2009) even if, for the sake of precision, it must be noted that these studies sometimes tend to include some social adaptation activities that could arguably be part of a baseline economic development (Fankhauser, 2009). We already clarified that there should be an "adaptation-development continuum", which means that resources for adaptation and for various development issues should be managed more according to contextual needs and priorities stated on the base of the relevance of these needs within a processes able of considering all points of information. However the numbers of the studies above are still useful to understand what is the extent of the financial commitment required for adaptation alone. On this regard it seems to be widely accepted that one significant constraint to adaptation would be the limited size of funding (Burton et al, 2006), but quite surprisingly the reality of adaptation's dedicated funds shows that there is still unutilized money though expressly allocated for adaptation. *Figure 2* clarifies better this situation by looking at the clustered result of the Adaptation Fund (6,4%), the Least Developed Countries Fund (25,3%), the Pilot Program for Climate Resilience (56,9%) and the Special Climate Change Fund (11,4%). The current adaptation's state can be deduced by looking at the bars' difference in height.

Figure 4: The state of Adaptation finance



Source: <http://www.climatefundsupdate.org/data>

Starting from the left the difference between the first two bars indicates that the money deposited in the funds has not been proportionate to the pledge made, therefore the money has only been promised but it is not currently available. Moving forward, the disparity between the second and the third bar indicates the presence of resources that countries might access by means of new project proposals, so in this case the money is available, but countries, for some reasons, do not come into possession of these resources. Finally the difference between the last two bars suggests that despite there are projects that have been already approved, hence suitable to be financed, they did not receive the money yet, which is a nonsense if we consider that projects for adaptation are usually implemented to face urgent needs. In this view the timing on the delivery of finance should also be a priority as there might be no adaptation without resources. One might see the speed of the "disbursed" bar to get to the same level as the "approved" one as the time needed for an already approved project to get financed. To understand the reasons of these differences requires a deeper understanding on the way adaptation could be enabled. We do not address the issue of how to enable countries to access funds, but to whom it may concern is nowadays available a funds compendium to see if a certain country is eligible (<http://www.adapt-asia.org/funds-compendium>). What we are doing here is another kind of consideration, i.e. how should this money be utilized. Starting from the

observation that much of the work on Adaptation done so far can be more framed as awareness raising rather than direct to inform practical decisions (Brown et al., 2011), it seems that we fell into what has been defined the "adaptation bottleneck" (Burton 2002; Vogel et al. 2007, Preston and Stafford-Smith, 2009; Brown, 2011), i.e. a situation in which decision makers have already reached a high level of awareness about the need for adaptation, but not enough real context-specific projects have been identified and implemented. In two words there is urgent need to facilitate the transition from generic making the case for adaptation messages to the effective implementation of an adaptive responses. Someone is warning that in this case there should certainly be a sort of disconnection between theory and practice (<http://adam-digital-compendium.pik-potsdam.de/learning-examples/background/>). So vis-à-vis to this intricate situation that sees underutilized climate funds although the claimed extraordinary need for adaptation, it seems clear that even if adaptation has been frequently referred both in recent scholarly work and in policy discussion to climate, still there is no common understanding of what is meant by the term (Smithers and Smit, 1997). If compared to Mitigation, Adaptation seems much less understood, although it needs solutions as well (Burton et al., 2006). It has certainly suffered from ambiguities in the regime and one of these has concerned its very definition that, as already pointed out, is nowhere explicit in the convention (Burton et al., 2006). Also historically the term adaptation has described a myriad of different actions throughout disciplines and society that fosters a huge variety of approaches and level of analysis. We propose that Adaptation should be seen as "strategic fit" alluding to the fact that organizations can be managed in such a way to find the best possible configuration for their particular situation.

CHAPTER 2

Adaptation: a promising metaphor to capture organizations' endeavor to fit the environment

2.1 Etymology and FAQ

While the concept of adaptation to environment represents an increasingly important component of the climate change's debate, its origins and development lie elsewhere (Smithers and Smit, 1997). To adapt comes from the Latin *aptus*, adjectival use of *apere* (to attach, to join), which means fitted, appropriate (http://www.etymonline.com/index.php?allowed_in_frame=0&search=apt&searchmode=none). Through the addition of the locution *ad* that means towards, one obtains the composite word *ad aptus*, whose verbal form *ad-aptare* was used during the 14th century to designate the action of "adjusting to" (http://www.etymonline.com/index.php?term=adapt&allowed_in_frame=0). Adaptation comes directly from the word *adaptatio*, noun that refers to the action of *adaptare*. Its use is witnessed by the borrowing of this medieval Latin word, precisely the accusative *adaptationem*, by the French and English literature during the 16th century to give the idea of fitting something for a specific purpose (Simonet, 2009) smoothing the way to its elliptical sense of "becoming appropriate to" that traces back to 1560s (http://www.etymonline.com/index.php?allowed_in_frame=0&search=apt&searchmode=none). However during 1670s adaptation started not only to indicate the sense of modification of a thing to suit new conditions, but also the condition of being adapted. This is a first ambiguity: adaptation can be semantically referred both to the process of adapting and to the condition to be adapted (Burton et al., 2001). It would appear that this semantic ambiguity has contributed to make the comprehension of the concept difficult to grasp (Simonet, 2009), but the real question here is not if adaptation should be seen as a dynamic process or as a state. Here adaptation is certainly the process, the trajectory toward a desirable goal: the adapted state. For the sake of clarity when we will make reference to adaptation as a state we will specify it.

The difficulty of the concept of adaptation is best documented by the incessant efforts of authors to analyze and describe it (Mayr, 1983). *Who or what adapts? Adapt to what? How does adaptation occur?* Are the central questions that need to be addressed (Smit et al., 2000). To provide an immediate answer to the first two questions we recall the notion of a "thing" that fits to something or that becomes appropriate to something, which means

that any entity or any "thing" that undergoes modifications as to fit new circumstances should be seen as an adaptation. This makes the concept of *adaptationem* meaningless without the specification of this related "something" which has been generally called in turn *environment* from the English literature, or *milieu* from the French. *Environment* determines the terrain where adaptation takes place and through its definition one gets the answer to the basic question *adaptation to what?* It is noteworthy that environment is an extremely general term, whose applicability and definitions are highly discretionary and potentially infinite: it could be referred to many diverse knowledge domains and its boundaries extended as needed (Simonet, 2009). This has necessarily created a very rich soil where adaptation's conceptualizations could flourish with very diverse nuances, but at the same time it has also contributed in creating confusion. However this aspect should be regarded as something useful with the satisfaction of those who attempted to bring together some of the disciplines where adaptation has been framed. Even if it has been argued that having in place a truly unified inter-disciplinary approach would not be desirable (Brown et al., 2011), it is an irony of our time that many disciplines representing the conceptual roots of adaptation are seldom referred to the climate change discourse (Schipper, 2007). We believe that relating different approaches would surely be a mean to aid discussion, perhaps grasping the interdisciplinary communalities that will facilitate the needed learning to answer the basic question: *How does adaptation occur?*

2.2. The origins of Adaptation in natural science

The study of adaptation has its roots in natural science (Smit and Wandel, 2005) and takes its conceptual glory mostly from the theory of evolution (Simonet, 2009) that was principally developed in the field of biology and ecology, with applications in chemistry and physics at the level of the cell or organic molecule. However it is from the very beginning that the idea of adaptation has been considered so much central, yet obscure, elusive and controversial concept in evolutionary theory (Krimbas, 1985) that even quite recent evolutionary biologists have been able to describe it as a slippery concept (Reeve and Sherman, 1993).

As it is known biology is concerned with the study of life and living organisms including their structure, function, growth, origin, evolution, distribution, and taxonomy (<http://en.wikipedia.org/wiki/Biology>). Ecology instead is the scientific study of the relations

of organisms with each other and with the natural environment (<http://en.wikipedia.org/wiki/Ecology>). Either changes in species and organisms' traits or in their relationships have been framed as adaptations in the sense of evolutionary modifications of characteristics under selection for advantageous functioning in a particular context (Montuori, 2003). At its most ground-to-ground level, evolution makes reference to change and movement in time and natural selection has been a sort of "label" for this "synthetic theory of evolution" which included molecular genetics, biology and ecology (Bertalanffy, 1972). However we learn from post Darwinian's evolution views of a shift from a process linked to chance and necessity to one that sees evolution more as an interaction between constraints and possibilities (Montuori, 2003).

Neo Darwinians originally saw evolution as a genetic mutation (random mutation) with the environment acting as a source of natural selection of the fittest, wedding out unfit mutations (Hannan and Freeman, 1977). According to this view the possession of certain genetic characteristics allows individual organisms to survive and reproduce in the environment they inhabit (Smithers and Smit, 1997). It is useless to say that natural selection as the agent of adaptation, has somehow replaced a supernatural design, which had to be perfect by definition (Mayr, 1983). This would suggest that when a biological systems adapt, no rationality would be implied if not natural selection's rationality. Hence it is the environment that has the power to act on organs and optimally shape their current functions. This nice evolutionary story has been explaining for years all in one: how organisms evolve in the environment they inhabit, the degree of spontaneous order, or self ordering properties shown by the universe we live in, and on top of that it also tricked us into believing that all this was compatible with the extraordinary evolutionary pluralism, i.e. the endless number of living forms. This conceptualization of evolution was grounded on the way classical science has been operating for years, that is in terms of isolable elements of the observed universe, one way causality or relations only between two variables at time (Bertalanffy, 1972). In this way chemical compound and enzymes, cells, freely competing individuals, were left isolated in the hope that by trying to put them together "the whole would have resulted and it would have been intelligible" (Bertalanffy, 1972).

From the first half of the 20th century these explanations started to instil increasing doubts and quite obviously the old way the classical science was dealing with complex phenomena came under attack pushing for a reorientation of thought toward a new paradigm: a system's perspective (Box 6).

Box 6: The General System Perspective

A general system perspective was firstly proposed by the biologist Bertalanffy and further developed by Ashby, but it is a common practice to ascribe a first distinguished contribution on this matter to Aristotle who noticed that "the whole is more than the sum of its parts" finding in the experienced world a *kosmos* or order, today synonymous of universe. Order is something we really observe when we look at a living system, social group, or even an atom. Order or organization of a whole system transcends its part when these are considered in isolation is nothing metaphysical, neither anthropomorphic superstition nor philosophical speculation (Bertalanffy, 1972). The systemic perspective was initially conceived only as a reaction against traditional scientific reductionism, but it started to take soon the connotations of an independent theory. This was pretty straightforward already in the late 1920's with the call for a discover of the laws governing biological systems (Bertalanffy,1972):

Since the fundamental character of the living thing is its organization, the customary investigation of the single parts and processes cannot provide a complete explanation of the vital phenomena. This investigation gives us no information about the coordination of parts and processes. Thus the chief task of biology must be to discover the laws of biological systems (at all levels of organization). We believe that the attempts to find a foundation for theoretical biology point at a fundamental change in the world picture. This view, considered as a method of investigation, we shall call "organismic biology" and, as an attempt at an explanation, "the system theory of the organism" (Bertalanffy in Bertalanffy, 1972).

This statement represented the germ of a General Theory of Systems grounded in the isomorphism of concepts and principles of organization along different disciplines (physics, biology, technology, sociology, etc.), which provided a basis for their unification.

There exist models, principles and laws that apply to generalized systems or their subclasses irrespective of their particular kind, the nature of the component elements, and the relations or "forces" between them. We postulate a new discipline called General System Theory. General System Theory is a logic-mathematical field whose task is the formulation and derivation of those

general principles that are applicable to "systems" in general. In this way, exact formulations of terms such as wholeness and sum, differentiation, progressive mechanization, centralization, hierarchial order, finality and equifinality, etc., become possible, terms which occur in all sciences dealing with "systems" and imply their logical homology (Bertalanffy in Bertalanffy, 1972).

This broad approach to system problems, i.e. problems of interrelation within a super ordinate whole and the exploration of the wholeness, was so successful that it fostered a great multiplicity of approaches. Although it was considered more as a metaphysical rather than a scientific notion, General System Theory became sound scientific when it was integrated with mathematics, the exact language permitting rigorous deduction and confirmation (or refusal) of theory (Bertalanffy, 1972). System science was described from that moment as the scientific exploration and theory of systems and General System Theory was the doctrine of principles applying to all (Bertalanffy, 1972).

From a mathematical point of view system theory is conceived in dynamic terms and has two kinds of representations: the internal description tries to depict systems in terms of state variables by means of first order differential equations; the external description instead, is more "behavioural" and conceives the system as a "black box" which interacts with the environment. However, there were still many systems asking for a theory, which was not always available in mathematical terms. This pushed toward the convincement that mathematical formalization was more an impediment for the exploration of real problems such as politics, socio economic systems, educational institutions, international relations, ecosystems, pollution and so on which were already too complex to be handled by traditional obsolete braches of technology and mathematics.

The range of phenomena that we have to deal with is so broad that, were it to be wholly dealt with at the technological or practical level, we would be defeated by the sheer quantity and complexity of it (Ashby, 1962).

This required a more integrated, holistic approach to systems that fostered the development of a "philosophy of systems" which started to question well-established paradigms through which society was looking at the reality. It was argued that in order to define a real system, i.e. a real object which is discrete in space and time, we cannot rely on our perception because...

...following it, we "see" the sun revolving around the earth, and certainly do not

see that a solid piece of matter like a stone "really" is mostly empty space with minute centres of energy dispersed in astronomical distances. The spatial boundaries of even what appears to be an obvious object or "thing" actually are indistinct (Bertalanffy, 1972).

Under this view all boundaries are dynamic rather than spatial which makes likely that a system would be definable only in relation to its parts. Here is how an ecosystem or a social system can be seen as real as a human being and social problems can be interpreted and understood (Bertalanffy, 1972).

This opened up the possibility that adaptation was not solely the result of the environment acting on organisms, but also the organisms active answer to perceived environmental constraints. This argument is nowadays confirmed even at the cell's level by the most recent findings in chemistry which lead to the 2012 Nobel prize: cells are endowed with receptors that strength their ability to adapt to the external environment making them able of sensing light, flavour, odour and receiving signals from hormones and neurotransmitters (<http://www.guardian.co.uk/science/2012/oct/09/nobel-prize-chemistry-2012-live>). Cells and their environment are considered systems because of the presence of vague spatial boundaries which allow them to maintain a flow of molecules entering and leaving which makes difficult to tell what belongs to the living system and what does not (Bertalanffy, 1972).

That is the reason why biological changes depend on the interaction between a thing and the environment, in this case the cell and its surroundings, or in a broader sense the living beings and their environments. Interactions do not imply one-way causality as in the classical science but rather a more complex relation, which involves a continuous exchange of information within the system. Under this view the infinite possible ways of couplings between a thing and the whole, the systemic complexity labelled by natural scientists "evolutionary pluralism" might also be explained by means of constraints and possibilities that are the essential part of this interdependence. By adopting this "new" approach one should not see anymore evolution as the "reign of necessity and optimal adaptation" but more as the "polymorphous and unpredictable result of contingent journeys, secondary and sub optimal adaptations, unpredictable bricolages" (Montuori, 2003). This is even more evident if one refers to cultural and social systems, which have the potential to express themselves in a myriad of interpretation of the world (Montuori, 2003).

2.3 Adaptation in social science

Crossing the *Rubicon* of social science would make more challenging to discover how adaptation occurs, however it is a necessary step because the "matter" adaptation has become nowadays merely a social issue. The term has been actually used already in varied fields of social science, but always to describe circumstances where an entity interacts with a super ordinate whole that contains it. Here is why elements of continuity with the natural science's tradition will be easily detected. Besides the development of social adaptation theories has not happened also temporary completely in insulation from the thinking developed in natural science so that we have inherited theories that had the time to develop their linguistic form soon after the "launch" of "the adaptation" par excellence. Here is why the use of well known evolutionary metaphors will be for a little while heard.

The anthropological conceptualization of adaptation is relevant because it sees its application directly to the study of collective human systems for the first time with respect not only for their biological but also cultural changes that have affected communities during their evolutionary course, however it exhibits still the typical centrality of adaptation in relation to life and survival as in the first natural science perspectives (O'Brian and Holland 1992). The concept of "cultural adaptation" was framed within a "multi linear evolution theory" describing the adjustment of cultures to different environments and high lightening how these cultures were evolving differently according to the environment where they were "absorbed" (Steward, 1955). So that in a short time adaptation took definitely its intransitive shape to undergo modification so as to fit new circumstances also in social science, but this time by means of adjustments in cultural practices which were represented by the ability of populations to add new and improved methods of dealing with the environment to their pre existing cultural repertoire (O'Brian and Holland, 1992). This view remained for a while on the "teleological" belief that adaptation would have dealt merely with existence, e.g. with issues like survival and reproduction (Mazess, 1975) like in the game where who has not enough improved methods to deal with environmental changes has failed to adapt therefore will not be able to compete for scarce resources (O'Brian and Holland, 1992). But that the sophistication of human adaptation had to "mean more than that" was soon recognized (Mazess, 1975). Social systems act in pursuit of goals beyond species survival, for instance they enhance life quality and exploit perceived opportunities (Smithers and Smit, 1997). This clear fact has represented a major turning

point in adaptation literature because it highlights the fundamental distinction between social and biological systems: humans have the ability to plan or manage adaptation. While biological responses can be merely reactive, humans might respond both reactively and proactively (Smithers and Smit, 1997) therefore we would not adapt to the environment, but to our interpretation of it (Montuori, 2003).

In sociology, even if the term adaptation is not directly used in sociology, words as "acculturation" and "socialization" identify the social adjustments of behaviour needed to acquire the feeling of belonging to a group that have nothing to deal with the struggle for survival, but instead imply the voluntary interiorization of symbols and models adopted by the group the individual wishes to belong to (Boudon, 2002). This to say that the process through which this voluntarism is expressed is characterized by a complex dynamic that involves information processing and decision making (Simonet, 2010).

Furthermore in psychology it becomes a "process of never ending interaction between Man and the ever-changing environment" where man decided to evolve opening the door to the idea that the old meaning of the evolutive metaphor could have been put away at some point if this was the result of a faculty, namely adaptation, of adjusting own behaviours to respond to new situations (Simonet, 2010).

Social science is concerned with changes in social systems at progressive levels: persons, groups and organizations (Fry and Smith, 1987). The aim with respect to organizations is the same of the other sciences that have treated the same events and phenomena at lower level of analysis (Katz and Kahn, 1966). Organizations display the kind of individuals' behaviour at the aggregate level that has labelled of "organizational theory", nothing than "a sociology of organizations" (Daft, 2008), i.e. a science that helps us to understand and diagnose what would be organizational issues, but maintaining a dialectical relationship to them (Astley and Van de Ven, 1983). In this way "organizational theory not only reflects organizational reality" but it offers the possibility of "producing that reality" when the "creative reconstruction of social arrangements" put into place by organizations would serve to improve upon our knowledge of the "art" of managing organizations (Daft, 2008).

2.4. An overview on organizations: definition and general design characteristics

Organizations are summarized as goal directed, social entities, linked to the external environment, if it is then added that these can be designed, structured and wilfully coordinated they would be best summarized (Daft, 2008). The importance organizations have for society lays in the fact that every aspect of human life could be lead back to an organization. We are all part of organizations and organizations "are all around us" so that they shape our lives in many ways (Daft, 2008). Some of the functions carried out by organizations are not only the creation of products and services and the coordination and deployment of resources to achieve desired goals, but organizations are the places where innovations are facilitated and where the ongoing challenges of diversity and ethics are discussed and solved (Daft, 2008). Since they are so important for society they have been object of in-depth study and nowadays we are taking advantage of this work to describe their traits in a similar way as we can describe people's personality and physical traits (Daft, 2008). This "being" could be described using two dimensions that interact to create he himself:

1. Structural dimensions, as suggested by the name, deal with the structure of the organization, i.e. with the internal elements that define it (Daft, 2008):
 - ❖ *Formalization* is a concept that most generally deals with the amount of "written documentation" (Daft, 2008) that clarifies the internal patterning of relationships occurring within the organizational boundaries requires regulation that is obtained by formalized norms, customs and laws (Astley and Van de ven, 1983).
 - ❖ *Specialization* deals with the range of tasks organizational memebers accomplish. When specialization is extensive, the members perform only a narrow range of tasks while in the case of low specialization they tend to perform a wider range of tasks (Daft, 2008). The main idea is that the activity of the organization cannot be carried on by one single individual, but it must be divided into various sub-activities and individuals tend to specialize in some of these.
 - ❖ *Hierarchy of authority* is the continuous line of authority (Daft, 2008). Authority referes to the right inherent to a certain organizational position to tell other members what to do, expecting them to do it. The fact that authority is arranged in a hierarchy allows to describe who report to whom. The

concept also relates with the span of control, i.e. number of members that can be supervised by one level of authority.

- ❖ *Centralization of authority* refers at the hierarchical level that has authority to make decisions (Daft, 2008). When decisions are undertaken at the top level the organization is more centralized whereas if decisions are delegated to lower levels then the organization is more decentralized (Daft, 2008). An organization that tends to decentralize is one in which members at lower levels are more empowered, i.e. they have more say in what is happening and they are capable and experienced in making decisions. This has relevant implications for the organization's strategy because it relates to the distance from the level where significant decisions are taken to the place where these decisions have an impact.
- ❖ *Professionalism* is measured by the level of formal education and training of organizational members (Daft, 2008).
- ❖ *Members ratio* deals with the distribution of roles, i.e. the parts every member plays in the dynamic social system, it can be interpreted as the way people are deployed to perform various activities within the organization (Daft, 2008). The ratio between the organization's size and the number of members deployed to perform a certain activity reveals somehow how much a certain activity would be important for the organization .

2. Contextual dimensions describe the contextual settings that have an influence on the organization structure. We can think about contextual elements as a set of overlapping elements that underlie the organization's life (Daft, 2008).

- ❖ *Size* mostly deals with the number of people that are part of the organization.
- ❖ *Technology* refers to the techniques the organization has established to perform its activities (Daft, 2008). It clearly depends from the nature of activities carried out within the organization because every activity has in general its appropriate technology.
- ❖ *Culture* contains the values and beliefs, i.e. unwritten norms, shared by the members of the organization and which address its ethical behaviour (Daft, 2008). The organization is made of informal institutions and social networks whose pattern of relationships is regulated, in absence of written formalization, by values its members share.
- ❖ *Purpose* is the aim of the organization defined by the leadership.

- ❖ *Environment* is, most commonly, everything outside the organizational boundaries. It stresses more clearly that organizations are part of the forces that unfold in the natural environment and in society as large (Astley and Van de Ven, 1983).

Although these are characteristics common to all organizations the last two dimensions need further clarification to understand the point of view of this study.

2.4.1. The organizations' purpose: help its members to fulfil their needs

Despite the growing theoretical pluralism in organizational literature and the various definitions of organization elaborated by scholars during the course of the time (Astley and Van de Ven, 1983) there would not be a better definition of organization for this study than the one that conceives it as a "dynamic social system of cooperative interactions" that is put into place with the purpose of satisfying "the individual needs of its members" (Barnard, 1938). As further proof that organizations would be nothing but social systems creating value for multiple constituencies, which populate and interact within their structures, deliberately creating and shaping a pattern of complementary or interdependent activities through a set of social relationships (Katz and Kahn, 1966), is that even more recent organizational theory underlies that organizations are made up of people whose relationships with one another are directed to the performance of essential functions that help them to fulfil some of their needs (Daft, 2008). Moreover it must be noticed that the organization is a "population", i.e. an aggregate of members with different characteristics (Astley and Van de Ven, 1983). For instance there might be more or less powerful members so that each member would carry different needs and interests, i.e. might want different things from his participation in the organizational life (Hicks and Gullet, 1975). Therefore objectives stressed by some of the members might have a significant impact on resource allocation (Biehl, 2001) and might incite controversy and disagreements, i.e. situations in which the initial statement of the decision rules out something that certain other members might consider important (Gregory and Keeney, 1994). Easy to say that to accommodate the ongoing challenges of diversity, ethics and resources allocation (Daft, 2008) the organization would make difficult trade offs giving up something that is valuable for some members (Gregory and Keeney, 1994). Organizational leaders are the people in charge of devising solutions for other members that carry expectations that decisions would provide them a valuable benefit (Daft, 2008).

But if it would be senseless thinking that organizational members' expectations may be fully satisfied all at once, it can be also said that an organization that is not able to meet the needs of its members is in the end a social structure that has failed to achieve its purpose (Daft, 2008). Needs might unfortunately be very basic and choices taken at the head of the organization might have a relevant impact for some members. It is not an oddity that the way these kinds of compromises are found are nowadays subjected to an higher level of accountability so that decisions that once were discussed behind closed doors are put through international public opinion and cutinisation (Gregory and Keeney, 1994).

2.4.2 Defining the organization's environment

Organizations are part of a wider context and exist in a very strong relationship with respect to it (Montuori and Purser, 1996). For this reason, drawing from the studies initiated in biology (Bertalanffy, 1972) it has been easy to extend to the organizational discourse the General System Perspective presented in box 6 for natural systems. By interpreting organizations through this lens we got to know that organizations would be impossible to be fully understood without a study of the forces that impinge upon them (Katz and Kahn, 1966). On this regard organizations are conceived as "opens systems" (Katz and Kahn, 1966) for their continuous inflow and outflow of interactions, through permeable boundaries with the environment (Katz and Kahn, 1966). However the environment could be framed in different ways. During the course of the reasoning we interpret it in two ways:

- ❖ *The environment in a broad sense* refers to the context where the organization is performing its activities. It deals with all the elements that are neglected by the other components of the contextual dimension and it underlies that the organization is part of the forces that unfold in society at large so that it would be inevitably influenced by the rules that govern its surroundings, by the network of relationships that the it is able to establish with higher organizative levels or other organizations that may have an impact on the ability of the organization to pursue its own activities. It is worth to notice that the organization has a certain power to influence the relationships it has within the broad environment, especially through political negotiation.

- ❖ *The natural environment* deals with the environment in the sense of climate. Environmental forces affect the organization in the ways described in chapter one and add new threats to the challenges already faced by the organization within its boundaries potentially hampering the organization's ability to perform its activities.

The object of the study deals with the ability of the organization to respond to shifts in the natural environment, however we might refer to environment in a broad sense to point out some important aspects of organizational life, but when we will do it we will specify it. The significant challenge posed nowadays to organizations to "respond quickly and decisively to environmental changes" requires organizations that are able to continuously adapt to these shifts, so that people in charge, i.e. organizational leaders, need to be prepared to the eventuality that the environment may "shift dramatically at a moment's notice" and this change force them to re-design solutions, transforming every time the organization into a radical different one (Daft, 2008). The process of organizational change and adjustment is the dynamic procedure object of our inquiry. We know that humans have the faculty to manage this process of change, but the extent to which our organizations and we can actually exercise this faculty on the natural environment is grounded into a preliminary specification of this relationship, i.e. organization-environment (Hrebiniak and Joyce, 1985). The quest of understanding if organizations could change and survive in face of major environmental shifts has been a true leitmotiv in organizational literature that can be traced back to the second half of the 20th century (Astley and Van de Ven, 1983 ; Hrebiniak and Joyce, 1985) when adaptation was proposed in term of the duality between two, not by chance polarized approaches abstracted in Box 7 below: strategic choice and natural selection (Hannan and Freeman, 1977).

Box 7: Can organizations change and survive in face of major environmental changes?

❖ ***Strategic choice***

Has historically held the scene in organization theory (Astley and Van de Venn, 1983) drawing the attention to individuals, their autonomy and the powerful choices they make. Strategic choice theorists argue that organization's behaviour has only partially reference to environmental conditions and that it is mostly driven by the choices of their leaders (Hannan and Freeman, 1977) who have primacy over environmental conditions. This thought is grounded in action theory according to which organizations would be

continuously constructed and changed as a product of actors' decision (Astley and Van de Ven, 1983). Strategic choice admits that the organization would be the place where learning, creativity and innovative activity would be developed thus opening up new possibilities for future actions (Lam, 2011).

❖ ***Natural selection***

It is the traditional approach utilized by population ecologists, economic historians and industrial organization theorists to describe the evolution of entire industries (Astley and Van de Ven, 1983). Population ecology models are usually based on the existence of "niches". The niche is a concept borrowed from biologists from early social science which plays a central role in ecological theory (Hannan and Freeman, 1977) because it constitutes all the levels of environmental conditions at which the population can survive and reproduce itself (Hannan and Freeman, 1977). This perspective emphasizes the role of organizational inertia's powerful forces that hamper leaders' capability of making radical changes (Lam, 2011) in face of not homogeneously distributed environmental effects (Aldrich, 1979). So that either the organization randomly adapts or it is placed at the merci of the environment which selects it out and makes it fail (Chakravarty 1982).

According to these broad perspectives the organization's ability or inability to change is connected with its level of innovative activity or the structural inertia that permeates its internal environment. However in this way it would be either a powerful environment acting on a "disarmed" organization, or the other way round, i.e. the organization would be one able of exercising its strategic power independently of the surrounding environment (Hannan and Freeman, 1977; Aldrich, 1979). In these ways, from the organization point of view, the environment would be alternatively conceived either in terms of something easy to exploit and dominate (Montuori and Purser, 1996), or conversely as a dominating entity (Hannan and Freeman, 1977). If these were the cases no possibility of reply would be left to the "dominated" and no other possible relevant interdependencies, exchanges and so on would have been admitted. Conversely it has been empirically found that choice and determinism might coexist as in the case of organizations "typically subjected to environmental constraints", but that still preserve individual choice, power, and sufficient means for achieving desired outcomes (Hrebiniak and Joyce, 1985). For this reason we should better agree that there is actually no binary distinction between environmental determinism and choice because they are two independent variables and not opposite

ends of a single continuum so that organizational change, that is certainly a dynamic process, would result from their combination, i.e. it depends from the peculiar conditions existing between the organization and its environment or more precisely by the relative strength and type of dependency between the two (Hrebiniak and Joice, 1985).

Organizations have the power to influence the environment through a strategic choice, i.e. mitigation policies that, as we pointed out in chapter 1.3, are certainly in principle useful strategies, but still not undertaken in a way that would guarantee to solve the underlying issue. The failure to address Mitigation has made that the environment became more turbulent, placing new threats to organization's life and imposing them no choice rather than adapting. This view emphasizes, rather deterministically, that we have reached a situation in which there are already clear limits to the degree at which strategic choice is viable (Aldrich, 1979) because when organizations have no control over changing environmental forces, their leaders have a very limited space to strategically define their actions. But if environment has causal primacy and limits managerial action, this must not imply that individuals should not try to mitigate peremptory environmental forces (Child, 1972; Aldrich 1979). To do this organizations need to figure out the appropriate technical manner to respond to changes in the environment "by fine-tuning themselves to the contingencies", i.e. by altering their environmental position since the environment itself cannot be altered (Astley and Van de Ven, 1983). As the organization shapes the lives of its members, well informed organizational leaders possess the tools to shape the rules of the game of its intraorganizational members, i.e. the organization (Daft, 2008) through the "creative construction" of an adequate social environment that would shield the organization, i.e. "mediates", from "the effect of the natural environment" (Astley and Van de Ven, 1983). Whenever changes occur in the natural environment, these must be perceived, processed and an adequate response elaborated in such a way that the organizational structure and processes would be adjusted to ensure survival and effectiveness to its members (Astley and Van de Ven, 1983).

2.5 Exploring the concept of "strategic fit"

The description of organization's design traits is an invitation to design, structure and coordinate organizations in different ways because it gives the basic tools to do it. However the assumption underlying organizational design is that there would be no design

if we were only able to include the appropriate components because for a design to be consistent it is necessary that these components should create logically consistent relationships. Only in that case "there would be no reason for the organization to perform bad" (Dunbar and Starbuck, 2006). However the ability to "reconcilate" the elements of organizational design is "nothing compared to the art of reconciling their implication in a choice of purpose" (Andrews, 1971 in Venkatraman and Camillus, 1984). Why is this so? The explanation is readily available: in face of a changing environment in order to create logically consistent relationships structural changes and adjustments need to be pursued (Chakravarty, 1982). The concept of Adaptation deals precisely with the possibility to realize these changes, which are logically consistent. Luckily Adaptation is "a challenge by no mean new to management science" (Pawlowsky, 2001) because the essence of management has since always been "coping with changes" (Chakravarty,1982). We found this "concern" for the need to change structural elements and adapt them to the organizational context in strategic studies that have employed a contingency theory perspective to understand the lawful statements, if there were any, between different organizational variables. The vast majority of these studies has started form the premise of congruence assumptions and then has tried to look at the impact of these variables on organizational performance (Drazin and Van de Ven, 1985). However their limit has laid in the fact that adaptation would have been mainly due to a process of bi-variate relationships unable to capture the larger set of interactions existing between multiple structural and contextual variables (Venkatraman and Camillus, 1984). This is a criticism that nowadays seems to be accepted by more recent contingent studies which have acknowledged the need to indentify and match more variables at the same time in such a way that context settings would be aligned with organizational settings (Volberda et al., 2011). In this way adaptation has started to deal with the concept of fit prescribing that when context and structure are "aligned", i.e. when they "fit", the organization's survival would be assured:

Structure and process of an organization must fit its context if it is to survive or be effective (Drazin and Van de Ven, 1985).

The concept of fit is explored in both organization and strategy literatures covering much of the descriptive and prescriptive research in these arenas (Volberda et al., 2011). The intuition is that there might be a positive link between the organization's ability to meet the needs of its members and the congruence of different organizational design components

so that it is commonly accepted that "organizations whose components fit well functions effectively, others whose components fit poorly do not" (Fry and Smith, 1987).

However before speaking about fit in a normative way we want to clarify how different perspectives have been developed and see if we will be able to make any recommendation applicable to organizations at large instead of taking the value of fit for granted and use it unconsciously. To explore the concept of fit we start from factual data, i.e. the preoccupation for organizational performance that has made that fit become the primary object in the field of strategic management (Venkatraman and Camillus, 1984) with the promise that its achievement would have unquestionably assured the "long term survival and growth of the organization" (Chakravarthy, 1982).

The primary purpose of strategic management is adaptation, i.e. to fit the organization more particularly for existence under the conditions of its changing environment (Chakravarty, 1982).

For this simple reason we argue that if one wishes to look for adaptation's concepts and see how these have been developed strategic management is definitely the right place where this inquiry should be addressed. Strategic management has been characterized in the last decades by a wave of intellectual bubbling dynamism and the great success of both business schools and consulting in more recent times has been partially due to the ride of the strategic fit wave (Grant, 2002). Not by chance strategic management scholars are nowadays the ones who are providing "the thought leadership that is reinvigorating organization's level research in various fields such as industrial economics and psychology, organizational theory and technology management" (Grant, 2010). However the development of strategic theories was, not that long ago, mostly dependent from ideas elaborated in other fields (Grant, 2010). This because fit was a relatively new area of inquiry that had to borrow concepts from the parent disciplines of industrial organization, administrative behaviour and marketing to define its own first theoretical principles (Venkatraman and Camillus, 1984). Moreover the topic has *per se*, since always, excited the interest of other scholars such as social and cognitive psychologists, historians and economists that have in different ways contributed to its development (Lawrence and Lorch, 1967). It is easy to understand that what we have inherited are different theoretical approaches and schools of thinking about fit that, focusing on single sides of issues, tend to use different vocabularies and often do not speak to each other (Astley and Van de Ven, 1983; Venkatraman and Camillus, 1984; Pawlowsky, 2001). The not surprising result

is the great diversity in concepts, terminology and methods of inquiry we have inevitably to deal with (Venkatraman and Camillus, 1984). Luckily these perspectives are seldom completely sealed off from one to another and a certain level of overlapping can still be grasped without doing violence to the complexity of each basic assumption. In the attempt to clarify the ambiguity due to the "paradigmatic differences" elaborated by different schools of thinking, fit has been schematized along two dimensions: the domain and the conceptualization of fit (Venkatraman and Camillus, 1984).

- ❖ *The domain of fit* provides some preliminary ideas on the scope of the elements to be aligned in order to ensure the achievement of "strategic fit" adding value to the underlying assumption that "not all researchers have recognized the same variables while dealing with strategic issues" (Venkatraman and Camillus, 1984). Domain can be schematized along three dimensions using "the classical organization-environment juxtaposition" (Venkatraman and Camillus, 1984). These three domain options are external, internal, or integrated and refer to as where we should look for in order to adapt, i.e. external environment, internal environment or both (Venkatraman and Camillus, 1984). The research on the domain of fit raises an "important managerial question" on the power organizations would have to choose their environment in the long run versus a much shorter perspective (Venkatraman and Camillus, 1984). This might be interesting also in the view of the natural environment we have defined that is fixed by definition, but further clarification on this point will be given at the end.
- ❖ *The conceptualization of fit* is ideologically divided in two complementary parts that reflect the two main perspectives adopted by the schools of thought that approached the study of fit during the course of the time. On one side those focusing on the content of fit, on the other the ones holding the idea that adaptation would have been a process and therefore it had to deal with a pattern of interactions. By intersecting these two ways of looking at fit along the three possible domains three "content of fit perspectives" and as many "pattern of interaction perspectives" can be detected (Venkatraman and Camillus, 1984).

2.5.1 The content of strategic fit

The content of fit perspectives deal with *what should be done* issues by trying to specify the strategic actions that should be taken to achieve a desired configuration (Venkatraman

and Camillus, 1984). Under these perspectives strategy becomes one of the elements that should be aligned with the others in the attempt to achieve "strategic fit" (Venkatraman and Camillus, 1984). The focus on a certain content more than another is directly inherited from the typical focus adopted by the parental disciplines where the concept of fit was previously utilized and inexorably linked to the continuous evolution and refinement that the notion of strategy has seen during the course of the time (Venkatraman and Camillus, 1984). This development has been mainly derived by practical reasons as the rate of environmental change above all. While most of the "traditional approaches to strategy, have tended to assume a relatively stable and predictable world" (Reeves and Deimler, 2011), it is well known that any organization may find itself in a stable environment for years, with no need to reassess an appropriate strategy, but then it may happen that the environment would become so turbulent that even the best planning techniques turn to be of no use (Mintzberg, 1978). It is acknowledged that the life of a strategy would end when it is not anymore suitable to its specific environment so that new solutions must be devised every time a change occurs in that environment (Chakravarty, 1982). For this reason when the environment changes rapidly, continuous adjustments are needed to cope with new conditions (Montuori, 2003). The assumption underlying the external fit perspective proposed by the *strategy formulation school* is that the ability of the organization to perform its activities greatly depends upon the environment in which it operates so that a fit between strategy and environmental conditions, i.e. where the destabilizing change happens, must inevitably be found (Venkatraman and Camillus, 1984). However by adopting only an external fit the importance of the internal organizational context would inevitably be neglected thus restricting the possibility for addressing complex organizational problems (Venkatraman and Camillus, 1984).

Conversely the *strategy implementation school* has focused on the need to achieve an internal fit, i.e. a fit between strategy and organizational structure. This fit should concern a broad set of organizational elements such as culture and managerial characteristics, however its main limitation lays in the fact that fit has been interpreted in a "one way sense" so that if it is recognized that strategy can change organizational structure, the converse it is not acknowledged (Venkatraman and Camillus, 1984). Moreover by focusing only on the internal elements of the organization the environmental importance would be neglected.

For a while the limit of strategic management was to be "divided" between strategy of action triggered by environmental changes and strategy of structure that was addressing

the different question concerning the need configure internal elements to strategic responses without acknowledging that they were both important (Chakravarty,1982). In the end it is neither external nor internal the kind of fit that can be sufficient to achieve a "strategic fit". Since organizational performance must be ascribed to both structural and environmental elements, an integrated approach seems certainly to provide a more comprehensive view of the reality of organizational life because it would be able of recognizing the link between internal and external elements (Venkatraman and Camillus, 1984). This tells us that strategic fit is certainly something that must be found looking both outside and within the organization's boundaries. However the main limit of the content of fit perspectives lays in the fact that these are not able to capture the essential dynamism that permeates both the environment and the organization. Fit is somehow interpreted as a static concept and strategy is often only viewed as a one way effect of the leader's decision but does not recognize at all that the organization is not only dealing with elements but rather with processes happening both within and outside the organization. If strategic fit would be related to both changes in the external environment and processes internal to the organization it becomes more pertinent to direct our glance also on perspectives that acknowledge for the presence of processes (Chakravarty, 1982).

2.5.2 The "pattern" of interaction perspectives

The pattern of interaction perspectives deal with *how should be done* kind of issues for what concern the managed process within organizations to achieve a strategic fit (Venkatraman and Camillus, 1984)

The *Network School* adopts an external focus and analyze strategy at "collective" level emphasizing the interdependence and interaction among organizations that gives us the opportunity to talk for a while about the environment "in a broader sense". The organization operates within the broad environment and is subjected to a natural environment. Reasonably other organizations are doing the same therefore it is possible that different organizations would establish relationships or only acknowledge for the presence of other organizations. The resource dependency theme is certainly among the most influencing streams in the *Network School* (Venkatraman and Camillus, 1984). Following it the organization should acknowledge for the activities of others when it competes for the allocation of scarce resources. We have discussed already that in order to adapt, most of the times, organizations have to access climate funds. We did not go in

depth into this issue, but the perspective provided by the network school acknowledges that there would be a competition between organizations. How do organizations compete in reality? In order to access funds they usually have to satisfy some requirements, however these requirements seems to be more a prerogative of tasks that need to be fulfilled more at the national level and that have coincided mostly with the drawing of NAPAs, but at the more local level this discourse seems not to have the same relevance. Certainly equally influential has been the contributing stream of the interorganizational networks that underlines how organizations can establish external relationships that may have an impact on their functioning (Venkatraman and Camillus, 1984). We add that this is perhaps what matter the most at the local level because the organization can actually exchange information and learn from what is happening in the broad environment to other organizations that are part of its interorganizational network.

By adopting an internal domain perspective the *Strategic Choice School* focuses on the pattern of coordination among internal elements such as structure, size and technology (Venkatraman and Camillus, 1984). This perspective sees as a conscious managerial choice in the sense that it assumes that environmental forces have no power on the internal functioning of the organization as we also said in Box 7 (Venkatraman and Camillus, 1984).

Finally the *Overarching Gestalt School* acknowledges that strategic fit refers to a broad gestalt and it must necessarily be interpreted as an interaction effect between both internal and external elements (Venkatraman and Camillus, 1984). This perspective clearly recognizes that there would be a dynamic feature in adaptation so that strategy becomes a pattern of interactions to arrive at a desired configuration involving a sort of "art" of matching various components of organization and environment in order to achieve the "most favourable match or alignment between the external environment and the organization's structure and processes" (Venkatraman and Camillus, 1984). According to this perspective environmental, contextual and structural elements affect the organization at any time. This is the confirmation that neither the environment nor the management of internal processes alone can establish what are the organization's constraints and possibilities. For this reason it would not be reasonable to talk about causation of one element or another because all of them are ultimately contributing to a unique final result that would completely change the way management relates to both the organization and the environment (Chorn, 1991)

One of the insights gained by using the concept of strategic fit to study organizations deals with the way management relates to the environment and the organisation. This is best summed up by the concept of an "interactive" style. Instead of thinking in terms of "reactive" (after the event) or "proactive" (before the event), management should realize that they simultaneously create and respond to situations. In other words, rather than viewing environmental dynamics and the organization as separate, interdependent entities, we should recognize that they are just different influences (Chorn, 1991)

While the principle of strategic fit remains unchanged: it considers the degree of alignment, i.e. the "appropriateness" of these elements to one another (Chorn, 1991), i.e. of all organizational design's elements, management becomes concerned with making decisions about what kind of interventions should be done to achieve strategic fit, i.e. to adapt (Grant, 2002). However the fact that there might be several combinations of how environmental, contextual and structural elements could merge opens the door to the possibility that there might be different "types" of fit as well.

2.6 How to achieve a strategic fit?

Even if the primary task of strategic management should be achieving a strategic fit (Grant, 2010), the failure of many organizations in pursuing it suggests that strategic fit is difficult to achieve. On this regard it is noted that it would be either rarely achieved or achieved just at a specific point in time because of the dynamic nature of both environmental and organizational contexts that make it similar to a moving target (Venkatraman and Camillus, 1984). It has also been argued that since strategic fit would often become somewhat "elusive" it should necessarily be interpreted more as an ideal state rather than an objective reality organizations should continually strive for (Chorn, 1991). Starting from these advices we would like to understand if the theory on organizational adaptation would prescribe somewhere how this strategic fit should be achieved. In order to understand this we start from an important criticism made to the attempts of conceptualizing fit described in the previous paragraphs. This issue has dealt with the concern to measure fit somehow (Venkatraman and Camillus, 1984). On this regard it has been noted that not all the fits that organizations may actually achieve would

be of the same level (Miles et. al, 1978). These should more properly be called adaptation's states drawing from the natural science's interpretation that an adaptation would be a condition able to (at least) ensure survival, but that this would be true for every entity in a different way. For this reason three main adaptation states are organized in a hierarchical form on the base of the environmental level of complexity they can respectively handle (Charkravarthy, 1982).

1. *Unstable adaptive state* describes a situation in which the organization is extremely vulnerable to environmental changes therefore it tries to buffer itself from the environment by lessening its interaction with it. Since environmental changes are not constant over time, the organization has to look for new buffer arrangements every time a change occurs (Charkravarthy, 1982). The organization behaves like a "defender" (Miles et. al, 1978), i.e. prefers to strengthen existing operations instead of looking for new solutions that would modify its technology and methods of operation (Truch and Bridger, 2002). It has been argued that a defensive strategy would be suitable only for stable environments, so that if it is true that the organization is capable to respond of today's world, it will be suited to respond to the world of tomorrow only if it will be similar to the world of today (Miles et. al, 1978; Charkravarthy, 1982). Defender's primary risk is connected with ineffectiveness, i.e. the inability to respond to a major shift in the environment (Miles et. al, 1978). Although the level of adaptation might be satisfactory in the short run, i.e. till when the buffer arrangements put into place are working properly, the organization is deemed to stay vulnerable in the longer term because there is no certainty that comparable buffer solutions would be found in the future (Charkravarthy, 1982).
2. *Stable adaptive state* is the one in which the organization is opened to the environment and able of reacting in a short time to environmental changes (Charkravarthy, 1982). The organization behaves like an "analyzer", i.e. attempts to minimize risk while maximizing its opportunity for adapting by trying to exploit its own resources and capabilities, but still keeping its antennae oriented toward the understanding of how other organizations have dealt with similar environmental issues (Miles et. al, 1978). The move toward new adaptation's practices is done through imitation, i.e. by selecting the options that look more promising among the ones adopted by others (Truch and Bridger, 2002). This can be done by

implementing surveillance systems or mechanisms that allow the organization to exchange information thus fostering the imitation of solutions and techniques developed by others (Charkravarthy, 1982)

3. *Natural adaptive state* is a condition in which the organization withstands to most of the environmental changes because it has invested in the required adaptive ability. The organization behaves thus like a "prospector" (Miles et. al, 1978), i.e. continuously experimenting new solutions which might lead to both breakthrough and flop (Truch and Bridger, 2002). For the sake of clarity it has been argued that when the organization achieves a natural state of adaptation it would be one able of modifying the environment to suit its needs (Charkravarthy, 1982). By sticking to the established law of relationship between organization-environment we have referred to in 2.4.2 that sees the natural environment as "given" we found this perspective as one of great interest because it throws light on the ability of "prospectors" to forecast or anticipate environmental changes and absorb threatening events (Miles et. al, 1978). Since these are certainly two attributes we are looking for in adaptive organizations together with the already praised ability of "analyzers" to imitate innovative practices we think that the processes that led to creation of these abilities should be object of further investigation.

If it would be desirable that organization would be able to continuously adapt to the environment the possibility that organizations would achieve a stable or natural adaptive state is constrained along two parameters: the adaptive ability of the organization, i.e. a measurement of the potential for adaptation, and the process to arrive at the desired state (Charkravarthy, 1982).

2.6.1. Adaptive ability

The adaptive ability or capacity deals with the level of both tangible and intangible resources that the organization commands, more precisely it depends on the interaction between material capacity and management.

- ❖ *Management* measures the information processing ability of the organization, is an aggregate measure of the human resources present in the organization (Charkravarthy, 1982). Management is a composite measure of the extent of human resources, i.e. the "level of differentiation" of human resources and their usability, i.e. their "level of integration" (Charkravarthy, 1982). The underlying

assumption is that an organization would be able to handle an always greater level of environmental complexity only if its information's repertoire would be expanded over and over and its ability to exploit it improved accordingly (Charkravarthy, 1982). The studies on managerial capacity have mainly focused on the link between management and organization's structure noting that different structural arrangements suit better given environmental conditions. Basically each adaptive state above depicted tend to be the one more suitable to a precise organizational arrangement so that if the environment is relatively stable a mechanistic form would be appropriate, conversely an organic system would perform better in the case the environment would be unstable (Charkravarthy, 1982). The organizational arrangement is certainly relevant for the way it relates to the other elements of organizational design (Daft, 2008). While in a mechanistic form authority is based on position rather than knowledge and decision making is highly centralized so that various organizational members do not have voice and their signals are often ignored; in the organic form the leadership style is instead participative and authority is commonly based on knowledge (Charkravarthy, 1982). Between these two lays the bureaucratic form that could be defined as a hybrid in the sense that organizational members are engaged although to a limited extent (Charkravarthy, 1982).

- ❖ *Material capacity* concerns the material resources available to the organization (Charkravarthy, 1982). On this regard material capacity is a composite measure of both the abundance and the latitude of resources for experimentation (Charkravarthy, 1982). The latitude for experimentation is at the base of the potential for innovative activities and it is influenced by: the pressure for short-term goals that can limit the degree of experimentation and divert resources to other activities; the extent of risk the organization is allowed to take (Charkravarthy, 1982). Conventional wisdom says that when resources would be abundant and usable the behaviour of organizational members would be more proactive as in the case of a prospector that has the kind of risk seeking behaviour that can take fail arguments for granted (Charkravarthy, 1982). Conversely if resources were scarce the organization would be preoccupied of conserving them and adaptation choices would tend to be more limited (Charkravarthy, 1982). Usually analyzers have resources but they are constrained in the possibility to experiment therefore they opt for imitative strategies that are less risky.

According to this simplified situation "strategic fit" would be achieved when the chosen strategy matches the organizational structure. However we have defined this perspective as simplified because, as it has already been noted, it proposes a limited focus on strategy and structure (Venkatraman and Camillus, 1984). According to the conceptualization that we have defined as more appropriate instead strategic fit would involve the consideration of all the contextual and structural elements included in organizational design. For this reason even if this strategy structure fit might seem poor, it should be conceived in the light of what has been said before. What is even more relevant is that through this conceptualization we can understand that while a state of adaptation would only ensure survival, achieving a strategic fit allow the release of the whole adaptation potential through the optimal use of material capacity and management (Charkravarthy, 1982). This can be best confirmed by deduction drawing upon the broad recognition that the only requisite for an organization to survive would be to keep the parameters of efficiency and effectiveness within desired levels (Daft, 2008). As it is well known efficiency refers to the amount of resources used to achieve a desired objective whereas effectiveness is a much broader term that regards the degree to which an organization would be able to meet the need of its members (Daft, 2008). These two parameters are clearly different not only for what concern their definition, but most of all for the kind of approach they require to the organization. While efficiency has clearly a "productivity" orientation, effectiveness involves the continuous redefinition of organizations' purposes putting emphasis on the organization's "creativity", i.e. ability to innovate (Charkravarthy, 1982). The fact is that in a certain state of adaptation there might be various emphases on creativity and productivity (Charkravarthy, 1982) as highlighted also by the concept of equifinality that permeates the open system theory (Katz and Kahn, 1966). Strategic fit instead is a unique situation because it represents the optimal balance between creativity and productivity which unfortunately "cannot be an enduring one", but should be the aim of the organization (Charkravarthy, 1982). This fact has led neo contingency theorists to talk about "quasi fit" referring to the condition of quasi-permanent disequilibrium that would continually trigger the research for adjustments (Volberda, 2011).

2.6.2. The process to arrive at "strategic fit"

The process of adaptation address the important managerial question of how to achieve or strive for a strategic fit, especially if it should be achieved more incrementally as an

"evolutive" theory would prescribe or if it should be done more suddenly in a "revolutionary" way (Venkatraman and Camillus, 1984). On this regard it should be clarified that the process of adaptation deals with changes in general that are directed toward the improvements of existing processes, policies, procedures and structures and that these changes can be achieved both incrementally and transformationally, but revolutionary or transformative changes are definitely "an important contribution to the process of organizational evolution and adaptation" (Venkatraman and Camillus, 1984). Moreover changes can be the result of both the "novel recombination of old ideas" and the direct creation of something new (Sussman, 2004). In order to give further clarification the process of adaptation is divided in two sub processes (Charkravarthy, 1982):

- ❖ *Adaptive specialization* is the improvement of existing processes and structures which led to an improvement in the goodness of fit within a given adaptation state (Charkravarthy, 1982). It is noted how adaptive specialization would be a "conscious managed process" of rationalizing existing material capacity and management by choosing a strategy that is both appropriate to the environment and the resources of the organization and by designing a matching structure (Charkravarthy, 1982). In the beginning on our discourse on fit in 2.5 we said that adaptation would have involved the "art" of reconciling the elements of organizational design in a choice of purpose. The aim of adaptive specialization is to do this optimally. Obviously optimality is always hard to achieve although it is always to be seen as a desirable state so that adaptive specialization should focus especially in the attempt of minimizing the misfit between the chosen purpose and organization's management and material capacity (Charkravarthy, 1982). This can be done in three ways: by making improvements in either of the two so to bring them in balance, revising the choice of purpose, or both (Charkravarthy, 1982).
- ❖ *Adaptive generalization* improves upon the coping capacity of the organization by enhancing both existing resources and management. It is the process that creates the premises to handle more environmental complexity. Usually it is assumed that adaptive generalization would be possible only when the organization has reached a state of fit so that it would be able of producing a slack that can be re-invested to generate new material capacity and management (Charkravarthy, 1982). During this process the organization can be misfitted temporarily therefore it is first of all important that material capacities and management would be kept into survival limits by maintaining the required levels of efficiency and effectiveness

(Charkravarthy, 1982). It is noted that on organization "in transition" toward an higher adaptive state are different from "reactors" (Venkatraman and Camillus, 1984), i.e. organizations that are not able of managing misfits so that their pattern of adjustments to environment would be both inconsistent and unstable (Miles et al., 1978). Reactors behaviour can be originated from three main different sources: the failure to articulate a viable strategy; the presence of an inappropriate linkage of strategy to technology structure and process; and the pursuit of a strategy structure fit that is no more relevant to the environment (Venkatraman and Camillus, 1984).

The process of adaptation involves loops of adaptive specialization and adaptive generalization. Adaptive specialization is the premise of adaptive generalization and once the organization manages to create new material capacity and management it can start again with its "rationalization" through adaptive specialization. Although adaptation is both specialization and generalization, by analyzing the two separately it can be grasped that in every moment adaptation challenges the organizational structure. In case of adaptive specialization an appropriate strategy to the environment is found on the base of existing resources and management and must be followed by designing an appropriate structure for implementation, in the case of adaptive generalization instead to pursue the increase of material capacity and management the organizational structure should be called into question and redesigned where necessary in order to improve them (Charkravarthy, 1982).

CHAPTER 3

Adaptation in practice

3.1 Bundibugyo district in Uganda

The case study has been selected from the three cases addressed by the Africa Climate Change Resilience Alliance (ACCRA) Uganda Synthesis Report *Preparing for the future in Uganda: Understanding the influence of development interventions on adaptive capacity at the local level* (Jones et al., 2011)

3.1.1 Understanding Uganda's context

Despite the economic improvements occurred during the 1990s Uganda still faces significant barriers to achieve its sustainable development goals. The principal deals with the difficulty in fighting against its widespread poverty that seems to be driven by both economic and historical reasons. Uganda generally lack technical skills to exploit income generating opportunities, so that its economic structure has not been able to achieve the hoped productivity increases in spite of an increasing population. Uganda's population growth rate of 3,4% in the period 1991-2002 has been above the average of other sub-Saharan countries and according to projections it will double in the period 2002- 2025. Moreover the country has historically experienced, and often it still does, numerous wars that further exacerbate already existing challenges. This has resulted in widespread poverty, internal conflicts, and poor access to health care and education systems. The opportunities for Uganda's development are inexorably linked to its environment. Land remains the fundamental asset for rural livelihoods. The agricultural sector employs around 80% of the national population and food crop accounts for 65% of the national GDP although the sector remains underproductive. Another issue is nowadays becoming land's access, fundamental for most of the population, which is always more constrained for the increasing demography and is likely to worsen in the next future.

3.1.2 Understanding Uganda's climate

At the national level issues of climate change are poorly mainstreamed into development planning. The National Priority Program Areas are education, health, clean and safe water, feeder roads and agriculture. However climate variability is a central feature of Uganda's environment and the population has to inevitably to deal with it. Although livelihoods have been tailored to the country's topography (highlands, savannah and semi arid regions),

these remain sensitive to the fluctuations in the pattern of seasonal rainfalls, e.g. the semi arid North East is notoriously vulnerable to the effects of a delayed, prolonged or failed rain. It seems that the capacity to cope with climate variability remains overall not sufficient.

The country's tropical climate is moderated by its high altitude that ranges from 600m to 5100m above the sea level so temperatures are quite constant throughout the year fluctuating between 20 °C in the coolest regions of the South West to the 25 °C of the hotter northern parts.

The rainfall regime is "bi-modal", "short" rains from October to December and "long" rains from March to May characterize i.e. it. However the distribution of total rainfall varies considerably across the country: the South West and the West throughout lake Albert are characterized by low annual rainfall (500-1000mm), while the remaining part of the country, i.e. the central regions, the northern parts and the South-East throughout Victoria's lake are characterized by relatively high annual rainfall (1400mm). Timing and seasonality of rainfall is influenced by atmospheric systems, i.e. the Inter-Tropical Convergence Zone (ITCZ), monsoons and the El Niño/La Niña-Southern Oscillation events (ENSO), which fluctuations can lead into significant variability especially into the onset of large precipitations. This often results into landslides, floods or droughts.

In order to get an accurate understanding of climate change it is important to take into consideration the sources of all points of information. The two most common, when available, are: observed recordings and modelled projections.

1. Past data from observed recordings: observed trends

Uganda has a poor network of meteorological stations, data collection happens with poor facilities and there are often records' gaps. In substance meteorological data are available but their reliability depends from these gaps. On this regard data on temperatures are certainly more reliable than data on precipitations patterns that have not always been recorded. In light of this researchers often have to turn their attention on climate modelling. However the observation of trends from past recordings is still an instrument to get some preliminary information. What the observation of meteorological records suggests is that since 1960s the mean national temperatures have risen at a rate higher than global averages, i.e. by 1.3 °C. This has led to substantial increases in the number of hot days and especially in the frequency of hot nights. For what concern precipitations, the

observations show a statistically significant decreasing trend in annual rainfalls, but no trend in the proportion of total rainfall occurring during heavy events.

2. Modelled projections to simulate future climate: General Circulation Model

According to available output from General Circulation Models (GCM) the mean annual temperature is projected to increase by 1 °C to 3.1 °C by 2060 and 1.4 °C to 4.9 °C by 2090. The number of hot days and nights is expected to grow accordingly. On the other side days and nights that are considered "cold" with respect to actual temperatures are expected to become progressively rare and completely vanish by 2090. For what concerns precipitation pattern the simulated future is in contrast with meteorological records. Projections are broadly consistent in indicating annual increases in the average rainfalls that are expected to be more pronounced in the short-rain season. The model also consistently projects increases in the proportion of total rainfall that falls during heavy events, but disagreement remains on how these changes will be likely to influence the atmospheric system El Niño/La Niña-Southern Oscillation events (ENSO).

3.1.3 Bundibugyo district: an overview

Bundibugyo is a district situated in the far West of Uganda, on the border with the Democratic Republic of Congo. The district's topography is not homogeneous: it includes both lowlands and highlands, i.e. the Rwenzori Mountains. The climate is on average temperate.

Bundibugyo is one of the most deprived district in Uganda and for this reason it has failed to meet even the most basic development goals. There are high poverty levels, i.e. 60% that means almost twice the national average of 31%, high levels of illiteracy, child mortality and population growth. Moreover the district has also suffered from the conflict between the government and the Allied Democratic Forces (ADF) that have produced violence and displacement from 1996-2002. Despite the district development plan (2010-2013) has noted that the situation has since then improved both in terms of resettlements and security still a lot of issues remain.

Informal institutions are a central feature across rural Uganda; these are also well established in the district. Although the power of each informal institution can slightly differ a sort of common structure can be recognized across districts. The categorization below is based on the findings from the district of Gulu, but Bundibugyo district is also influenced by the presence of similar informal institutions each of them with own informal rules that ultimately shape people's behaviour within the community.

- ❖ *Clan or elders network* may oversee the management of natural resources, e.g. water and land, usually it also give advise to youth, arbitrates disputes and consult the gods for blessing.
- ❖ *Family networks* are meant to decide on the allocation of resources at the household level and to give support in period of stress.
- ❖ *Local councils* are usually responsible for directing development initiatives. They may also solve conflicts and seek support in case of disasters.
- ❖ *Religious institutions* give moral, spiritual and ethical support.

The importance of informal institutions has largely to deal with their power in deciding upon people's roles and responsibilities, in establishing rules regarding collective ownership, access to natural resources, or influencing actions and creating restrictions in many other ways. On this regard women are subjected to multiple institutional barriers and restrictions in term of entitlements. Especially their land's rights are often not recognized, they do not have voice in local councils and sometimes it is even hard for them only to attend the council, moreover they have a very little say also within the men-headed structure of the family. Despite these social and political deprivations women are in charge of primary activities such as the collection of food, wood fire, water, the preparation of meals and also the care of family members. During times of hardship when their responsibilities are further exacerbated they are also more likely to be subjected to domestic violence.

In Bundibugyo people principally earn their livelihoods working in the agricultural sector to get rain-fed agricultural products for market. The principal staple crops are maize, cassava and beans while "cash crops" as cocoa and palm oil account for a substantial portion of household income in low lands areas. Casual labour and petty trade represent secondary sources of income. This economic structure is very likely to be affected by ongoing climate alterations that are adding new challenges to the existing development issues the district is facing.

3.1.4 Exploring climate variability in Bundibugyo

Despite the climate picture in Uganda is becoming increasingly clear for the years to come location specific information remains more limited. Take into consideration all the potential sources of information is fundamental to take actions. On this regard should be considered, when available, not only weather stations data and climate models, but

communities perceptions of current climate trends and the issues people really face on the ground.

❖ *Weather station data*

Unfortunately the district has no meteorological station so that the research team has gathered information from the adjacent station of *Kasese*, a place some 50 km far away, but characterized by a totally different geography and climate. Data show an increasing trend in temperature but their underlying limitation cannot be denied.

❖ *Climate Model: Regional Climate Model (RCM)*

Accessing the available data from Regional Climate Models (RCM) has complemented data. These have been used to provide information on past and future trends considering variables for the period 1972 - 2015. The model shows significant increase in minimum temperatures, decreasing trend in the number of cool days and a slight decrease in the number of consecutive dry days. No significant trend is found in the number of consecutive wet days, in the total of very wet days or in the number of heavy precipitation days.

❖ *Community perception of current climate trends and issues*

People point on changes in alterations in seasonality, i.e. changes in the onset and duration of rainfall, as well as greater variability and uncertainty in rainfall patterns noting that the changes have considerable implications for their livelihoods. Although people perceive changes in seasonality and rainfall patterns, still traditional seasonal calendars are prescribing when crops should be planted. At the national level there is awareness of this. For this reason the National Department for Meteorology generates seasonal forecasts and broadcast them on local radio in the attempt of providing short-term solutions on what, when and where to plant crops. However farmers lament to have encountered failures after making decisions upon the forecast and so they tend not to adopt them. Discussion group has highlighted that the main problem is that the parameters on which forecasting are based would not be shared at the community level so that often information was right, but poorly interpreted. This has inevitably led to widespread food insecurity because even farmers that try not to follow traditional seasonal calendars do not know when to plant their crops. This insecurity establishes a series of events that are coming in a chain. Farmers' decisions about when to plant their crops are often undermined by unexpected rainfall patterns that have the potential to disrupt their yields. At the same time farmers also need to face an always-greater incidence of various

crop diseases. All this results in poor crop yields that means low income from farming households and, most of the times, food shortages.

People living in the highlands feel insecure because the infrastructures on which their livelihoods depend upon are continuously at risk. The district is naturally prone to landslides, but this risk seem to be augmented because by various factors: increased precipitations, unregulated deforestation and the poor agricultural practices pursued on the highlands which have led to the disruption of normal foliage cover and resulted in an increasing degradation of the local environment and its impossibility to retain the always higher level of surface runoff which is favouring floods, the spread of malaria, cholera, other water borne diseases and loss of lives.

People acknowledge that they lack awareness and technical capacity to make forward-looking decisions. For this reason local communities alone cannot change their practices and successfully adapt to the changing environment because they do not have the tools to enhance this capacity. This requires assistance and support from government and development partners.

3.1.5 Development efforts in Bundibugyo

Bundibugyo precarious situation has made that different development agencies including civil society, government actors and private operators would contribute with different interventions to the wished development of the district:

❖ Development agencies interventions

- i. *Rwenzori Livelihoods and Disaster Preparedness Support Programme* is the principal development program in Bundibugyo. It is a three-year initiative sponsored by Oxfam that includes various coordinated interventions. The program has been set up to ensure that poor women and men in the disaster-prone Rwenzori region are empowered to achieve sustainable livelihoods, influence those with power over them and ultimately improve their standard of living. The programme sought to give voice to community priorities such as support in improving livelihood diversity, food security, agro-processing activities and Disaster Risk Reduction (DRR) planning.
- ii. *Wide-ranging livelihoods programme* aimed at supporting education, agriculture, primary health care and community advocacy activities implemented by World Vision Uganda.
- iii. Other initiatives that support education, livelihoods programme and children's

rights awareness by Save the Children.

iv. *River Catchment Project* by the World Wildlife Foundation (WWF) supports water management on the Lamyra and Semliki rivers.

❖ Local and central government programmes

i. The provision of improved crop seeds under the National Agricultural Advisory Services (NAADS)

ii. Other activities connected with the provision of enhanced seed varieties and the promotion of improved natural resource management practices by the local government

iii. Programmes for the provision of mosquito nets and anti-malarial drugs, water guard for prevention of cholera and other water related diseases under the Ministry of Health.

❖ Private sector's initiatives

i. ESCO and OLAM Uganda initiative helps cocoa farmers with improved agronomic practices and provide a market for the sale of cocoa.

3.1.6 How are interventions contributing to adaptive capacity?

Adaptation practices undertaken in the district come not only in response to climate change alone, but to the multiple pressures that affect Bundibugyo of which climate change is, but one of the multiple drivers. These responses can be classified according to their incremental or transformational nature. *Incremental responses* are those that imply small changes in people's activities and livelihoods whereas *transformational responses* are the actions that imply major changes in people's way of living. A first concern of development interventions has been to support livelihood assets in face of a changing climate and development pressures. On this regard various practices have contributed positively by implementing land and soil management techniques that have had a strong positive impact in strengthening traditional sources or in creating new sources of income.

Certainly incremental can be considered the small, although significant in term of impact, changes happened in agricultural practices that have been facilitated by various development interventions realized at the local level. In order to respond to the greater uncertainty and variability of rainfall patterns the joint effort of government programs and development agencies have lead to the adoption of improved varieties of crop species with a greater resistance to pests, to the introduction of pesticides, fertilizers and other improved cultivation techniques such as terracing and agro-forestry. The success of these

innovations lays in the fact that new techniques have been soon replicated, but since the imitation has happened mainly through informal institutions such as family ties and social networks only the members closer to the farmers that firstly implemented these improved methods have benefited from the brand-new knowledge which underlies an issue of poor communication of innovation within the community. It is also pointed out that who firstly started to use these improved measures were the richer households because the new options required a certain initial investment. For this reason people who lack initial resources or feel particularly risk adverse may have not the sufficient incentive to deviate from traditional practices.

Other responses which have been more transformational have concerned the adoption of new forms of supplementary livelihood activities, such as brick making, sand mining, charcoal production and stone quarrying during times of hardship. This have resulted in enhanced people's ability to respond to climate change by assets' diversification so that people had to exploit no more their basic assets during time of hardship or shocks, i.e. they had not to sell important assets to face an extreme situation because they were offered more than one option to earn their livelihoods. For instance whenever a flood or a landslide comes they can shift from agriculture to sand mining. These alternative options have become increasingly common for their ability to take advantage of more frequent incidences of rock and landslide events in highland areas, as well as higher levels of silt, sand and gravel being deposited by rivers further downstream.

Another program have provided support to the creation of new skills and training activities among youth groups in the attempt to create alternative livelihood training in goat rearing. The program has not been widely accepted probably because perceived as a "prescribed innovation" unrelated with present community's needs. In the end it has been cornered and deemed as unsustainable.

Activities to give voice to under-represented groups to express their needs have supported the creation of women, labour and youth groups. These activities have been really a platform for voicing concern. On this regard women above all have been given more voice and enabled to access political power at multiple levels from village to district level and to influence livelihood and household choices. The success of this initiative has lead to the creation of quotas for under representative groups, e.g. women disabled and youth, in local councils. This has also fostered a greater effort toward equality issues and has contributed to direct the public attention on other issues such as universal education.

Among the other *transformational responses* noteworthy is the spontaneous relocation of the poorest farming households from highland to lowland. This can be interpreted as a reactionary last resort option. The reasons for this transformational response are the increased exposure to hazards and degradation in the higher altitudes and the need to access improved formal markets and better health and educational facilities placed in the lowlands. However the population's displacement has contributed to the increase of intra-community conflict over scarce natural resources such as land.

3.2 Kase-hija kebele in the Gamechis District (Ethiopia)

The case study has been selected from the three cases addressed by the Africa Climate Change Resilience Alliance (ACCRA) Ethiopia Synthesis Report *Preparing for the future? Understanding the Influence of Development Interventions on Adaptive Capacity at the Local Level in Ethiopia* (Ludi et al., 2011)

3.2.1 Understanding the Ethiopian context

Ethiopia has seen a strong economic growth during the past years. It can certainly be considered one of the fastest growing economies in the sub-Saharan Africa. Although the government estimated in 2011 an annual growth of 11.4%, according to a more realistic picture drawn by the International Monetary Fund (IMF) the annual growth for the period 2010-2011 would have been around 7.5%. These numbers are still high and above the 7% target which is in line with the Millennium Development Goal (MDG) of halving poverty by 2015. This economic growth has led in the period 2008-2009 to the overtaken of the agricultural sector, which accounted for 43.2% of the total GDP, by the service sector (45.1%) for the first time in the country's history.

However disparities between urban and rural areas remains extremely pronounced so that people living in rural areas still rely principally on agriculture and livestock to earn their livelihoods. Small-scale rain-fed agriculture is mainly practiced in the highlands with traditional technologies whereas livestock represents the main source of livelihood for people living in the lowlands. However the tendency to mix agriculture and livestock, when possible, seems to be an always more common tendency to diversify livelihood's assets.

One of the main issues in Ethiopia concern land and soil degradation which undermine the possibility of agricultural growth by decreasing the availability of arable land and the

depletion of natural resources at the same time. A case in point regards forests (but similar reasoning can be done for every natural resource): deforestation is accelerated by the increasing population rate that adds pressure for the employment of this natural resource for fuel wood consumption. For instance at the current demographic rate of 2.5% a year the natural regeneration capacity of the remaining forests to face the countries' needs for fuel wood have already been undermined so that overgrazing has already become a serious problem (in this specific case people are forced to use animal dung as fuel).

Ethiopia is considered one of the most vulnerable countries to the impact of climate change. The survival of about 70 million people depends from rain-fed agriculture (this estimate includes both farming and livestock activities for which water is needed). It must be remembered that the country has historically suffered from severe droughts and also many other local droughts that have also led to widespread food insecurity. Moreover due to the increased soil and land degradation and deforestation also the risk of experiencing floods has increased.

The limited capacity of the government to address these impacts is also linked to the institutional framework that is highly complex and characterized by the overlapping of informal and formal institutions which direct people's behaviour especially through the governance of various entitlements on important assets. These may deal with the use of land, especially share cropping practices, i.e. practices governing labour contributions and crop compensations, but also rental and inheritance arrangements; the access to natural resources such as grazing land and irrigation water; the prevention of women to plough land and other religious regulations governing the number of "compulsory" holidays. Although these institutional norms are defined "traditional" they seem far from depicting a static environment. For instance the government is questioning religious regulations on holidays and asking for less of them, women are gaining voice and they have started to be always more educated (although politics remains heavily male dominated) and there have been various attempts to change the governance of many natural resources.

3.2.2 Ethiopia's climate trends and projections

In order to get an understanding of the current Ethiopian climatic situation, observed trends can be obtained through the analysis of national meteorological data and projections from Global Climate Modelling.

- ❖ *Observed trends.* It has been observed an increase in the mean average annual temperature by 1.3 °C between 1960 and 2006 that is reflected by a substantial

increase in the number of annual hot days and nights, but no significant trend is detected for what concern the average level of annual precipitations.

- ❖ *Climate projections.* The mean annual temperature is projected to increase by 1.1 °C to 3.1 °C by 2060 and 1.5 °C to 5.1 °C by 2090. By crossing the outputs of different climate models the annual average rainfall is projected to increase in the Southwest and decrease in the Northeast of the country. In any case the proportion of total rainfall that falls during heavy events is expected to increase.

3.2.3 An overview on Kase-hija kebele in the Gamechis District

Kase-hija is a *kebele* (the word *kebele* derives from Amharic "neighbourhood" and identifies the smallest administrative unit of Ethiopia) situated in the Gamechis District that is a relatively new district established in 2004 in the west Hararghe zone in Oromia Region. While the overall district accounts for a total population of 180.170, Kase-hija *kebele* has only 1.545 households and a total population of 10.455. In order to understand the average composition of the population living in Kase-hija, data from a sample village within the *kebele*, i.e. the Hajedin village that accounts for a total population of 793 of which 126 households, were collected on the base of interviews.

Gamechis district has a varied topography and includes three agro ecological zones, but only two main livelihood zones: the sorghum maize chat (SMC) and the Chercher/Gololcha coffee, chat and maize (CGC) livelihood zones. Kase-hija is classified as lowland, i.e. *kwolla*, and belongs to the former livelihood zone.

The district's area has lately suffered from a significant deforestation. On this regard people noted a significant reduction in the natural forest area during the last 35-40 years. According to estimates there would have been a likely reduction of around 5.350 ha (around 6.7 % of the total) most of which has been concentrated in the highlands.

Potable water coverage is still very poor. According to observations dated back to 2007/2008 only 28,1 % of the rural areas were served by potable water. In Kase-hija the main source of water is *Kase Spring*, a system of motorized pumps that distributes water near 4 points in the *kebele*. Researchers pointed out that at the time of the case study two out of four water stations were not working. As a response people have created a sort of "water market". Basically some better-off households with own water pipes sell water to other people. However only part of the population can afford to buy water from private suppliers so that the poorest households have to fetch their water themselves from the functioning stations.

Kase-hija has a high irrigation potential. Three rivers flow through its territory: the *Kase*, the *Burka Jini* and the *Dagaga*. However only the first is a permanent river endowed with a diversion irrigation system that was built by the Government during the '80s. The other two rivers are instead seasonal, i.e. they flow only during the raining season and are not equipped in such a way as the *Kase*. In anyways the irrigation potential remains high, but for some reasons only approximately half of the population in the *kebele* have access to water for irrigation. This proportion becomes even lower in the Hejedin village where only 18 out of 126 households have regular access to water for irrigation. In the attempt to link people's wealth status and livelihoods options, the population of Hejedin was ranked by wealth status according to local perceptions of wealth, i.e. by means of judgements expressed by the members of the community itself. As a result out of the 126 households living in the village 17 were considered rich, 30 medium and 79 poor.

Table 4 : Households' wealth status in Kase-hija kebele (data referred to Hejedin village)

	Wealth Food Characteristics		
	Livestock	Farmland	Food security
Poor	0-1 ox	Landless, or non-irrigable land or could not plough their land due to health or age reasons	Cover their food deficit by engaging in labour market and food aid
Medium	3-10 cows, 2 oxen	Non-irrigable land	Produce up to six quintals which will feed a family for most of the year - food shortfalls are covered by livestock sales.
Rich	10+ cows, 3-4 oxen	At least 1 ha of land and 0.5 ha of irrigable land	Produce enough to feed the family for the whole year

Source: Ludi et. al, 2011

It can be noticed how the access to a range of assets gives people more diversified and resilient options for their livelihoods. Quite clearly wealth seems to depend on the ownership of livestock or on the access to irrigation water that directly impact on households' food security. Access to irrigation allows for two or three cropping seasons

and decrease households' dependence on rainfall. It is pointed out that households with access to irrigation have chat and can also plant vegetables (i.e. carrots, onions, and red beet) and fruit (i.e. bananas sugarcane and coffee). For those who are not granted the access to irrigation water sweet potato becomes a very important "survival crop" during droughts' times. This highlights how diversification of agro-ecological niches may enable farmers to cope with climate extremes. From the tab.. It can also be noticed that better-off households are keeping more livestock (cattle sheep and goats are not included, but are also popular) for which having access to communal grazing land and water would also be important. Other additional sources of income (not mentioned on the table) are petty trading, the sale of firewood and the provision of labour for time-consuming tasks, e.g. clearing land, ploughing and harvesting, which mostly occur during certain periods of the year.

Access to roads and telecommunications does also make the difference on how people can deal with climate stress. The lack of mobile landline and a very poor road connection that becomes unusable during the dry season (despite the increasing investments in road construction during the past three years) prevent people from reaching the market and be engaged in high value "cash crop" production (with the exception of chat), limiting both employment and business opportunities. A local farmer rightly points out these deficiencies:

*The rain is in the hands of God, but the road is in the hands of the government.
We can't do anything about the rain, but the government could help us by
building us road and bringing us telecommunication service (Farmer, Kase-hija).*

From the above description it can be noticed how access to a range of assets, i.e. irrigation systems, communal grazing land, roads or communications may be fundamental for people livelihoods. However access do not only require assets' availability, but also institutions able to guarantee this right. On this regard it is emblematic the management of the irrigation system that is meant to decide who benefit from the public good, i.e. irrigation water, with the "declared" aim to ensure that every user would get water for at least two or three hours a month. In order to guarantee this right users committee have been established and people in charge to manage the scheme, i.e. committee leaders, have been elected. However what is happening seems to be far from a democratic way of managing the public good in question. Farmers lament that bribes are usually paid to water committee leaders so that a system of influence peddling is in the end determining

who ultimately get what. Naturally who cannot pay, i.e. the poorest, and other people with low social standing, e.g. women or disadvantaged groups are cut-off from the possibility of accessing irrigation water.

The question regarding women is certainly deeper. Women face many restrictions, one of the most common is that they are discouraged from ploughing by the existing social norms which inevitably would mean that a female headed household would need to rely on the support of male relatives to deal with the practices of land preparation. At times this might imply also the need to pull children out of school that in turn would mean less possibilities for future generations to adapt. More often these social norms entail a reduction in land's productivity because of the tendency of who have to deal with the preparation of the land to do it after he has already prepared its own land. Since late land's preparation leads to reduce productivity this has the potential leave women with less resources during periods of hardship. Women are also likely to generally receive unfavourable share cropping arrangements. Therefore the irrigation system is just one of the institutions skewed toward male headed households. Although formal institutions are directed by better educated young or middle aged men, informal institutions remain in the hands of elder less educated men.

In conclusion the *kebele* does not only need an institution that could manage water in an equitable and sustainable manner because the government is also falling short in securing the adequate provision of many other important services ranging from education to health care. Many decisions are still in the hands of informal institutions that function on the base of well-established norms that may not facilitate adaptation. This highlight that the problem is often not only the lack of financial resources but also managerial capacities.

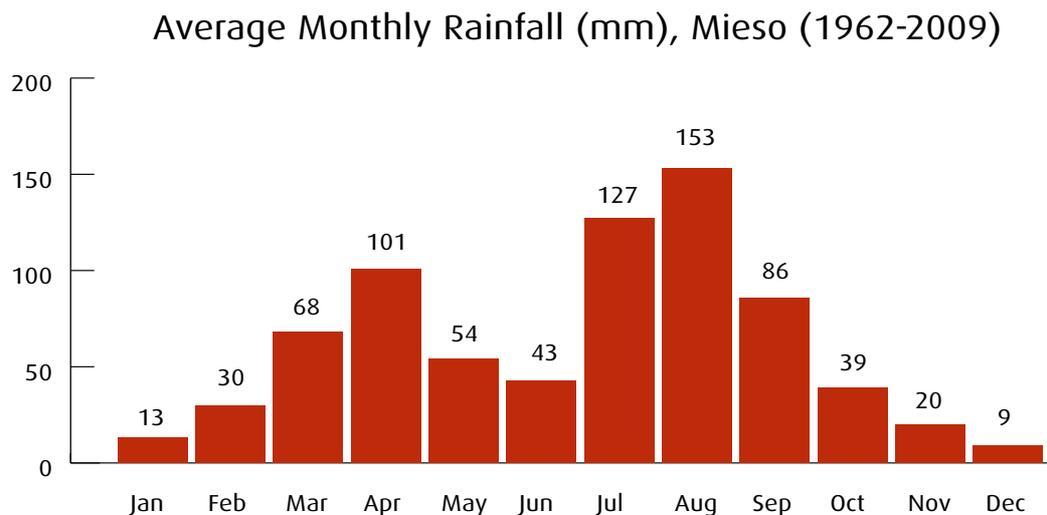
3.2.4 Changing climate in Kase-hija kebele

In Kase-hija, as in many parts of Ethiopia, some of the most common perceived climate changes are the increasing temperatures, especially at nights, and changes in seasonality, i.e. the shift in the onset and duration of rainfall and variability in rainfall patterns. All these changes have serious implications for people's livelihoods. In order to inform decision-making it is important to analyze all the possible points of information. Meteorological data are collected from the nearest meteorological station of Mieso, some 77 km far away from Hajedin village. Unfortunately Mieso meteorological station lack continuous and long-term weather records therefore statistical data analysis is quite constrained. However some preliminary analysis and interpretation of data may give a hint of the current climate trends

if there were any. Long-term maximum temperatures range from 29.1 °C to 31.6 °C with an average of 30.4 °C. Temperatures have been slightly increasing on average in the years after 1993. Long-term minimum temperatures range from 14.1 °C to 15.9 °C with a mean of 14.8 °C and have been slightly increasing since 1990.

As it can be easily detected in the *picture* below: rainfall follows the bi-modal pattern that is common in the eastern highlands of Ethiopia. Kase-hija is in fact characterized by two traditional raining seasons: *Belg* (from March to May) and *Kiremt* (form July to September). According to data on mean precipitations the mean level of annual rainfall in Mieso is 745mm with 30% of precipitations falling in *Belg* and 38% in *Kiremt*. For what concerns rainfall projections no significant trend has been found. It is only worth noticing that people have documented a shift in the days of maximum rainfall from the period July-August to September-October during the last years.

Figure 5



Source: : Ludi et. al, 2011

3.2.5 Hazards in Kase-hija kebele

People were asked to rank the hazards they were facing on the base of the potential these would have to affect their livelihoods. According to a five-hazard ranking produced by the community the hazards were ranked in the following order: drought, heat, poor infrastructure (roads), human diseases, and weeds. On average there was quite high agreement between man and women about the ranking whereas people belonging to different groups often did not agree since they perceived hazards effects differently. Poor

women ranked shortages of grazing land quite high because they were forced to migrate during the dry season with their livestock. Married women also noted a decrease in wealth sharing to help households during period of stress, but men did not feel the same. Another issue raised by women groups dealt with their psychological stress during times of hardship due to the increased burden they were supposed to undertake. Children noted increasing temperatures and the risk of flooding they were exposed to when looking after livestock.

According to a timeline exercise some of the key climate and development stress were also classified on the base of the period of their occurrence. The output of the exercise highlights that stress on livelihoods has been increasing over time.

3.2.6 Local responses in Kase-hija kebele

People noticed that climate shocks were becoming worse also for reasons independent on climate: increasing population, decreasing access and availability of natural resources and landholdings which are coming along with the increase in the prices of the most basic goods. So that the way they adapt have to take account of all these multiple pressures. As a result people are aware that the impacts of climate hazards are felt indirectly. For instance seasonal changes (and pressure over land) is felt in term of decreased land's productivity, increased need for seasonal migration with livestock, and increased food insecurity. Another important consideration the community made was that despite the increase to climate and development pressures over time, also the ability to deal with them has changed during the course of the time that means that they have been somehow able to thrive an always highly variable climate.

To cope with present hazards people may rely on relatives, neighbourhoods and local institutions. These "support institutions" however are set to help vulnerable people to deal with personal shocks, e.g. fire, theft or death of a family member, but are rarely prepared to deal with weather related shocks which may be directed to the whole community.

Perceived changes in rainfall patterns have led to a shift in the crops used within the community. While in the beginning farmers relied only on long maturity sorghum, the increasing stress posed to the water system due to uncertain rainfall patterns led to shift toward shorter maturity varieties of maize. The adoption of these varieties was favoured by two main reasons: they were promoted and made available to farmers by the public agriculture extension system and become soon more attractive probably because of a state of confidence in the market of maize.

Another response more transformational has been the increasing investments by private household in small-scale irrigation systems that expanded the overall irrigation system. An example of how changes in people practices have triggered changes in institutional arrangements is provided by the blossom of new institutions to facilitate the diffusion of irrigation practices by allowing people without available land for irrigation to plant sweet potatoes on the land of other households during times of hardship.

3.2.7 Development interventions in Kase-hija kebele and the Gamechis District

CARE Ethiopia is one of the NGOs involved in the implementation of the program which has been operational since December 2004 with the aim to assist 167.602 people in the Gamechis District, i.e. the Household Asset Building and Rural Transformation (HIBRET) that includes the government Productivity Safety Net Programme (PSNP). The overall development intervention in Kase-hija *kebele* and in the Gamechis District is principally focused on social protection and to make livelihoods sustainable by decreasing food insecurity and strengthening community resilience through the achievement of two main objectives:

1. The protection of existing livelihood assets and resources.
2. Increase the community's capacity through enhanced agricultural output due to integrated Natural Resource Management (NRM) practices and by strengthening civil society.

Asset poor households are the ones who benefit the most from the PSNP, which provides labour-based cash or food allowance (which may also be paid without labour contribution by those who cannot give it, i.e. 2.000 people living in the Gamechis District). Under the programme 22.390 people, roughly 12% of the whole Gamechis District's population are regularly employed in public work activities that aim to enhance community's assets. These activities may be directed toward soil and water conservation or the construction of basic infrastructures, e.g. roads, health centres and classrooms. The program also aims to provide timely preparation in case of shocks by the implementation of early warning systems in 13 *kebeles* and emergency preparedness plans in 24 *kebeles*. In Kase-hija *kebele* these activities have been mainly directed toward the implementation of soil, water conservation schemes, hillside enclosures, afforestation (with over 30.000 tree seedlings planted). Work activities were also directed to the construction of a new school, the maintenance of ten classrooms and the formation of an early warning committee with eight members to give early warning training to other twenty various group's members.

Under the second objective 1073 farmers in Gamechis District received training to use new agricultural practices such as making compost and improved traditional storage, home horticulture production and drip irrigation practices. People in the district have benefited from the distribution of new seed varieties that has improved the relationships with seeds' suppliers, the implementation of new Natural Resource Management practices focused on watershed management and other efforts toward the promotion of honey, fruit and fodder productions (mainly directed to landless groups). In Kase-hija especially the interventions have been focused on the delivery of new seeds as maize and haricot beans varieties, fruit seedlings and the promotion of new techniques as compost making, backyard gardening and use of improved stoves. It has been noted that better-off household were in general the ones more likely to adapt to externally promoted innovation packages because more able to take risk and to have access to the credit needed to buy improved seeds and fertilizers. In the end it was found that they also were the ones who could access better information from the agricultural extension at the community level or from other experts at the district level. Kase-hija has also seen the establishment of village savings and credit associations among which women saving and credit associations that have served as a mean to give voice to women. However the establishment of such groups remains still far from addressing the underlying social marginalization that characterize their position in the *kebele*.

Although the value of PSNP is to prevent poor from selling their assets by giving the means to face urgent needs, this is rarely a sufficient policy to lift people out of poverty. In substance it does not support people to do new activities and so it does not entail any transformative change, e.g. moving people from agriculture to non-rural employment. While the Household Asset Building Programme could be used to stimulate this kind of change, people prefer to use it to support existing livelihoods, e.g. to buy livestock.

3.3 Caia district in Mozambique

The case study has been selected from the two cases addressed by the Africa Climate Change Resilience Alliance (ACCRA) Mozambique Synthesis Report *Understanding Adaptive Capacity at the Local Level in Mozambique* (Arnall, 2011)

3.3.1 Understanding the national context

The 1992 peace agreement ended about 25 years of civil war and pushed Mozambique to undergo a lot of improvements in term of economic growth, poverty reduction and political stability. However the country remains dependent upon foreign assistance and most of its population still live below the poverty line. The main socio economic issues deal with the widespread malnutrition, HIV infections, rudimentary schooling and lack of medical facilities. The Human Development Report ranked Mozambique 184th out of 187 countries. Most of the population earn its livelihood by means of small-scale rain-fed agriculture. The best soil Mozambique offers to its population is placed in the low-lying flood plains that regularly experience flooding events (however the country is also threatened by periodic droughts in the internal southern and central regions). In 2000 widespread major flooding resulted in 700 deaths, 491.000 displaced people and million dollars worth of damages. Since this traumatic event the government decided to install early warning systems especially in the Zambesi river basin.

3.3.2 Understanding Mozambique's climate

Mozambique's climate ranges from tropical to sub-tropical. There are two main seasons: a wet summer form October to March and a dry winter form April to September. Temperatures vary between lowlands and highlands. The main climate problems are caused by the passage of tropical cyclones which frequency vary from year to year and by the Indian Ocean's sea surface temperatures which may led to the phenomena called *El Niño* and *La Niña* that cause climatic variability, especially during the wet season, leading respectively to warmer and drier conditions in the warm phase and colder and wetter conditions in the cold phase. This often results into floods and droughts. According to climate scientists these phenomena that are still under study may mask general climate trends so that in order to take well-informed actions it becomes important to get all points of information.

- ❖ *Observed trends:* Mean annual temperature has increased of 0.6 C between 1960 and 2006. Daily temperatures show significant increasing trends in the frequency of hot days and nights. Precipitations shows decreasing trends but the total rainfall that falls during heavy events had increased significantly since 1960.
- ❖ *Climate modelling projected trends:* The mean annual temperature is projected to increase by 1.0 °C to 2.8 °C by 2060 and by 1.4. °C to 4.6. °C by 2090 with a higher warming rate for the central regions. Projected rains show mixed results. The only

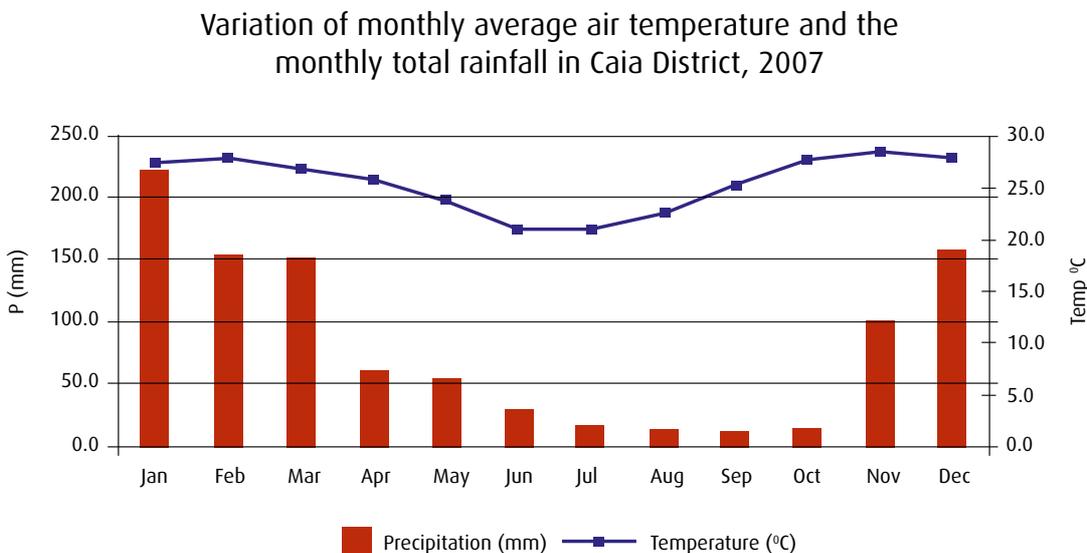
significant trend is the increase in the proportion of rainfall that falls during heavy events.

3.3.3 Caia district: an overview

Caia district covers an area of 3.542 km² in the Safala province. It includes three administrative posts: *Murraça*, *Sena* and *Caia Town*. According to the 2007 census the total population living in the district was around 116.000 of which roughly 61.000 were women and 55.000 were men. The eastern region of the district is dominated by a major river system: the Zambesi River Basin that is notoriously a flood plain system.

The climate in the district is semi arid in the northern part and semi tropical in the interior and the southern part. As it can be seen from the picture below there is only one raining season in Caia so that the 80-95% of the average annual precipitations, which is around 987 mm, occurs only in the period between November and March that has implications for the ways people may earn their livelihoods.

Figure 6



Source: Arnall, 2011

There are two main agro-ecological zones: the low lands (zonas baixas) close to the river and traditionally densely populated and the highlands (zonas altas). In both zones rain-fed agriculture is the main livelihood option, however during the raining season agriculture is only possible in the highlands because the lowlands get flooded. The main rain-fed harvest in the highlands happens in the window period between April and July and the

best crop to plant in terms of profitability is sesame. In the lowlands instead flood recession agriculture takes place on the riverbanks during the dry period leading to the possibility of a second subsidiary harvest in the window August-September. Usually in the lowlands "cash crops" such as tomatoes, cabbage, lettuce and other valued vegetables are mostly adopted. A last annual income opportunity comes from fishing in the period between January and April, i.e. when the water level picks. Livestock also supplements at times crop production, but this is an option only for better-off households. The socio economic differences are quite relevant across the district: while poor people usually dispose only of one hectare of arable land and very rarely possess animals, better-off households, which already access on average from three to five hectares of arable land, also own from ten to twenty goats. Sometimes they also own cattle for transport that can be used for sale during periods of hardship.

3.3.4 Major Changes in Caia district

While most of the people living in the lowlands adapted naturally to the environmental situation by moving temporarily to the higher zones when their lands got flooded some major events have undermined this possibility.

A key date for the district is certainly the 1974. That year saw the construction of the Cahora Bassa dam from Caia upstream. This infrastructure is a clear example of a top-down adaptation. The dam's construction has led to the alteration of the annual cycle of flooding people were used to. Since the 1980, i.e. after the civil war other events contributed to change the socio economic configuration of the region. The district started to be more integrated with the main national market centres that gradually stimulated outlets for surplus production forcing people to increase the proportion of "cash crop" cultivations in the lowlands. In the same period the selling of state farms to private (mostly large scale commercial farms) and family sectors resulted in an unregulated reorganization of land's rights. These events had some relevant impacts on the lives of the people in the district. The dam's construction implied *per se* major changes both in the natural and the social environment of the district. Firstly it implied the drying up of the secondary rivers flowing into the Zambesi. Secondly it forced small-scale farmers and fishermen to move closer to the Zambesi main channel to earn their livelihoods thus placing them in a more vulnerable position than before. Not only farmers were more exposed to normal flooding, but also "surprise floods" due to water pulses released from the dam to irrigate the

surroundings commercial sugarcane farms and allow upstream navigation further damaged them.

According to factual data there have been three major floods during recent years, i.e. 2000, 2001 and 2007 that have led to the resettlement of around 20.400 people (around 15% of the total district's population). The *Resettlement Program* was coordinated by the District Services for Planning Infrastructures (Serviço Distrital de Planeamento e Infra-estrutura) and led by the National Institute for the Management of Disasters (Instituto Nacional de Gestão de Calamidades; INGC). The program encouraged farmers living in flood prone areas to resettle in the highlands during the raining season, but to "commute" to their lowlands during the dry season when they could cultivate "cash crops". In theory this would have allowed farmers to cultivate both in the highlands and in the lowlands and maximize income opportunities.

3.3.5 People's responses

The findings below refer to a resettlement community situated 17 km² from Sena Town composed by 4300 people (900 households) where an NGO was operating with a livelihood project aimed at reducing people's vulnerability.

After some preliminary interviews the NGO understood that only after the major floods people started to perceive an increased irregularity in rainfall patterns and changes in the severity of the raining season. Unfortunately there were no meteorological data to measure the extent of the actual changes, however it was observed that people changed the "timing" of planting and harvesting lamenting that flooding were often destroying their harvest before they could harvest them. These adaptive measures included different kind of approaches:

- ❖ *Wait and see* means delay planting crops in the first growing season until the risk of flooding has reduced or passed, but it is a risky strategy because it may led to the loss of the whole low zone cultivation period.
- ❖ *Early harvest* consists into harvest as many crop as possible before the flood arrives. It is employed as a option of "last resort" designated to minimize losses
- ❖ *Replant* some vulnerable crops in the high zone.

The only information farmers could rely on for their responses were seasonal forecasts provided via radio which were regularly reinforced by the *community based disaster risk management groups* instituted by the government after the major floods. The groups were

giving advices on where to plant, i.e. if in the highlands or in the lowlands acknowledging that not every farmer was able to manage two farms at the time. However despite people were very willing to access farmlands in the new high agro-ecological zone they started to realize that there was no space for them there:

"The high area belongs to the companies. You can try to grow something there, but it can be taken away from you" (Farming association president).

With the greatest part of the highlands sold to large scale cotton companies and the risk of expropriation, relocated people were left without the possibility to access arable lands in their new living zones so that also the information provided by the community based disaster risk management groups was of no use for them.

The resettlement was in the end a good option only for better-off households who saw it as an occasion to improve their market access by starting small business along the road to Sena and Caia Town. Therefore while they had the opportunity to diversify their incomes, poor households remained dependent on agricultural labours. In particular they were forced to look for other agricultural jobs to complement their income that was coming from cash crop production in the floodplain. The need to complement their income was due to recent flooding events and by the insufficiency of available practices to deal with them.

In any ways the resettlement placed the community in a better-connected place in terms of roads and access to other infrastructures such as schools and hospitals. Farmers living permanently in the highlands had the opportunity to meet food traders demanding for vegetables that they grew in the lowlands. This further contributed to increase their income dependence on cash crop cultivations in the flood plain zone determining a major change in their farming activity that definitely shifted from subsistence to business agriculture. A major cultural change as documented by a local farmer:

"A long time ago we did not produce crops for sale. We inherited this culture from our ancestors: that we should only produce enough to eat. Now the people have educated themselves, and they want to gain money. Now people come to the community and encourage us to plant vegetables as these are things that they need". (Local "cash crop" farmer)

This change has contributed and was fed by the ongoing process of monetization of the economy saw as a more convenient system than barter. However the increasing cultivations along the river have destabilized riverbanks and made crops more vulnerable to floods.

3.3.6 NGO's Livelihood project in the resettlement community

In this situation takes place the NGO's livelihood project that engaged 14 groups (for a total of 200 people) divided into 4 livelihood activities. People had the opportunity to chose among: animal traction, fish trading, goat rearing and vegetable production with irrigation. Although the information provided by the NGO was not meant to specifically address climate events the underlying assumption was that it would have made people more resilient to these hazard. For instance the animal traction group learned from the NGO on how to build a silage during the raining season, i.e. when materials were more available, to use it during the dry season. In general the NGO gave the possibility to share and experiment new ideas.

For what concern the observable results the major fault of the project was its underlying assumption that by "injecting" information into pre defined groups there would have been a dissemination of knowledge to the population at large. In reality targeted people "felt more beneficiaries than partners in development" demonstrating to be reluctant to pass the information unless they did not get compensated. Moreover the fact that local leaders tended to cluster around groups underlies that being beneficiary of a development intervention, i.e. being in posses of new knowledge, was not only economically valuable but it also had a political relevancy. In the end the only information that was disseminated dealt with learning by doing practices such as vegetable growing and cattle raring, i.e. practices that were easily observable. Another criticism was that groups' members were in the end not the more vulnerable, but better-off community members having more assets and information.

CHAPTER 4

FINAL CONSIDERATIONS

4.1. Preliminary findings

Markets are not a feasible response to all climate damages (Bosello et al., 2009), which intuitively means that if Mitigation is mostly addressed by economics (Aaheim and Aasen, 2008), Adaptation is a question that belongs to a different way of thinking.

We have presented our perspective that is based on the concept of "strategic fit". This viewpoint recognizes Adaptation as the dynamic pattern of interactions necessary to arrive at a desired configuration, i.e. strategic fit. However achieving the "most favorable match or alignment between the external environment and the organization's structure and processes" (Venkatraman and Camillus, 1984) involves an "art" that only well informed organizational leaders possess (Daft, 2008).

When the art, i.e. management is practiced correctly it can influence members' behavior (Daft, 2008) through the "creative construction" of an adequate social environment that would shield the organization from "the effect of the natural environment" (Astley and Van de Ven, 1983), conversely when the art is not practiced correctly it becomes mismanagement and would continuously create the premises for the roughness of the next impacts because "existing conditions can limit people's ability to shape, create and respond to change, therefore leaving them vulnerable to climate change impacts" (Pettengell, 2010).

The beauty of the framework lays in its own veracity in which environmental, contextual and structural elements affect the organization at any time. This is the confirmation that neither the environment nor management of internal processes alone can totally establish what would be the organization's destiny. For this reason it is not reasonable to talk anymore about causation of one element or another because all of them are ultimately contributing to the unique, observable, final result (Chorn, 1991). The idea is that management should only be concerned of making decisions about what kind of interventions should be done in light of what is known to achieve strategic fit.

Another element that seems to be true is that the way organizations adapt greatly depends upon the environment they should adapt to in the sense that when the environment is relatively stable organizations are not required to undergo big changes in their existing practices because they would be already doing enough supported by their own traditional knowledge and by the means they are currently able to develop by their

own. A radically different situation is instead the one in which organizations do not know how to deal with climate issues because these have already overwhelmed their coping capacities. On this regard it would be desirable that organizations would be good analyzers striving for learning from prospectors' ability to innovate. Certainly it is not a matter of preferences to reach a certain adaptive level otherwise every organization would be efficiently adapted to its natural environment and there would be no need to discuss about adaptation's issues. Despite this would be a very desirable situation, the possibility that organizations would be actually able to adapt to an unstable environment is found to be constrained along two parameters: the level of adaptive ability and the process through which adaptation is meant to be achieved (Charkravarthy, 1982). This is the heart of the framework: adaptive ability is a mixture of material capacity and management and this last is a central feature for the process of organizational change and adjustment (Charkravarthy, 1982).

It is easy to believe that in reality not all organizations would be equally adapted. While the only requisite for an organization to be "adapted" is to survive, i.e. to keep material capacity and management within desired levels, achieving a strategic fit allows to release the whole adaptation potential through the optimal use of material capacity and management (Charkravarthy, 1982)

This process through which strategic fit is meant to be reached involves loops of adaptive specialization and adaptive generalization. *Adaptive specialization* is the improvement of existing processes and structures which practically deals with the rationalization of the current balance between material capacity and management in order to turn mis-fits into fits (Charkravarthy, 1982). *Adaptive generalization* is meant instead to improve upon the coping capacity of the organization by enhancing both existing resources and management creating the premises to handle more environmental complexity (Charkravarthy, 1982). The fact that the framework considers both adaptive specialization and adaptive generalization is indicative of the fact that innovation plays a very important role in Adaptation.

This combined approach moves adaptation beyond building resilience (the ability to absorb climate shocks or to ride out changes) towards making the transformational changes that are needed to move communities from being victims of climate change to actively pursue opportunities and allay the negative consequences of climate change. Bouncing back after a shock is not enough if

the shocks become more frequent; a change is required in order to ensure livelihoods in a changing climate (Pettengell, 2010)

Some other empirical confirmations come from the case studies presented in Chapter 3 adding and strengthening our preliminary findings in the hope of providing the base for further discussion:

- ❖ *The framework recognizes the environment as one of the elements that affect organization's functioning (Daft, 2008) validating the hypothesis that Adaptation would not happen in insulation from other organization's phenomena (Smithers and Smit, 1997; Adger et al., 2004) allowing for an integrated Adaptation-Development perspective in which the need to define interventions as "adaptations" to climate change is removed because strategic fit is a concept that take into consideration all aspects of organizational life (Venkatraman and Camillus, 1984) so that management becomes concerned with making decisions about what kind of interventions should be done to achieve a strategic fit (Grant, 2002).*

The reality of Adaptation on the ground has confirmed the need to have such an integrated approach. In the three case studies it is observed that climate change affects the communities in question in different ways (i.e. landslides in Uganda, drought in Ethiopia, flood in Mozambique), but it always adds new issues to already existing problems, in turn people are calling for solutions that do not only regard climate change.

- ❖ *The concept of adaptive capacity helps to recognize that exists an indissoluble link between resources and management that must be placed at the centre of Adaptation's efforts by expressing formally that both management and material capacities are responsible for Adaptation (Charkravarthy, 1982). In particular it seems that a focus on management would allow to throw light on a few neglected or poorly addressed managerial issues, i.e. the potential misfits of the organization, as the functioning of informal institutions or the existence of other barriers to adapt.*

In each of the three cases there are various examples of internal processes that have affected the possibility of communities to adapt. These elements mostly deal with the

functioning of informal institutions that have a relevant impact on resources allocation and entitlements of various kinds.

In Uganda informal institutions are a central feature that is found to be well established also in Bundibugyo district where it is the *clan or elders network* that oversees the management of natural resources *de facto* establishing the rules regarding collective ownership like the access to water and land that are essential for people's livelihoods and adaptation. Women are subjected to multiple social and political deprivations: their land's rights are not recognized, they do not have voice in local councils, i.e. the places that direct development initiatives, they have little say within the men-headed structure of the family, i.e. where households take decisions on resources allocation and support in period of stress. However women are in charge of primary activities within the organization, but because of their position they tend to be more vulnerable during times of hardship.

In Ethiopia in Kase-hija *kebele* management is clearly limited by an highly complex institutional framework characterized by the overlapping of informal and formal institutions that direct people's behaviour especially through the management of various entitlements on important assets. Although formal institutions are directed by better educated young or middle aged men, informal institutions remain in the hands of elder and less educated men. Within informal institutions are taken decisions on the use and access to natural resources such as grazing land and irrigation water, on share cropping practices, rental and inheritance arrangements. It was noted how the access to a range of assets gave people more diversified and resilient options for their livelihoods because wealth in Ethiopia depend either on the ownership of livestock or on the access to irrigation water that allows for two or three cropping seasons thus decreasing households' dependence on rainfall. Despite Kase-hija *kebele* has an high irrigation potential the resource "irrigation water" is mis-managed, this to clarify that access does not only require assets' availability, but also institutions able to guarantee this right. This should give us the time to reflect on when a problem should be one of material capacity and when the issue should be concerned with management (on this regard it was defined "emblematic" the management of the irrigation system). Elected and corrupted committee leaders take decisions on who should benefit from the public good irrigation water. Most naturally who cannot bribe, i.e. the poorest, and more generally other people with low social standing, e.g. women or disadvantaged groups are cut-off from the possibility of accessing irrigation water, becoming more vulnerable in case of drought. Furthermore other social barriers are placed on women who are not involved in politics (that remains heavily male dominated), and that

are prevented by the existing social norms to fulfill basic activities such as ploughing land. This means that a female-headed household would need to rely on the support of male relatives to deal with the practices of land preparation. At times this implies that children are pulled out of school, which means less possibilities for future generations to increase their "professionalism" which means less management in the future. Quite always these social norms entail late land's preparation because of the tendency of who have to deal with the preparation of women's land to do it after he has already prepared its own land that determines an average reduction in land's productivity leaving women with less resources during periods of hardship. On top of that women are also likely to generally receive unfavourable share cropping arrangements because of their low social standing. In Mozambique the government displays managerial deficiencies because its *Resettlement Program* seems to not acknowledge other processes that had occurred before in the organization such as the selling of state farms to private (mostly large scale commercial farms) and family sectors that had resulted in an unregulated reorganization of land's rights. So that despite people were willing to access new farmlands in the high agro-ecological zone they found out that there was no space for them there. (*"The high area belongs to the companies. You can try to grow something there, but it can be taken away from you"* - *Farming association president*). In the end with the greatest part of the highlands sold to large scale cotton companies and the risk of expropriation, relocated people were left without the possibility to access arable lands in their new living zones.

- ❖ *The process of "Strategic Fit" clarifies that Adaptation has always to challenge existing organizational structures when this is instrumental to the achievement of "Strategic Fit" because adaptive specialization states an appropriate strategy with respect to the environment on the base of existing resources and management, but it must be necessary followed by the design of an appropriate structure for implementation (Charkravarthy, 1982). Adaptive generalization instead to pursue the increase of material capacity and management may call into question and redesign the organizational structure if necessary (Charkravarthy, 1982).*

By referring to the issues underlined in the previous point we see if existing programs have challenged institutional barriers.

In Uganda the *Rwenzori Livelihoods and Disaster Preparedness Support Programme* was set up to ensure that poor women and men in the disaster-prone Rwenzori region would

have been empowered in part by influencing those with power over them in such a way to give voice to community priorities. The program has been successful in giving voice to the under-represented groups to express their needs and to support the creation of women, labour and youth groups that have been a real platform for voicing concern. Women above all have been given more voice and enabled to access political power at multiple levels (from village to district level) and to influence livelihood and household's choices. The success of this initiative has led to the creation of quotas also for under representative groups in local councils, i.e. not only women, but also disabled and youth. This has also fostered a greater effort toward equality issues and has contributed to direct the public attention to other issues such as universal education that was previously not ensured.

In Kase-hija *kebele* the main issue regarding the management of water has not been addressed by the NGO intervention. However the project has to some extent involved the management of water through the implementation of water conservation schemes and practices focused on watershed management, but has not called into question the existing informal institution's functioning that was overseeing the management of irrigation water. Kase-hija has also seen the establishment of village savings and credit associations (among which women saving and credit associations) that have served as a mean to give voice to women. However the establishment of such groups remains still far from addressing the underlying social marginalization that characterize women's position in the *kebele*.

❖ *Adaptation deals with changes that can be achieved both incrementally and transformationally, but revolutionary or transformative changes, i.e. innovations, are definitely "an important contribution to the process of organizational evolution and adaptation"(Venkatraman and Camillus, 1984).*

In Uganda innovations have concerned the adoption of new forms of supplementary livelihood activities, such as brick making, sand mining, charcoal production and stone quarrying during times of hardship. This have resulted in enhanced people's ability to respond to climate change by assets' diversification so that people had to exploit no more their basic assets during time of hardship or shocks, i.e. they did not have to sell important assets to face an extreme situation because they were offered more than one option to earn their livelihoods. For instance whenever a flood or a landslide came they could shift from agriculture to sand mining. These alternatives became increasingly common for their

ability to take advantage of more frequent incidences of rock and landslide events in highland areas, as well as higher levels of silt, sand and gravel being deposited by rivers further downstream.

Innovation in Ethiopia has dealt with increasing investments by private household in small-scale irrigation systems that contributed to the expansion of the overall irrigation system. In this case this change has also triggered institutional changes, i.e. the blossom of new institutions to facilitate the diffusion of irrigation practices by allowing people without available land for irrigation to plant sweet potatoes on the land of other households during times of hardship.

In Mozambique after the resettlement better-off households started small business along the road to Sena and Caia Town.

❖ *The analysis of material capacity gives information on the abundance and the latitude of resources available for experimentation thus guiding initial considerations on the potential for innovation (Charkravarthy, 1982)*

In the three cases we have examples of situations in which the latitude of material resources for exploitation fosters innovations or the adoption of externally provided innovations as the theory prescribes. In Uganda only richer households start the adoption of improved varieties of crop species with a greater resistance to pests, pesticides, fertilizers and other improved cultivation techniques such as terracing and agro-forestry because the new options required a certain initial investment. For this reason people who lacked initial resources or felt particularly risk adverse had not sufficient incentive to deviate from traditional practices and adopt the innovation.

In Ethiopia we have examples of both spontaneous and externally provided innovations. The first deals with the spontaneous creation of a "water market" by better-off households with own water pipes that started to sell water to other people. Also in this case the poorest households were cut off from the innovation because they were not bale to pay for the water so they had to fetch their water themselves forms the functioning stations. The second deals with externally promoted innovation packages that considered the possibility to access credit to buy improved seeds and fertilizers. In the end only better-off household were in general the ones more likely to adopt these options.

In Mozambique after the resettlement only better-off households had the occasion to diversify their incomes, by improving their market access starting small business, poor households instead remained dependent on agricultural labours.

4.2. Conclusion

The environmental conversation has already shifted from the question if climate was changing to how much or how quickly it is changing (World Economic Forum, 2013). What we know for sure is that we are facing a problem of anthropogenic climate change that, despite would tend to be framed as a global issue, does not affect everyone in the same way (Pettengell, 2010). Especially who have done the least to cause the problem, i.e. the most vulnerable, from the world's poorest communities are hit hardest (<http://www.guardian.co.uk/global-development/2012/jun/06/scotland-climate-justice-fund-poorest?INTCMP=SRCH>).

The developed World has "officially" promised to take care of this showing unwary optimism for its high-flying (and too often flaunted) aim of providing the cost of "transforming business as usual fossil fuel led growth, into a sustainable, low emission, climate resilient, economic development" (Schalatek and Bird, 2010).

The climate policy devised to pursue this transformation involves a portfolio of diverse Mitigation and Adaptation actions (Klein, 2007), which not only tackle the problem from completely different angles (Bosello et al., 2009), but are also fundamentally different in their conceptual backgrounds.

Mitigation is the effort to reduce emissions to achieve the stabilization of green house gases in the atmosphere (http://unfccc.int/methods_and_science/mitigation/items/3681.php). It is grounded on top-down economic and financial beliefs. Mainstream economists have used public goods arguments to address how society should rethink its responsibility on climate change thus providing the "rational" for an international collective action (Aldy et al., 2001) that since always has worked for the establishment of a global carbon market. For the sake of clarity the establishment of global market by government fiat is a practice that has never been successful for any commodity in the history (Prins and Rayner, 2007).

However the Kyoto Protocol has established flexible market mechanisms such as the *Clean Development Mechanism* (CDM), the *Joint Implementation* (JI) and the *International*

Emission Trading (IET) to "assist" developing countries in achieving sustainable development by means of "improved" living conditions and technological transfer (http://cdm.unfccc.int/about/dev_ben/index.html), but at the same time safeguarding developed nations by giving them a flexible instrument to meet their reduction targets.

The second option, i.e. Adaptation generally refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate (<http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=643>). Adaptation realistically tries to give vulnerable people the means to self-organize and participate in a process that enables them to better withstand, recover and possibly adapt to climate impacts (<http://niccd.wordpress.com/tag/leadership-and-adaptation/>).

Since impacts are felt locally and greatly depend on the specific characteristics and vulnerabilities of the affected contexts (Klein et al., 2007) adaptive responses should inevitably be tailored to local circumstances (Burton et al., 2006), i.e. be case specific. Therefore having a market for Adaptation as the one in place for Mitigation would not be feasible for at least three reasons: there would be no global public good rationale; apart from being difficult to measure, Adaptation should be better contextualized rather than abstracted in one unit; subsidizing Adaptation would not bring any benefit to a distant sponsoring entity. For these reasons Adaptation is conceptually grounded in development studies, it adopts a bottom-up perspective and it should come in form of assistance.

Despite this it is not only meant to provide resources where these are lacking, because the process of influencing organizational change and transformation by addressing people's behaviour and enabling them to make more informed decisions to overcome the uncertainty, complexity and urgency of the issues they face, certainly requires a greater commitment than a simple resources' provision. This is why Adaptation requires leadership, i.e. it needs to be managed since there is no "magic" market incentive for addressing it.

Despite officially Adaptation is as important as Mitigation, following an established rhetoric in climate change negotiations which suggest that climate finance should be split 50:50 between the two policies, we have seen that Mitigation alone attracted so far the large majority of funds: USD 93 billion out of USD 97 billion (Buchner et al., 2011). Despite the extraordinary need for Adaptation and the disproportionately small share of finance devoted to it, still there is some money is unutilized.

The striking reality is that Mitigation has since always represented the most prominent option and has created a taboo of discussing other approaches, especially Adaptation (Prins and Rayner, 2007). As a confirmation of this *just a decade ago, "adaptation" was something of a dirty word in the climate arena — an insinuation that nations could continue with business as usual and deal with the mess later* (<http://www.nature.com/news/adapting-to-a-warmer-world-no-going-back-1.11906>).

For this reason it has been noted that even if Adaptation has been frequently referred both in recent scholarly work and in policy discussion to climate, "still there is no common understanding of what is meant by the term" (Smithers and Smit, 1997).

In the meanwhile the suspicion that the global carbon market would have welcome sharp and corrupt practices (Prins and Rayner, 2007) has become reality. It seems that the CDM could have worked as an instrument to subsidize many dangerous for profit activities, making them more advantageous for multinational organizations and at the same time letting the same organizations polluting above their assigned targets (Bond et al., 2012).

The Kyoto Protocol has reached its "scheduled" end in December 2012. Recent discussion of the UN Climate Change Conference in Doha has confirmed that today GHGs emissions, sea level rise, and global temperatures are in line with the highest projected scenarios in the 4th IPCC Assessment Report fostering major concerns on the irreversible consequences caused by changes in "extremes" and the increasing socio-economic pressures on natural resources for food and energy production (http://belfercenter.ksg.harvard.edu/files/carraro-side-event_mit-adapt.pdf). Despite over fifteen years of Mitigation efforts our world is nowadays hotter than it has been in two thousand years (<http://www.greenpeace.org/usa/en/campaigns/global-warming-and-energy/>). Regardless of the possibility to find alternative ways to reduce global emissions, e.g. through more national legislations and changes in people's behaviour, much of the climate change for the years to come is already in the pipeline and Adaptation is the only answer we are left with.

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