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Climate Change and Development: Community Based Reactions.

The Case of Agri-Nature Foundation and Sufficiency Economy in Thailand.

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Abstract

This work carries out an analysis of the state of development and climate change adaptation of the rural communities in Thailand. It includes the analysis of the impacts that climate change could have on the population, especially rural communities involved in the agricultural sector. The dissertation illustrates the dynamics of a complex Socio ecosystem and it analyses strategies that integrate climate change adaptation into development. The analysis then focuses on the top-down and bottom-up approaches that are used to implement actions on the territory. The dissertation also depicts the community-driven strategies and the participatory process, and it illustrates the Sufficiency Economy principle that is driving the development strategies in Thailand. The practical application of this principle in the agricultural sector is also taken into consideration, with the concept of New Theory Agriculture. The dissertation continues with the introduction to the Agri-Nature Foundation of Thailand and its model of development, examined through some instruments taken from the strategic management. The analysis ends with the proposal for the implementation of a project aimed to test the reproducibility of the model presented.

Index

Thesis Title: "Climate Change and Development: Community based reactions. The case of Agri-Nature Foundation and Sufficiency Economy in Thailand".

Chapter 3: "Top-Down" and "Bottom-Up" approaches in adaptation to climate change. The insurgence of Community-Based Adaptation strategies.

Chapter 4: Agri-Nature Foundation and the Sufficiency Economy principle.

Charts, figures and tables list.

Chapter 1:

Chapter 2:

- Figure 5.4: SWOT Analysis Agri-Nature Foundation (“Inghenia :: SWOT”- free software elaboration).
- - Figure 5.5: Graphical output SWOT Analysis Agri-Nature Foundation (“Inghenia :: SWOT”- free software elaboration).

Introduction

The idea to start the investigation that brought to this study has been designed during my experience as an intern at the United Nations Environment Programme (UNEP) in Bangkok, Thailand.

Travelling around the country it was impossible to overlook the huge differences in life conditions among the population, and especially between the urban and the rural areas. Around October 2010, the Indochinese peninsula was scourged by an extraordinary period of rainfalls characterized by an unexpected intensity for a duration of several weeks. In the entire region more than 200 victims were registered, especially due to the overflowing of the Mekong River. Almost half of the Thai territory, especially the northern and the southern part of the country, was devastated by floods and inundations that killed several people and compromised the already precarious conditions of the people excluded by the extraordinary economic development that the country is experiencing since the last four decades. The rural areas and the rural communities were difficult to reach, even for the rescue units prepared by the national and local institutions, and the news reported cases of people completely abandoned without any possibility to survive.

Investigating on the situation of the rural communities of Thailand, my attention was captured by the precarious economic conditions of local people, mainly employed in the agricultural sector. The need for the implementation of good strategies of development and Climate Change adaptation was an urgent priority. Therefore I focused my investigation on the actions undertaken by the Thai institutions. As far as rural communities and agricultural sector is concerned, these actions have shown to be in general unsuited to cope with the gravity of the situation, especially in some areas of the country. My attention was then captured by the measures undertaken directly by the rural communities and by the organizations that operate in close collaboration with the

grassroots. In this context, my research focused on the activities of the Agri-Nature Foundation of Thailand, an organization that operates in the implementation of strategies aimed to the achievement of development and climate change adaptation in the rural communities. This organization is active in the field, supporting set up and management of the farms and the activities related to the agriculture, following the procedures inspired by the Sufficiency Economy principle, using traditional techniques in combination with the use of modern technologies. The Sufficiency Economy principle – especially as regards the aspect of the agricultural sector – is determined by the combination of traditional and scientific knowledge, and its purpose is to provide guidance to drive the development strategies in the country.

The aim of this work is to analyze the development model adopted by the organization studied in order to highlight its positive and negative aspects, with the possible effectiveness and efficiencies. Moreover, this study considers the possibility to reproduce this model, in order to understand the possibilities of standardization of this strategy in different contexts and different areas.

This work initially deals with a general analysis of the state of development and the state of the climate in Thailand. Then, it examines some of the causes of the general inefficiency of the development strategies in the country. The dissertation includes the analysis of the impacts that climate change could have on the populations that live in rural and coastal areas of the region. Moreover, it detects the limits of development process in Thailand: what emerged from this analysis is that the most vulnerable part of the population to every kind of impact, and especially to climate change, is the poor population that lives in the rural areas and particularly the people involved in the agricultural sector.

This work also takes into consideration the dynamics of a complex system represented by the social, economic and ecological aspects involved in the study of a community that interacts with the surrounding environment. It analyses the integration of climate change adaptation strategies into actions aimed at the achievement of an adequate level of development. The study examines the main theories about the design of activities that combine national and local strategies to implement measures for the achievement of climate change adaptation and development. This analysis includes the different stages

of delineation of the specific strategy: from the identification of the stakeholders, the preparation of the activities, to the practical implementation and the evaluation.

The analysis continues taking into consideration the different approaches that have been used in the past – and that are still used in some cases – to implement actions to cope with the impacts of climate change or similar problems in the territory. Within this framework, community-driven strategies and the participatory approach play a relevant role, as they represent the common ground where international and national organizations and institutions cooperate with local communities, ranging from the decision making stage till the final implementation, to maximize the possibilities of success of their actions.

The Sufficiency Economy principle is examined in details, highlighting the main characteristics and the cultural background. The analysis focused on the practical application of this principle in the development strategies of the country and in the different sectors of the economy, with particular emphasis on the agricultural sector. The dissertation continues with the introduction of the Agri-Nature Foundation of Thailand, with the description of the network of villages in which the model under consideration has been developed.

The final part of this work presents the qualitative analysis of the development model: this analysis is carried out with the collaboration of members of international organizations and field professionals that operate in the territory of Thailand in the sector of development and climate change adaptation. Some instruments taken from the strategic management - like the Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis - are used in order to examine the Agri-Nature's development model. The analysis brings to the proposal for the implementation of a project aimed to test the replicability of the model presented.

Chapter 1: Climate Change and Development State in Thailand.

1.1: Climate Change Impact in South-East Asia.

According to the Fourth Assessment Report (IPCC, 2007), extreme weather events were reported to provide evidence of increase in intensity and frequency during the 20th century in Asia. Projected scenarios have shown an enhanced hydrological cycle and an increasing in area-average mean rainfall. An increase in annual and winter mean precipitation would affect the northern part of the continent, with consequences with the flow of the Siberian rivers; a decrease of mean precipitation would affect the dryer areas in the central part especially during the summer, with strong impact on the arid and semi-arid parts of the continent; an increased rainfall intensity would affect the temperate and tropical Asia, with considerable impact on the flood-prone areas, especially during the monsoon season.

The most vulnerable sectors are represented by agriculture sector and water management sector: they give evidence to be the most sensitive to climate change. Agriculture and forest ecosystems are severely threatened by high temperatures, flood condition, soil degradation and droughts.

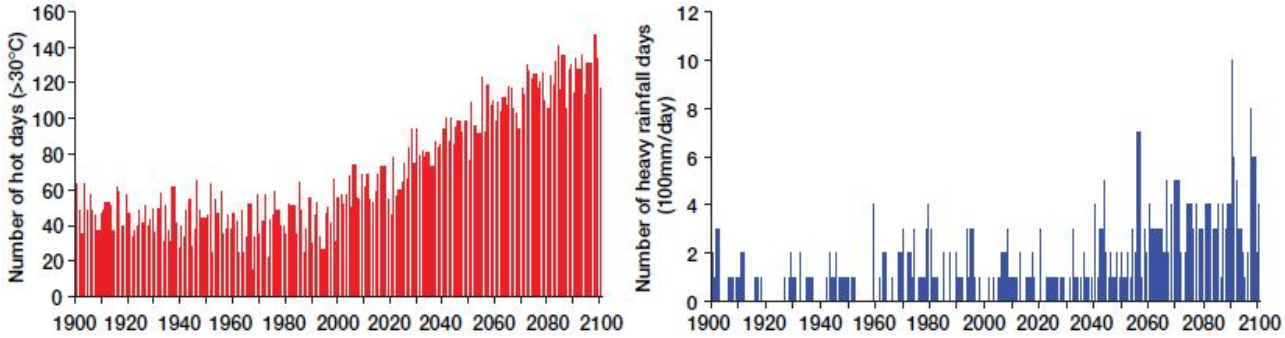
Due to the increased exposure to extreme events, typhoons, hurricanes, floods and tropical storms, the areas most subjected to vulnerability are the temperate and tropical Asia.

In many part of Asia, production of rice, crops and wheat has declined in the past few decades due to the increasing water stress provoked by increasing temperature, reduction of number of rainy days and to the effects of El Niño. The International Rice Research Institute, with a study published in 2004, observed that the yield of rice decrease by 10% for every 1°C increase temperature in growing season minimum temperature (Peng et al., 2004).

Global warming and sea-level rise, in combination with the extreme climatic and non climatic events, cause coastal flooding, coastal erosion and infiltration of salt in freshwater reserves. In coastal area, rate of sea-level rise has been observed to be between 1 and 3 mm/year, moreover has been shown that it has accelerated relative to the long term average.

Natural ecosystems have been threatened by the increasing intensity and spread of the forest fires during the dry seasons. About 3 million ha of peat-land have been burned in South-East Asia in the last 10 years. During the period 1997/1998, characterized by a long dry season, around 12 million hectares have been destroyed by fire, only considering the countries more damaged: Indonesia -9.7 million ha- and the Philippines -2 million ha- (Figure 1.2).

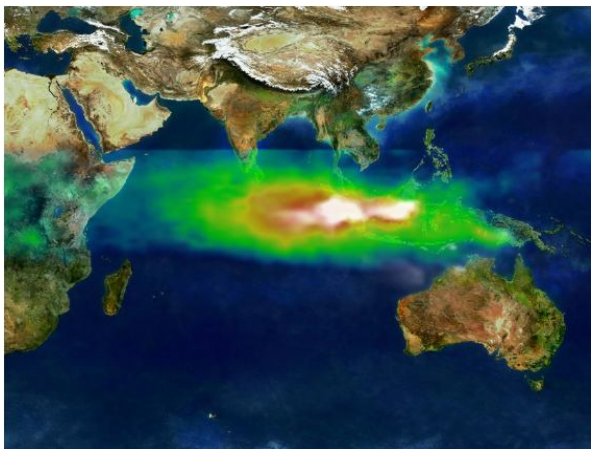
Figure 1.1: Projected number of hot days (>30°C) and days of heavy rainfall (>100 mm/day) by the high resolution general circulation model



Source: Hasumi and Emori, 2004

Crop yield projections for the 21st century, indicate that production could increase up to 20% in East and South-East Asia, while it could decrease up to 30% in Central and South Asia. These changes could be provoked by the changes in rainfall concentration and by the shift of proper climatic condition for the crop production (IPCC, 2007).

Figure 1.2: Smoke and ozone pollution from Indonesian fires, 1997



Source: NASA, Visible Earth. http://visibleearth.nasa.gov/view_rec.php?id=1651

As a result of development activities, land degradation, deforestation, pollution, over-fishing and hunting, infrastructure development and land-use change, the biodiversity in Asia has been affected by the lost of several species. As consequence of climate change, a large number of plants and animal species are moving to higher altitudes and latitudes in many parts of Asia in the recent past (IPCC, 2007).

Net primary production of livestock direct and indirect products, like meat and milk, is expected to decline in the next future, due to the relative land scarcity and to the shifting of the grasslands.

The Asia and Pacific region is one of the largest producer of fish in the world, from both, aquaculture and capture fishery sector. Some recent studies suggest a possible reduction of primary production due to the changes in water circulation in a wormer environment. The impact of climate change on Asian fishery depends on the impact on the fragile equilibrium of the food chains in the surrounding oceans. Future changes in ocean currents, sea level, water temperature salinity, wind speed and direction, intensity of upwelling, the variation of the different species of fishes due to climate change, water pollution, over-fishing and other climatic and environmental pressures could determine the abundance of fish populations in Asian waters and the sustainability of the fishery industry (IPCC, 2007).

An important threat for food security is estimated to be represented by pests and diseases. Warmer temperatures will reduce winter kill, increasing the population of insects and influencing crop pathogen interactions.

In the period 2010-2038 the maximum monthly flow of Mekong river is projected to increase by 35 – 41% in the basin and by 16 – 19% in the delta; in contrast, minimum monthly flows are projected to decline by 17 – 24% in the basin and 26 – 29% in the delta (Hoanh et al.,2004). The situation in the other river basins is not expected to be different. This suggests that the risks of flooding in the wet season and water shortage in the dry season are highly increasing, due to the concentration and contraction of the rainy days.

The general reduction of the rivers' flow and the rising of the sea level could provoke the intrusion of saltwater in the estuaries: this could cause a general deterioration of surface and ground water stocks. Overexploitation of groundwater in the past has

caused the drop in its level and, in some cases, the consequent contamination with saline water in the coastal areas.

Asia is the most populated continent in the world. It's estimated that, in 2000, over 3.6 billion people resided in Asia, three fifth of the world's population. Population is expected to increase in the first half of 21st century, especially in Southern and South-Eastern part of the continent, the most populated part of Asia. This event could cause an increasing of pressure on land and exploitation of natural resources.

In all the temperate and tropical region of Asian continent, public health would be increasingly threatened by temperature anomalies and overpopulation. Risk of cerebral infarction and cerebral ischemia have been shown to be increasingly influenced by raise of temperatures. Natural habitat for vector-borne diseases are reported to be expanding. The distribution of vector-borne diseases, like malaria, is strongly related to the diffusion of the species that act like vector, such as insects, and to the climate dependence of the infectious pathogens. The list of infectious diseases most directly related to climate change include malaria, schistosomiasis, dengue fever (IPCC, 2007).

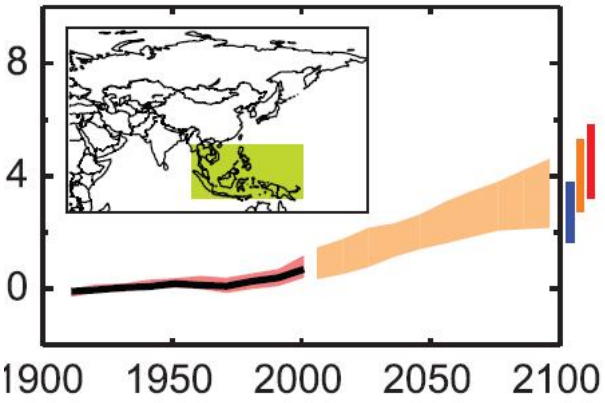
In this continent, migration accounts for 64% of urban area growth. International migration is estimated to count 23 million cases and refugees 4,8 million (UN-HABITAT, 2004). Climate-induced changes are expected to increase the migration and urbanization phenomena. Climate change is expected to exacerbate environmental conditions giving rise to land degradation, shortfalls in food production, rural poverty and urban unrest. These conditions could exacerbate the social vulnerability, the exposure of group of people to stresses resulting from climate and environmental changes. Social vulnerability analysis emphasises how damages and risks are inequitably spread among different part of the population. The poorest part of the population, particularly in urban and urbanising areas in Asia, due to the impossibility to access to profitable livelihood opportunities and safe living areas, are expected to be highly vulnerable to climate changes. They are considered to be more exposed to the risk related to floods and other climate-related hazards in places where they are forced to live.

1.2: Climate Change Impact in Thailand.

1.2.1: Introduction.

Instrumental records show that, in the past century, mean temperature in Thailand has increased of 0.6°C. The Intergovernmental Panel on Climate Change (IPCC, 2007) forecasts that, by the end on this century, the mean temperature could increase between 1.4 and 5.8°C and the sea-level would rise by 0.09 to 0.88 meters. A General Circulation Model (GCM), "mathematical formulations of atmospheric, ocean, and land surface processes that are based on classical physical principles used to simulate climatic patterns under changing climate" (Gates et al., 1990), used to reconstruct climate scenarios of the Mekong river basin, forecasts that mean temperature in Thailand may increase from 21.5-27.5 to 25-32°C.

Figure 1.3: Temperature anomalies in South East Asia



Temperature anomalies with respect to 1901 to 1950 for South East Asia region for 1906 to 2005 (black line) and as simulated (red envelope) by MMD models incorporating known forcings; and as projected for 2001 to 2100 by MMD models for the A1B scenario (orange envelope). The bars at the end of the orange envelope represent the range of projected changes for 2091 to 2100 for the B1 scenario (blue), the A1B scenario (orange) and the A2 scenario (red). The black line is dashed where observations are present for less than 50% of the area in the decade concerned. (IPCC, 2007)

Source: International Panel on Climate Change,2007

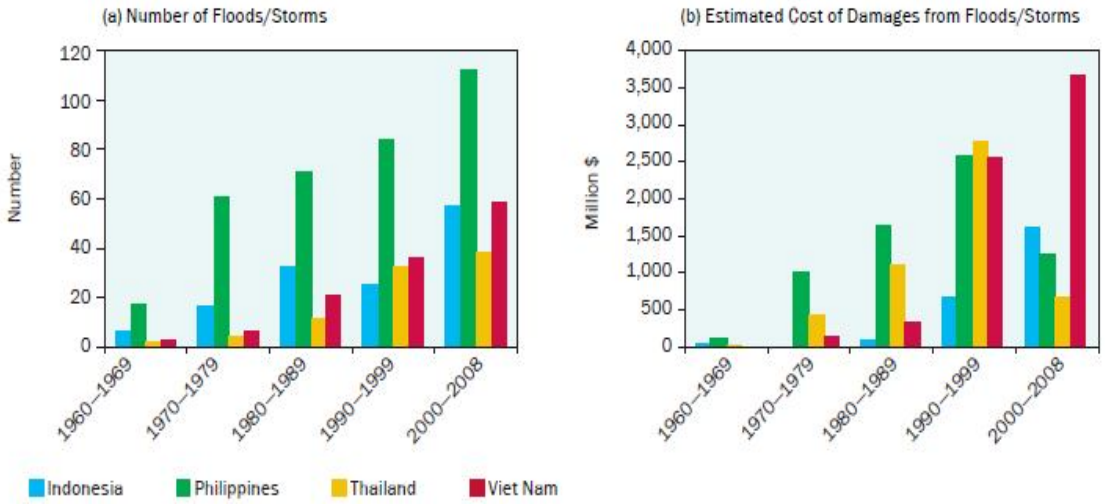
Like the other developing countries, Thailand is reported to be hardest affected by climate change. Consequences of climate change will tremendously impact natural resources and environment. IPCC reports that, in the period 1950-1990, climate-related catastrophes have increased 5 times and their consequences on the economy of the country have been 10 times more.

Impact on water resources has been evident in the last decades. Changes in rainfall patterns, intensity and frequency of rainfall have been affected quantity and quality of freshwater from the twenty-five existing watersheds down to the estuaries. The

reduction of total rainy days and the increased intensity of the rainfall have provoked a frequent occurring of prolonged droughts and intense floods, with strong consequences on the agricultural, industrial and tourist sectors.

Thailand is one of the biggest exporter of food, especially rice, in the world: floods and drought are compromising seriously the agricultural sector, with strong consequences on the food security and the well-being of the majority of Thai people.

Figure 1.4: Number and cost of floods in South Eat Asia



Source: CRED, 2008; CCFSC, 2005.

Thailand's coastline is more than 3000 km, this area is very important for the economy of the entire country: it is importance is determined by the activities related to commerce, recreation, tourism, fishery and coastal flora (UNDP, 2007). Coastal erosion, due to sea-level rise and other climate related changes, like storm surges and chemical composition of the sea-water, could compromise the precarious equilibrium of this socio eco-system.

Climate changes and overexploitation are seriously compromising the existence of tropical rain forests and deciduous forests. Climate related processes are expected to radically change the ecosystems contributing to the extinction of many species.

1.2.2: Climate scenarios.

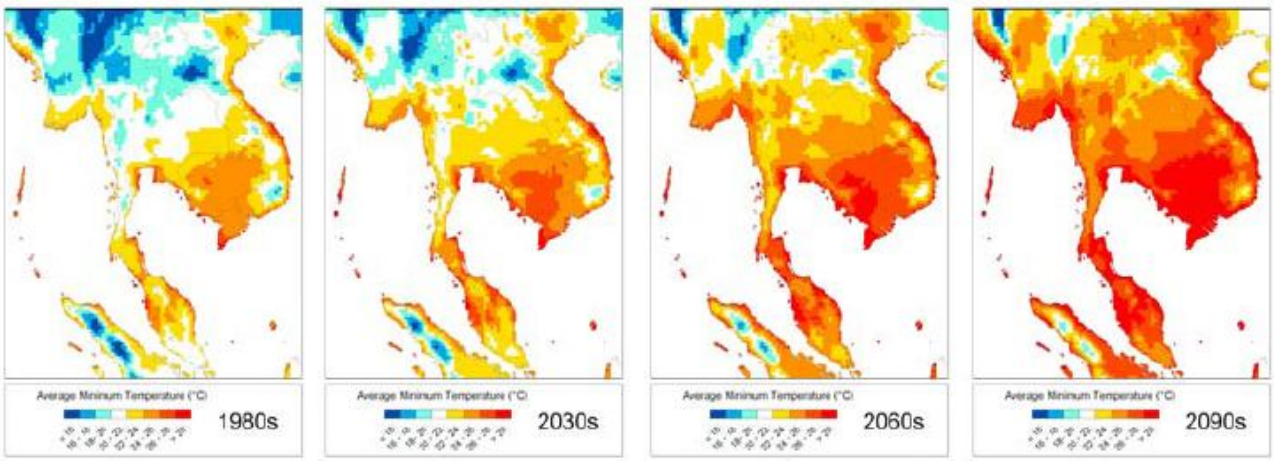
Average daily temperatures across South East Asia have increased 0.5 to 1.5ºC between 1951 and 2000 (IPCC 2007). Thailand's temperatures have reportedly increased 1.0 to 1.8ºC in the past 50 years; average daytime temperatures in the month of April have been particularly high at 40ºC. Daily maximum and minimum temperatures are also increasing (SEA START RC 2009).

Since 1950 Thailand has registered more hot days and warmer night and fewer cool days and nights (Figure 1.5).

By the end of this century the region is expected to register an increase of further 1-4 degrees (SEA START RC 2009).

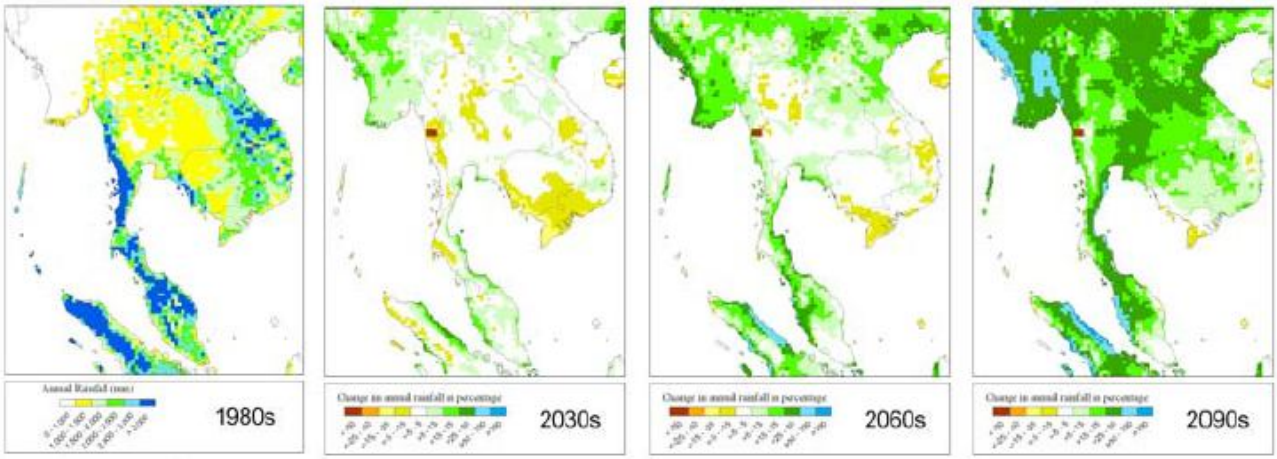
The average annual rainfall has registered an increasing in the last five decades. Future scenarios underline an expected further increasing of 5-25% in the next two decades, and up to 50% by the end of the century (Figure 1.6).

Figure 1.5: Average daily minimum temperature trends



Source: Southeast START Regional Centre ,2009

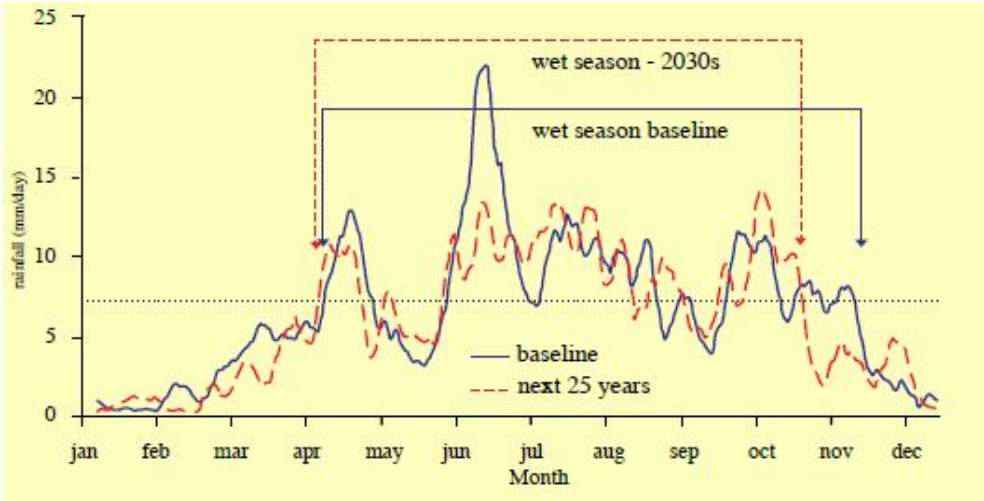
Figure 1.6: Average annual rainfall



Source: Southeast START Regional Centre ,2009

The fact that the dry season is expected to be dryer, predicts the increasing of rainfall intensity during the wet season; the length of wet season is not expected to change in most part of the country; these facts highlight the possibility of heavier storm surges during the rainy season. (Figure 1.7).

Figure 1.7: Mean daily rainfall (mm) for 1980s (baseline) and 2030s



Source: Southeast START Regional Centre ,2009

1.2.3: Impacts of Climate Change

- Forests.

The most important study on the impact of climate change on the forests of Thailand was conduced in 1996 by Boonpragob and Santisirisomboon. The study aim was to understand what would happen to the forest of Thailand in the contest of the climatic scenarios. To assess the possible changes in natural vegetation patterns due to global warming, the authors used the Holdridge Life Zones Classification Model, a model that correlates climatic features with vegetation distribution (Figure 1.8), in combination with the simulations of the various climate scenarios obtained with the General Circulation Models.

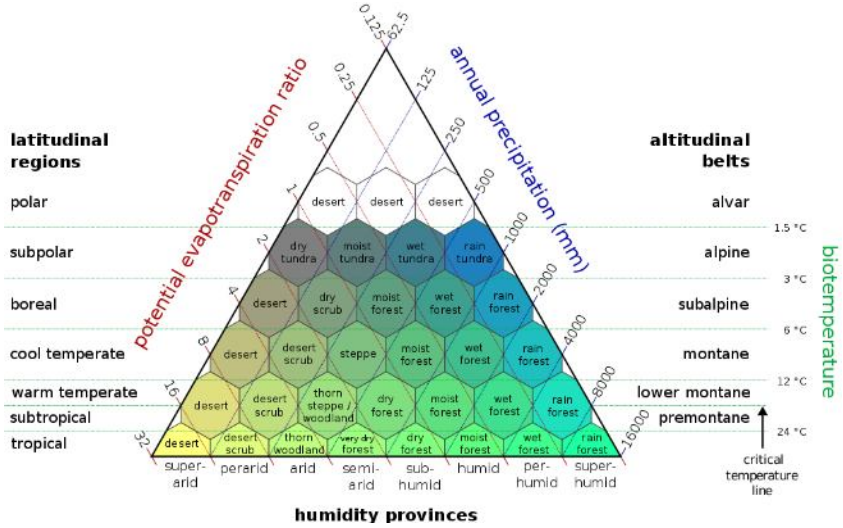
Six Holdridge life zone types of forest cover are found in Thailand: subtropical dry forest, subtropical moist forest, subtropical wet forest, tropical dry forest, tropical moist forest, and tropical wet forest.

Conclusions of the study are the following:

"Under the climate change scenarios simulated by the three general circulation models, the subtropical dry forest could potentially disappear, and areas of tropical very dry forest would appear. In general, the area of subtropical life zone would decline from about 50% to 20%-12% of total cover, whereas the tropical life zone would expand its cover from 45% to 80%. All general circulation model scenarios suggest that the tropical dry forest has the greatest potential to extend into the subtropical moist forest. […]

The simulation models consistently predict the expansion of tropical dry forest into sub tropical moist forest in the upper part of the country, whereas subtropical forests in the southern portion will be replaced by tropical forests. (Boonpragob, Santisirisomboon, 1996)".

Figure 1.8: Holdridge Life Zones Classification Model



Source: http://en.wikipedia.org/wiki/Holdridge_life_zones

- Coastal Resources, Ocean and Fisheries.

Thailand's coastline is under serious threat from coastal erosion, this phenomenon is already occurring at the rate of several meters per year. IPCC Fourth Assessment Report (2007) estimated a sea-level rise between 0.09 and 0.88 meters in this century (Figure 1.9). Most part of the population of Thailand and important economic infrastructures are located in places where the risk of strong impact is higher. Coastal ecosystems are expected to adapt naturally to rising sea levels by migrating landwards, but human development and human infrastructures are seriously in danger.

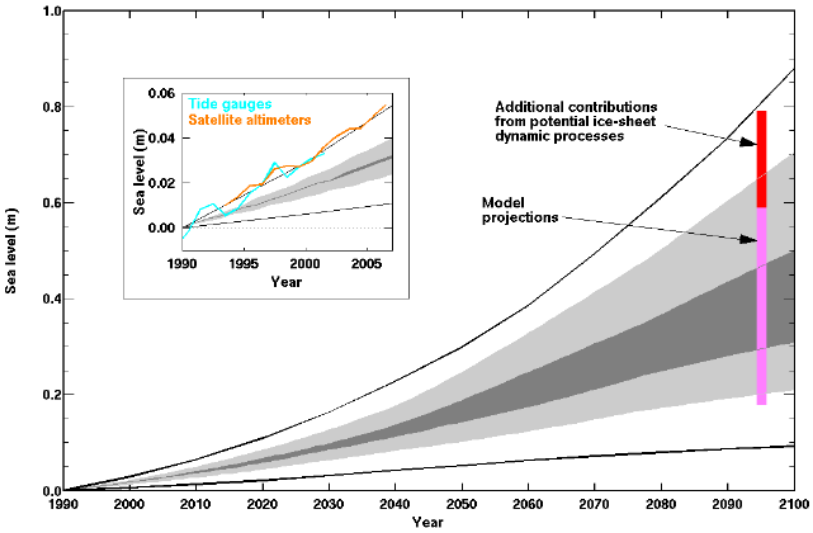
An important study on the impact of sea-level rise to the population was conducted by World Bank's researcher on 2007. The authors employed Geographic Information Systems (GIS) to overlay the critical impact elements - such as land, population, agricultural extend, urban extend, wetlands and Gross Domestic Product (GDP) – with the inundation zones projected for 1 to 5 meters of sea-level rise (Annex 1).

In the following tables (Table 1.1 and 1.2), it is possible to find the impact assessment of the possible sea-level rise in Thailand.

The IPCC forecasts make us feel confident to think that the impact could be limited under one meter of sea level rise. This, however, is expected to cause consequences to

more than 600.000 people that probably could be forced to migrate with the obvious social and economic consequences.

Figure 1.9: Sea-level Rise



Source: World Meteorological Organization, IPCC 2007 data..

Table 1.1: Critical impact elements in Thailand

Country Name	Surface (sq.km.)	Population	Total GDP (million USD)	Agriculture Extent (sq.km.)	Urban Extent (sq.km.)	Wetland (in sq.km.)
Thailand	**513.618**	**62.806.000**	**378.476**	**347.615**	**27.284**	**32.383**
Year 2000. Source: World Bank						

Table 1.2: Impact of sea level rise in Thailand

	1 meter	2 meter	3 meter	4 meter	5 meter
Area (Total = 513.618 sq. km.)					
Impacted Area	1.607	3.685	7.578	12.924	18.498
% of Total Area	0,31	0,72	1,48	2,52	3,60
Population (Total = 62.806.000)					
Impacted Population	686.175	1.516.607	3.074.655	5.297.225	7.810.588
% of Total Population	1,09	2,41	4,90	8,43	12,44
GDP (Total = 378.476 million USD)					
Impacted GDP	5.372	10.411	28.230	61.179	85.669
% of Total GDP	1,42	2,75	7,46	16,16	22,64
Urban extent (Total = 27.284 sq. km.)					
Impacted Area	361	964	1.993	3.335	4.782
% of Total Area	1,32	3,53	7,30	12,22	17,53
Agricultural extent (Total = 347.615 sq. km.)					
Impacted Area	772	2.204	5.304	9.895	14.864
% of Total Area	0,22	0,63	1,53	2,85	4,28
Waterland extent (Total = 32.383 sq. km.)					
Impacted Area	911	2.062	4.405	7.846	11.617
% of Total Area	2,81	6,37	13,60	24,23	35,87

Source: World Bank, 2007.

The expected warming of the oceanic water, the possible consequences on the water cycles and the distraction of the mangroves population in the sea-side could impact strongly on the fish population, with catastrophic consequences on the fishery industry.
Moreover, storm surges have become stronger and more frequent. The expected increasing number of extreme weather events and the rising of ocean water's temperature, give the evidence of the possible increasing of number and strength of storm surges.

Table 1.3: Exposure to storm surges in Thailand

	Current Storm Surge	Storm surge with intensification of climate change	Increment %
Coastal Area (Total = 41.369 sq. km.)			
Exposed Area	5.989	7.945	32,70
% of Total Coastal Area	14,48	19,21	
Coastal Population (Total = 17.901.827)			
Exposed Population	2.879.597	4.444.000	54,30
% of Total Coastal Population	16,09	24,82	
Coastal area GDP (Total = 86.619 million USD)			
Exposed GDP	17.127	27.331	59,60
% of Total coastal GDP	19,80	31,60	
Coastal Urban extent (Total = 11.694 sq. km.)			
Exposed Area	2.109	2.875	36,30
% of Total coasta urban Area	18,00	24,60	
Coastal Agricultural extent (Total = 22.953 sq. km.)			
Exposed Area	1.845	2.672	44,80
% of Total coastal agri. Area	8,00	11,60	
Coastal Waterland extent (Total = 20.043 sq. km.)			
Exposed Area	2.217	2.937	32,50
% of Total coastal w. Area	11,10	14,70	

Source: Centre for Global Development, 2009.

- Agriculture and Food Security.

Around 50% of Thai population is employed in agriculture. Thailand is one of the largest exporter of rice in the world. Agricultural products are the base of the economy of the rural areas of the country and represent almost the only income for the poorest part of the population.
Crop production is mostly obtained from rain-fed agriculture: rain fluctuations caused by climate change could strongly impact on this activity. During the decade 1991-2000, the consequences of extreme events like floods and droughts brought to the loss of crop yields, with damages for dozens million Baht (local currency). Increase of extreme events, caused by climate change, in the next future could cause a general reduction of

agricultural production, with a consequent retard on economic development and an increase of social problems.

Especially for what concerns the impact of climate change on rice production, it is shown that the production could decrease substantially (Felkner et al., 2010). This study, conduced in the Sisaket province (North-East of Thailand), saw the forecasting of rice production in presence of climatic conditions predicted by the IPCC (2007) scenarios. For this study were used two of the scenarios, an optimistic one called "low emissions" and a more extreme one called "high emission". The instrument used is the DSSAT, Decision Support System for Agrotechnology Transfer (DSSAT). The conclusion of the study are:

"Daily precipitation increases throughout the year under low emissions climate, with particularly high increase of 5.3% in December and 4.4% in January. However under high emissions scenario there is less rain in the second half of the year, starting in June, which is exactly the period of rice cultivation. Thus low emissions climate change brings moderate increase in temperature and more rain, while high emissions climate bodes both higher increase in temperature and less rain for rice cultivation.

DSSAT predicts decrease in aggregate yields compared to the neutral climate simulations for both high and low emissions scenarios by 3.53% and 13.79%, respectively. This result is highly statistically significant. Lower aggregate yields under low emissions compared to high emissions scenario, despite the fact that low emissions scenario is less extreme of the two, may be due to the damaging effect on the crop of higher rainfall during the final production stage in December and January, when grain is mature and harvesting takes place. The same results hold for model predictions, although under model predictions the difference in yield decreases under high and low emissions scenarios is much smaller, with respective decrease of 10.81% and 12.04% (Felkner et al., 2010)".

Moreover, increasing temperatures during flowering and pollination process could cause a strong reduction of pollen fertility. Different plant species react differently to high temperatures: some rice species lost their fertility for temperatures higher than 34°, some others can tolerate to heat up to 38°. Rainfall variability and extreme events lead

to the reduction of rice, corn and sugar cane production. Frequent inundations, especially in the more flood-prone areas of the country, could lead to plant diseases and insect infestation.

Climate change and precipitations could also strongly impact on natural pasture and mixed farming system: this could lead to a sensible reduction of livestock production. Droughts and floods could cause shortage in food and new diseases outbreak. Change in temperature and humidity could put livestock under different stressed conditions. These changes could lead to animal's physiological processes distortion and epidemic diseases carried by flies.

The most important problem of agricultural and livestock production is linked to the large vulnerability of this economic sector: most of the farmers in Thailand are poor, small holders that most of the time are not conscious of the problems related to climate change and the opportunities represented by new technologies and scientific research.

1.3: State of Human Development in Thailand

Most of the information discussed in this section and in the following subsections have been taken by the studies conduced by United Nations Development Programme (UNDP, 2007) and the World Bank (2010).

1.3.1: Thailand, a story of successful development strategies.

- Introduction.

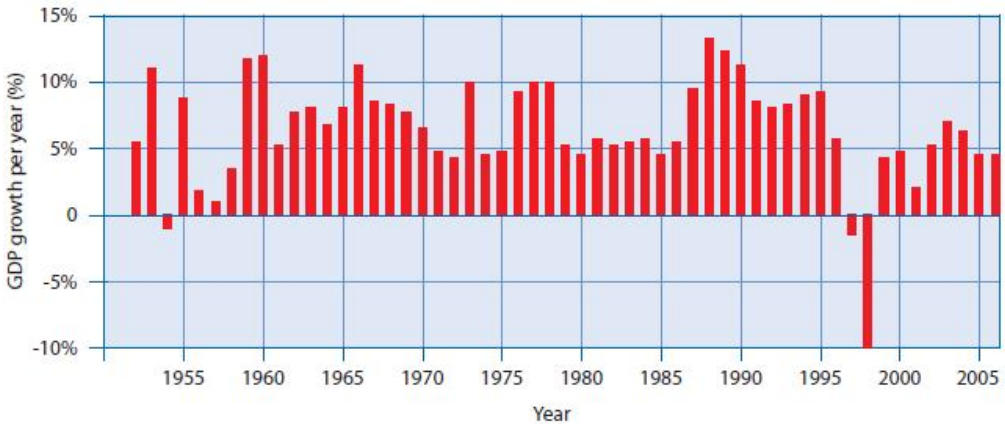
Fifty years ago, Thailand was a rural and underdeveloped country even in comparison with its Asian neighbours. Principal activity was agriculture and principal exports were almost completely represented by rice, tin and teak. During the Cold War, and especially during War in Vietnam, the development of the country started, thanks to the huge flow of investments from the United States of America. Between 1950s and 1980s, huge investments in infrastructures like ports and roads permit to connect remote areas to the world market. Development planners and private investors introduced into the

country cultivation of new crops, with the assistance of new techniques and new technologies; large areas of the countryside were made available to agricultural exploitation; improvement of processing factories, storage yards and transportation companies accompanied the development of this agricultural economy.

The second stage of development of Thailand started in the late 1970s: laws, tax system and economic policies were changed to push the country toward an export-oriented industrialization and the attraction of foreign investments. In this stage, the growth of industrial sector was accompanied by the improvement of infrastructures like airports, ports, power generators, transport systems and waste management systems.

Economic growth has been fast and constant: from 1957 to the 1997 financial crisis, Thailand's Gross Domestic Product growth averaged 7,6% a year and was never below 4% (Figure 1.10); per capita income increased of more than seven times (Figure 1.11).

Figure 1.10: GDP growth per year in Thailand (1952-2006)

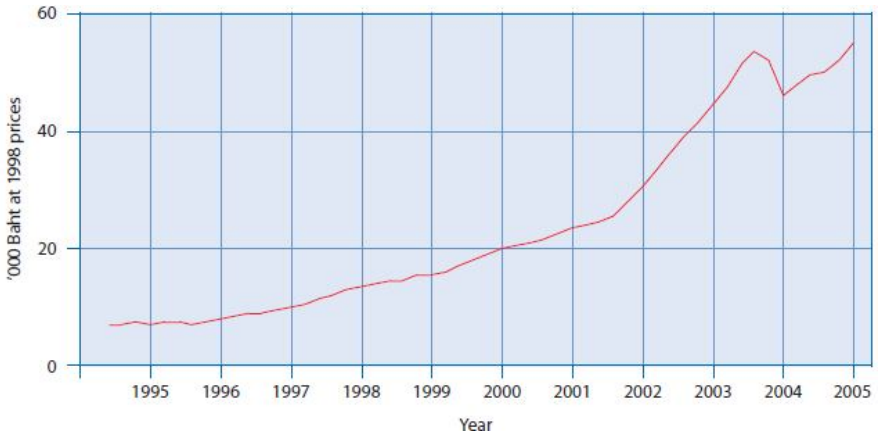


Source: NESDB (Thailand's state economic-planning agency) GDP Tables, 2007.

Thailand became a medium-income country. The rate of poverty has fallen from 57% in 1962 to 38% in 1990 and 11% in 2004; proportion of underweight children has dropped by the half; level of education is constantly increasing; malaria is no-longer a problem in most part of the country and annual rate of new HIV infections is constantly decreasing.

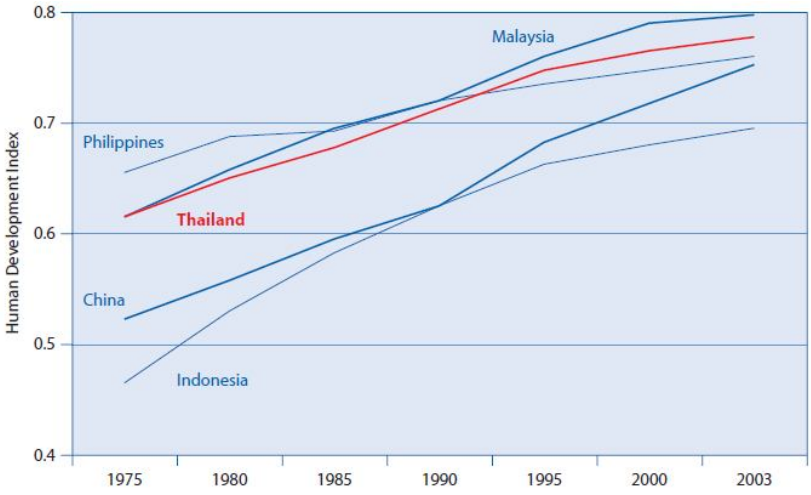
In the last forty years, the Human Development Index (HDI) measured by UNDP in Thailand was constantly increasing and constantly good in comparison with the other countries at a similar income level (Figure 1.12).

Figure 1.11: Per-capita income per year (1995-2005)



Source: NESDB (Thailand's state economic-planning agency) GDP Tables, 2007.

Figure 1.12: Human Development Index (1975-2003)



Source: UNDP Human Development Report, 2006.

Saw the remarkable progress in human development in the last twenty years, the country is expected to achieve most of the Millennium Development Goals before 2015 (Table 1.4).

Table 1.4: Millennium Development Goals in Thailand

MDG TARGET	SCORECARD
1. Halve, between 1990 and 2015, the proportion of people living in extreme poverty	Already achieved
2. Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Already achieved
3. Ensure that by 2015, boys and girls alike, will be able to complete a full course of primary schooling	Highly likely
4. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015	Already achieved
5. Reduce by two thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality already approaching OECD levels
6. Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Maternal mortality already approaching OECD levels
7. Have halted by 2015 and begun to reverse the spread of HIV/AIDS	Already achieved, but with warning signs of resurgence
8. Have halted by 2015 and begun to reverse the incidence of malaria, tuberculosis, and other major diseases	Already achieved for malaria; potentially for tuberculosis
9. Integrate the principles of sustainable development into country policies and programmes and reverse the losses of environmental resources	Potentially
10. Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation	Already achieved
11. By 2020 to have achieved a significant improvement in the lives of slum dwellers	Likely

Source: UNDP Millennium Development Goals Report, 2004.

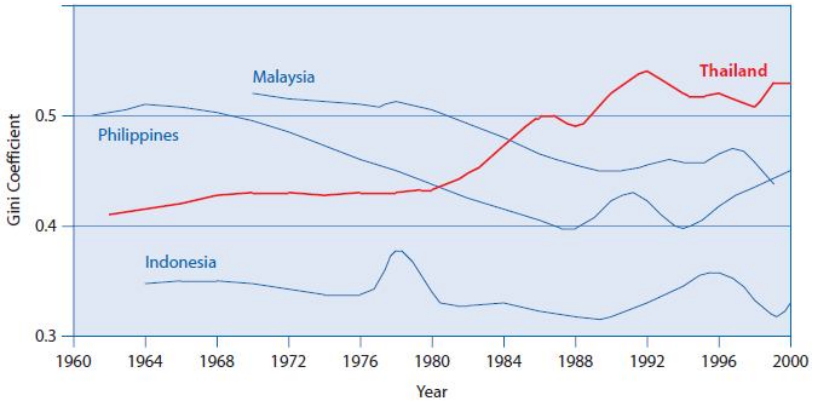
Development of Thailand has been seen like a great success, but there are several problems. First of all, the development has not been equal among the population in different areas of the country (Annex 1).

- Inequality.

Theory and observation suggest that development processes in poor countries should see, at the first stage, an unequal distribution of the richness, but later this trend should tend to reverse. Monitoring the trend of inequality in Thailand for the last forty years, it

can be observed that the situation has relentlessly gotten worse (Figure 1.13). Many are the factors that determined this situation: Government's spending has been unevenly distributed; investments in education have prioritized tertiary above secondary; education subsides have been used by rich families more than poor families. But the main reason of the improvement in inequality is the difference of development between urban and rural areas. Since the Government started to focus investments on industrial development, support of agriculture has gradually declined. The overexploitation of natural resources have denied people to access to land, water and forest resources that are fundamental for rural economy.

Figure 1.13: Trends in inequality – Gini Coefficient (1960-2000)



Source: Australian National University. Note: Gini coefficient value 0 indicates total equality, 1 total inequality.

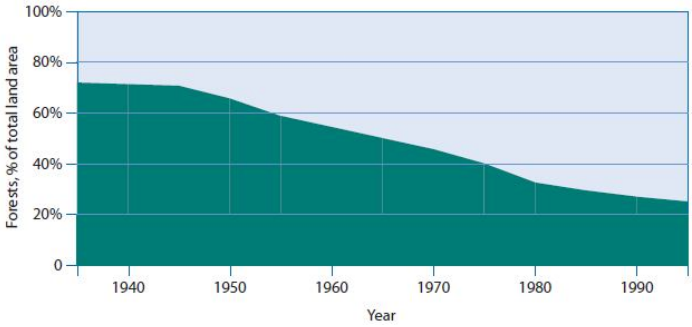
For less organized farmers, export-oriented crops became less and less profitable and always more easily, market volatility brought them into financial problems.

- Environmental decline.

In only one generation, Thailand went from being one of the most resource abundant country of the planet to be resource-constrained. Overexploitation and rapacity of the growth, with the almost total failure of any form of control, brought to a serious depletion of the natural resources.

In 1930-1940s, around 70% of the territory of this country was covered by forests, today only 33% (Figure 1.14).

Figure 1.14: Forest cover, percentage of total land area (1935-1995)



Source: Royal Forestry Department.

Urban expansion caused a relevant increase on water pressure and a strong competition with agricultural use to contend the fixed supply. Every drought period creates a battle between urban and rural consumers of water.

1.3.2: Human Achievement Index and limits of Thailand's development process.

Gross Domestic Product, alone, even if it has wrongly been used in this way in the past, cannot be a good indicator of the state of development of a country. There are several other indicators that help to better measure and understand this phenomena. The most used are the Human Development Index (HDI) and the Human Achievement Index (HAI) developed by UNDP.

In one of the last studies about the state of development in Thailand (UNDP, 2007), HAI has been used to monitor the progresses and the problems that still have to be solved in this country, the particularity of this index is to be able to highlight the differences within the country.

The Human Achievement Index is a composite index, that use 40 indicators to monitor eight aspects of human development:

- Health;
- Education;
- Employment;
- Income;
- Housing and Living Environment;

- Family and Community Life;
- Transport and Communication;
- Participation.

In particular, some of the aspects highlighted by this analysis have to be considered for the purpose of this study.

- Health.

Despite the success of the policies aimed at improving health conditions of the population, in the rural and poor areas most of the common problems of underdevelopment are still present.
Malnutrition and poor maternal and child health still affect some of the rural areas, especially in the north, north-east and south of the country.
People with disabilities, estimated to be more than one million, have difficulties to access education, employment, income and other benefits. There is not a real social system that take care of people affected by disabilities. Incidence in rural areas is double respect to urban areas.
Large use of agricultural pesticides is seriously threatening the wellness of Thai population. Agricultural workers are the most severely impacted by this problem. Some studies conduced by the Department of Disease Control, documented the consistent increase of pesticides-related illness incidence in the population; another study, conduced by the Department of Health, documented that on a sample of 115.105 farmers, almost 30% present a dangerous level of toxins in the blood from exposure to agricultural pesticides.

- Employment.

There is the evidence of a large rate of employment among the Thai workforce. The problems are linked to the partial inefficiency of the social security. Number of work-related injuries, diseases, deaths and disabilities is large. Social assistance and old-age pensions are not sufficient and unevenly distributed among the population.

Work demand is almost completely concentrated in urban areas. Unemployment is more diffused in the rural areas.

- Income, poverty and debt.

It has been estimated that, in 2004, 11.3% of the population lived in absolute poverty. 87% of the poor are farmers or farm workers in the rural areas. Poverty problems are not uniformly present in the country: percentage of poor is less than 2% in Bangkok, 5% in the Centre, 16% in the North 17% in the North-East. The top 20% of the population enjoys 55.2% of the total income, the last 20% just 4.3% (UNDP, 2007).
Rural areas and agricultural sector are subjected to the variability of the prices, at the world level, of the goods that they produce and are subjected to the forces of the market. This situation exposes the less resilient part of the population to the most dangerous social and economic risks.

- Family and community life.

Family and community are the fundament of the Thai society. Family relations were strong and communities have had a long tradition of cooperation. This important cultural heritage is seriously threatened by the rapid changes brought by the industrial and economic development. Shared labour and other forms of local exchange are almost completely disappeared. The crisis of agricultural sector and rural areas joint to the development of urban activities have been determining an always more important internal migration process that is disrupting the rural communities.
Family breakdown and single-headed households are the first consequences of the work demand-leaded migration. In 2004, almost 30% of all the household has been single-female leaded, almost 25% elderly headed leaded.
Another relevant phenomena is the child labour. Most of the poor families are forced to send their youth to work in the main cities: these children, in almost all the cases teenagers, work to support their families, in most of the cases renouncing to improve their education.

An increase in crime and drugs and alcohol addiction has been registered in the past two decades.

In some areas of the country, the recent escalation of conflicts is generating a general situation of insecurity.

Chapter 2: Resilience of the socio ecosystem. Mainstreaming adaptation into development strategies.

Introduction

Analyzing the state of climate and development in Thailand, there is the evidence of consistent problems in the rural areas that affect the most vulnerable part of the population and national territory: the small and poor farmers that live the countryside.
This chapter will analyze the interactions between social, economic and ecological environments as a complex system.
The evidence of the necessity for adaptation practices to better manage climate change consequences, jointly with development practices, will bring to the analysis of the logical approach to the outline of an adaptation and development project.
The analysis will address key concepts related with the problems exposed and some of the strategies that could be used, already used in some cases, to manage these issues. Also, the principal stakeholders related to these issues and the main strategies adopted by the decision makers and by the grassroots will be examined.

2.1: Social, economic and ecological environments, a complex system: Resilience and Socio Ecosystems.

The study of the situation in the rural areas of the country under consideration gives the evidence of different subjects under threat: human life, social cohesiveness, agricultural industry, sustainability of the socio-economic activity and the ecosystem's health. All this aspects are indissolubly linked to each other: the whole can be considered a complex system that dynamically adapt to the changes inside and outside itself in base of its own resilience and vulnerability.
Some definitions:

Resilience – "Amount of change a system can undergo without changing state" (IPCC, 2001).

Resilience – "Resilience is a tendency to maintain integrity when subject to disturbance" (UNDP, 2005).

Resilience – "The ability of a system to recover from the effect of an extreme load that may have caused harm" (UKCIP, 2003).

Klein et. al. (2004) reviewed the literature relating to the concept of **Resilience**. The authors of this study concluded that resilience "is best used to define two specific system attributes: the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; the degree to which the system is capable of self-organisation".

There are several studies about the Resilience Theory, co-evolved with the development of Complex Adaptive Systems. Considering that the analysis of adaptation to climate change occurs in the contest of human, economic and ecological systems, it is interesting, in this contest, to analyze the interaction of these theories applied in complex systems like: ecosystems, social systems and socio ecosystems. Socio economic systems show the same characteristics of Complex Adaptive Systems: Self-organization and co-evolutionary dynamics, with large macroscopic patterns which emerge out of local, small-scale interactions among system components and the environment, path dependence and system memory (Rammel et al., 2007).
The concept of resilience is also defined as:

"The capacity of a system [social – economic – ecologic – political…] to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks
[…]
There are four crucial aspects of resilience. The first three can apply both to a whole system or the sub systems that make it up.

Latitude: the maximum amount a system can be changed before losing its ability to recover (before crossing a threshold which, if breached, makes recovery difficult or impossible).

Resistance: the ease or difficulty of changing the system; how "resistant" it is to being changed.

Precariousness: how close the current state of the system is to a limit or "threshold."

Panarchy: because of cross-scale interactions, the resilience of a system at a particular focal scale will depend on the influences from states and dynamics at scales above and below. For example, external oppressive politics, invasions, market shifts, or global climate change can trigger local surprises and regime shifts." (Walker et al., 2004).

In this definition, it is possible to find that resilience is more than the ability of a system to defend itself from shocks or stresses. There is the evidence of a concept that expresses its capabilities in a dynamic way: absorbing the disturbance provoked by a shock and taking the initiative to reorganize itself after the disturbance. It is also possible to underline the presence of all the factors that determine the identity of a system: structure, linkages among actors and processes inside the system; function, services and products provided by the system; feedbacks, the combination of processes that cyclically stimulate or reduce the activities of the system.

Holling (1996) provided other two key definitions:

- **Engineering Resilience**: the rate at which a system returns to a single steady or cyclic state following a perturbation.
- **Ecological Resilience**: the magnitude of the perturbation that can be absorbed before the state of the system falls outside its domain of attraction (Holling, 1996).

Resilience Theory and Complexity studies indicate that systems do not have only one equilibrium. There is the evidence of "Multiple Equilibria" (or multi-stability) evolution of the systems in response to the disturbances that determine a trajectory of the evolution of the system itself.

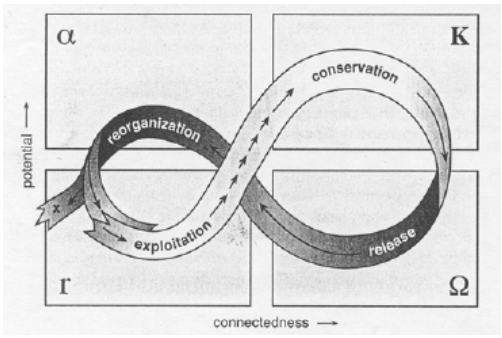
Gallopin (2006) highlights how in any dynamical system, the property of multi-stability implies that the behaviour of the system changes qualitatively and quantitatively. This theory defined, also, three levels of stability:

- Local stability (identified with the concept of engineering resilience), refers to the behaviour of the trajectories of the system in the presence of an attractor, with a given domain of attraction;
- Multi-stability (identified with the concept of ecological resilience), refers to the changes in the state of the system between the different domains of attraction [defined like: "region of the state space where the system would tend to remain in the absence of strong perturbations"], within the stability landscape of the system;
- Structural stability, the capacity of the system to preserve the topology of its trajectories under perturbations of the dynamic equations of the system.

The consequences of a structural instability are expressed by the transformation of the system in a different one (Gallopin, 2006).

To explain the dynamicity of the adaptive process of complex systems, Holling (1986) introduced the Adaptive Cycle (Figure 2.1).

Figure 2.1: Adaptive Cycle



Source: Holling, 1986

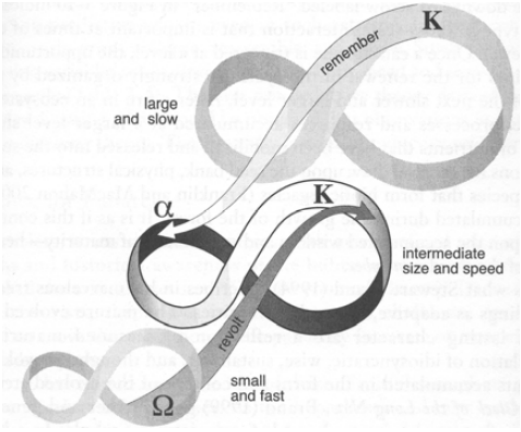
This model is well analyzed and used in the study conduced by Walker (et al., 2004):

"The dynamics of Socio Eco Systems can be usefully described and analyzed in terms of a cycle, known as an adaptive cycle, that passes through four phases. Two of them—a growth and exploitation phase (r) merging into a conservation phase (K)—comprise a slow, cumulative forward loop of the cycle, during which the dynamics of the system are reasonably predictable. As the K phase continues, resources become increasingly

locked up and the system becomes progressively less flexible and responsive to external shocks. It is eventually, inevitably, followed by a chaotic collapse and release phase (Ω) that rapidly gives way to a phase of reorganization (α), which may be rapid or slow, and during which, innovation and new opportunities are possible. The Ω and α phases together comprise an unpredictable back-loop. The α phase leads into a subsequent r phase, which may resemble the previous r phase or be significantly different.

This metaphor of the adaptive cycle is based on observed system changes, and does not imply fixed, regular cycling. Systems can move back from K toward r, or from r directly into Ω, or back from α to Ω. Finally (and importantly), the cycles occur at a number of scales and Socio Ecosystems exist as "panarchies"—adaptive cycles interacting across multiple scales. These cross-scale effects are of great significance in the dynamics of Socio Eco Systems." (Walker et al., 2004).

Figure 2.2: Panarchy



Source: Holling, 1986

The notion of regime shift was empirically suggested to scientists by the catastrophic changes in large-scale ecosystems in the past. But the regime shift can also take place in a not catastrophic way and in the small-scale. Regime shift is recognized in a socio eco-system when some endogenous processes change in their rate and extent of operation and in their relationship to each other, till the entire system state changes from an equilibrium to another. When the threshold between two different equilibria is passed, the system shifts from a regime to another. The disturbances that cause this shift could be both endogenous and, more often, exogenous (Sendzimir, 2007).

These theories suggest how important it is to analyze the rural areas of Thailand as a whole socio ecosystem threatened by climate change and the possible harms derived by economic development. Consequently, further attention should be given also to the study of how it could be possible to improve the resilience of this socio eco-system to avoid undesirable changes, how to reduce its vulnerability and how to stimulate adaptation practices to reduce the adverse consequences of the unavoidable changes.

2.2: Adaptation to Climate Change, Development strategies and Mainstreaming: some definitions.

There are several definitions of the main concepts involved in the analysis of this socio ecosystem: the adaptation to climate change and the integration of adaptation into development strategies toward a sustainable development.
Starting from the adaptation to climate change: this concept is mostly taken from the evolutionary theories in the biological contest. The best definitions of adaptation are given by the eminent geneticist and evolutionary biologist Theodosius Grygorovych Dobzhansky (1900-1975):

Adaptation is the evolutionary process whereby an organism becomes better able to live in its habitat or habitats (Dobzhansky T., 1968);

Adaptedness is the state of being adapted: the degree to which an organism is able to live and reproduce in a given set of habitats (Dobzhansky T., 1970);

An **adaptive trait** is an aspect of the developmental pattern of the organism which enables or enhances the probability of that organism surviving and reproducing (Dobzhansky T., 1956).

From biology to climate change studies, this concept has been developed in the following ways:

Adaptation – "Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial

opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation" (International Panel on Climate Change, IPCC, 2001)

Adaptation – "Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change. For example, flood walls should be built and in numerous cases it is probably advisable to move human settlements out of flood plains and other low-lying areas…" (United Nations Framework Convention on Climate Change, UNFCCC Secretariat).

Adaptation – "Is a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented." (United Nations development Programme, UNDP, 2005).

Adaptation – "The process or outcome of a process that leads to a reduction in harm or risk of harm, or realisation of benefits associated with climate variability and climate change." (UK Climate Impact Programme, UKCIP, 2004).

Adaptation can be defined as adjustments of a system to reduce vulnerability and to increase the resilience of system to change, in this case, the climate system (IPCC, 2007). Adaptive Capacity, Vulnerability and Resilience are other important concepts to better clarify talking about adaptation to climate change.

Adaptive Capacity – "The ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC, 2001).

Adaptive Capacity – "Is the property of a system to adjust its characteristics or behaviour, in order to expand its coping range under existing climate variability, or future climate conditions. The expression of adaptive capacity as actions that lead to adaptation can serve to enhance a system's coping capacity and increase its coping range thereby reducing its vulnerability to climate hazards. The adaptive capacity inherent in a system represents the set of resources available for adaptation, as well as the ability or capacity of that system to use these resources effectively in the pursuit of adaptation. It is possible to differentiate between adaptive potential, a theoretical upper boundary of responses based on global expertise and anticipated developments within

the planning horizon of the assessment, and adaptive capacity that is constrained by existing information, technology and resources of the system under consideration" (UNDP, 2005).

Adaptive Capacity – "The ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. Adaptation can be spontaneous or planned, and can be carried out in response to or in anticipation of changes in climatic conditions" (UKCIP, 2004).

Vulnerability – "The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity." (IPCC, 2001)

UNDP distinguishes: "**Socio-economic vulnerability** – Is an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations. And **Vulnerability** – the degree to which the exposure unit is susceptible to harm due to exposure to a perturbation or stress, and the ability (or lack thereof) of the exposure unit to cope, recover, or fundamentally adapt (become a new system or become extinct) (Kasperson et al., 2000) It can also be considered as the underlying exposure to damaging shocks, perturbation or stress, rather than the probability or projected incidence of those shocks themselves." (UNDP, 2005)

Vulnerability – Refers to the magnitude of harm that would result from a particular hazardous event. The concept recognises, for example, that different sub-types of a receptor may differ in their sensitivity to a particular level of hazard. Therefore climate vulnerability defines the extent to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It depends not only on a system's sensitivity but also on its adaptive capacity. Hence arctic alpine flora or the elderly may be more vulnerable to climate change than other components of our flora or population. (UKCIP, 2004)

In concrete terms, adaptation to climate change takes the form of specific actions and projects that aim to reduce the vulnerability of socio-economic or ecological systems.

The ability to undertake such actions by a society, is mainly related to the adaptive capacity of the society itself. Literature about this issue concluded that improving the adaptive capacity would reduce the socio-economic and ecological vulnerability to climate change (IPCC, 2001). Broadly, adaptive capacity is the reflection of fundamental condition of a society, such as: health conditions; education; income; equity among the population; housing and living environment; efficiency of the institutions. From this point of view, the activities that improve the adaptive capacity are basically equivalent to the activities that promote sustainable development. These activities include:

- improving access to resources and their efficient use;
- reducing poverty;
- lowering inequities of resources and wealth among groups;
- improving education and information;
- improving infrastructures;
- improving institutional capacity and efficiency;
- improving access to information and technology.

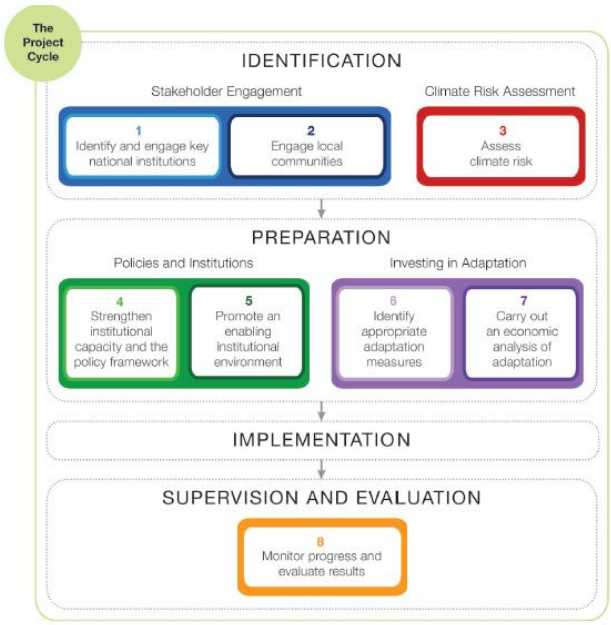
These aspects underline how the adaptation strategies applied to socio-economic systems and to the ecological systems could be enhanced jointly, for at least some points of view. There is the evidence that adaptation to climate change has to be considered and introduced in the development planning activities, especially in the most vulnerable areas. In this sense: "Mainstreaming refers to the integration of adaptation objectives, strategies, policies, measures or operations such that they become part of the national and regional development policies, processes and budgets at all levels and stages" (UNDP, 2005).

2.3: Adaptation project cycle: theories and strategies.

The analysis conduced above enhanced how important it is to delineate a series of good strategies in order to achieve a consistent reduction of vulnerability, an increase of the adaptive capacity, resistance and resilience, with an efficient management of the socio

ecosystem under consideration. In literature it is possible to find different guidelines that suggest how to delineate a series of activities, a project, to improve the state of development and the state of adaptation to climate change. One of the most interesting is suggested by World Bank in 2010 (Figure 2.3). The information exposed in this section are mostly taken from these reports. These are mostly referred to the agricultural sector and the Natural Resources Management (NRM).

Figure 2.3: Adaptation Project Cycle – World Bank.



Source: World Bank,2010. http://beta.worldbank.org/climatechange/content/mainstreaming-adaptation-climate-change-agriculture-and-natural-resources-management-project

The logical framework followed by the researchers of the World Bank, is the classical project cycle in four steps:

- Identification of problems, risk assessment and identification of the key stakeholders involved;
- Preparation of a series of strategies, policies and activities aimed to face the problems under consideration;
- Implementation of the project on the field;

- Supervision and evaluation of the activities and the results obtained. “Ex ante”, “in itinere” and “ex post” evaluations; data collection; quantitative and qualitative analysis.

2.3.1: Identification.

The first step consists in the study of the local situation and the delineation of the field in which to operate. The suggestion is to identify a sort of “entry point” to engage a fruitful collaboration about climate risk management and adaptation to climate change with the international, national and local stakeholders. In the case of agriculture and natural resource management, good entry points for adaptation and development projects could be represented by food security, natural disasters, water availability and environment degradation. The review of the national institutional structure could immediately suggest the institutional stakeholders that, at the national level, should be involved in the project that is going to be studied. The review of the existing disasters or climate risks management programs, jointly with the existing development plans, could easily provide information about institutional stakeholders, such as international organizations, and non-institutional ones, i.e. NGOs. The involvement of the local government is considered fundamental for the feasibility of the project. It is not always easy to identify the most appropriate counterparts: every country differs because of its internal dynamics. The study of ongoing projects and institutional landscape could not only help with the choice of the counterparts, but also help in finding the most effective approach to build a strong political consensus about the activities that are to be delineated. In order to maximize the effectiveness, adaptation and development strategies should be fully integrated in national economic planning and in the preparation of sectoral plans and budgets. Using strategies, policy notes, sectoral assessments and studies specifically conduced and produced at the country level represents a key point to raise awareness and promote mainstreaming of adaptation measures in the development agenda. In order to improve the uncritical acceptance of the project, the evidence on vulnerability patterns and socio-economic impacts of climate change should be presented in a transparent way. The involvement of the key

ministries, the entire government and the international organizations, should be ensured by the demonstration of feasibility and cost-effectiveness of the initiatives introduced. These have to be studied in order to support initiatives already adopted in the region.
All these considerations underline how important it is to involve institutions, or more broadly speaking decision makers. But it is also essential to involve the local communities.

The involvement of local communities is to be considered fundamental for the success of adaptation and development strategies, as will be thoroughly analyzed in the next chapter.
Climate change related problems are affecting more and more the most vulnerable part of the population of the world, especially the rural communities in the poorest parts of the globe (IPCC, 2007). In this contest, the awareness of the practical sides of the climate patterns is higher: rural communities are already familiar with inter-annual and intra-annual variability in the local scale: the possibility to adapt is more elastic in the small communities. The problem is represented by the uncertainty and the increasing variability of the climate. The adaptive capacity of the rural communities is not enough to face increasing problematic situations. Another aspect to take into consideration is that problems related to climate variability can be differently considered, or totally neglected, by different communities and different groups inside the same community. In this perspective it is important to involve the locals in the process of assessment of climate change related problems and in the process of delineation of practical strategies to be adopted to achieve adaptation. Local communities directly experience climatic variability and could represent the driver for adaptation. In order to achieve sustainable adaptation strategies and actions, the local dynamics and social structure must be taken into consideration. From another point of view, the process of education of rural communities about climate change and development could represent the winning strategy to achieve effectiveness and avoid mal-adaptation.
More and more in the last years, it is frequent to find in literature discussions about Community Driven Development and Community Based Adaptation. Practical problems that are often to be faced are mainly lack of communication and mis-communication between decision makers and scientific analyzers on one side and local

communities on the other. Continuous misunderstandings and lack of communication, jointly with the lack of confidence that often is possible to find between the grassroots and the decision makers especially in the most underdeveloped countries, bring to the delineation of wrong strategies to achieve adaptation or to the wrong application of well designed strategies.

In order to achieve a good involvement of local communities into the "identification" process, as it is discussed in this section, there are many different strategies that have to be taken into consideration: involvement of NGOs and local institutions (legal or traditional) into the process of assessment and strategy building; implementation of education activities that aim to involve part of the local communities' population, especially youth, as key figures for a proficient communication; exhibition farms and learning villages in which enhance the practical application of efficient practices.

The first step of the involvement of the local communities into the adaptation procedure, is the assessment of the communities' adaptive capacity: assessment of social, economic and environmental conditions. Carrying out this assessment, there is the need to achieve a good understanding of: vulnerability of the community to climate variability and change; current coping strategies and knowledge; key limitation factors that could restrict the effectiveness of the adoption of long term adaptation strategies; local understanding of climate risks.

Increasing the participation of local communities in climate management activities can improve the local adaptive outcome. This is due to different facts: local communities are more aware about their own priorities; decision made through a participatory process are expected to better address local vulnerabilities; participatory processes improve the level of responsibility of the local communities towards the adaptation strategies, with a good impact on the quality and effectiveness of the activities and on the long term sustainability of climate change and development projects.

Climate change forecasts are strongly influenced by the uncertainty that characterized this phenomenon. Consequently, the risks that could come from these changes are characterized by the same level of uncertainty. In this view, it has to be considered fundamental to develop impact assessments using a risk-based approach. Developing climate risk-based assessments represents a good way to drive the adaptation practices

in a more efficient way. Climatic risk assessments should analyze climate risks resulting from current climate condition and trends and future, long-term, projections. The climatic risk assessment represents only one aspect of the global assessment of a community or a region.

After assessing the climate risks, there is the need to assess non climatic factors that influence the vulnerability and resilience of the socio ecosystem taken into consideration. These aspects, that determine the adaptation deficit of the system and intervene in these non climatic factors could determine the success or the failure of the adaptation strategy. The impact assessment has to be built following several steps:

- Identify region, sub-region, district, area or community and the time horizon of interest;
- Identify nature and extent of current and future climate risks in the area of interest. Identify the degree of uncertainty;
- Identify the principal climate variables that could influence agriculture and natural resources management in the area under consideration;
- Identify the activities already put into practice in the area and the adaptation gaps in relation with trends and future projections;
- Identify sensitivity and vulnerability of the different sectors that characterize the area under study in the period under consideration;
- Identify vulnerability determined by non climatic factors;
- Identify the different options to achieve sustainable adaptation to climate related changes.

2.3.2: Preparation.

- Policies and institutions

Following the Guidance Notes of the World Bank (2010), once the institutional counterparts have been identified, there is the need to carry out an institutional capacity and needs assessment study. These kind of studies could help to identify to which areas and institutional levels capacity building efforts should be directed, in addition to human and financial capital, in order to increase the possibilities to achieve successful

adaptation strategies. This assessment should focus on the link between institutional capacity and the adaptation response expected. The levels at which this assessment could be undertaken are different, from community institutional level up to national institutional level. The same could be said about the possible objective of the assessment: this could vary depending on the institutional level and the specific problems of the system under consideration. The objective of the assessment is to identify the changes that institutions need to undertake in order to better respond to the climate risks.

The assessments regarding the institutional capacity have to be followed by a process of development of an institutional coordination that should be functional for the implementation of the adaptation practices. Depending on the institutional level chosen as counterpart for the adaptation strategy to develop, the World Bank's study suggests three ways for furthering an enabling institutional environment for climate change adaptation: community based driven Natural Resource Management and agriculture; decentralization of Natural Resources Management; and institutional coordination.

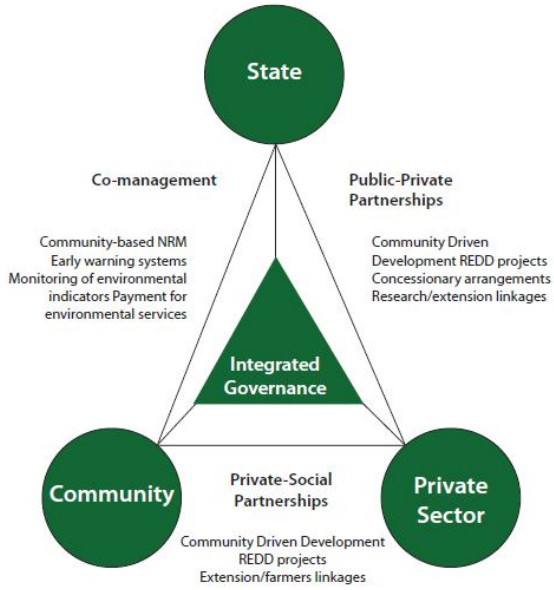
- Community based adaptation strategies could represent the most efficient strategy to successfully implement adaptation activities in the sphere of agricultural practices, local water management, food and water security. Nevertheless, sometimes, the internal dynamics inside the community could represent an obstacle to the adoption of this strategy. What is certain is that, without the involvement of the local community in the decision process and in the implementation of the adaptive strategy, it is almost impossible to reach a successful and efficient result.

- Effective adaptation practices need to be settled by the centre, by the adoption of policies and strategies at the national level, but there is the need to have a good coordination between central institutions and peripheral institutions especially for what concerns the practical application of the strategies and policies. This is mostly true in the case of Natural Resource Management. The principle followed for this theory seems to be similar to the legal organizing principle of "Subsidiarity". Decentralized institutions could ensure an effective national-local coordination and act like an effective support to community level initiatives. Designing an adaptation strategy that expects to benefit from a national-local institutional coordination, presupposes a

developed organization of the national institutions and a good level of accountability between local institutions and local communities.

- Inter sectoral coordination at the national level could be another option to implement adaptation strategies. Often, to implement adaptation and development projects, especially at national level, it is possible to find the creation of specific agencies that operate like intra and inter-governmental interlocutors. These institutions operate among the relations between the central and local institutions, the communities and the private sector (Figure 2.4).

Figure 2.4: Adaptation-relevant projects and activities requiring inter-institutional coordination.



Source: World Bank,2010.

- Investing in adaptation

The process of delineation of an adaptation practice, as seen before, is characterized by several steps: identification of the institutional stakeholders, identification of the local social stakeholders, climate risk assessment, institutional assessment and institutional coordination. Once clarified all these steps, it is time to choose one of the different options to mainstream adaptation into development projects, especially for the sectors represented by agriculture and Natural Resource Management.

Following the Guidance Note 7 of the World Bank's study, to be able to choose the most efficient adaptation option some steps should be considered:

1. Generation, analysis and access to climate information;

2. Assessment of impacts of climate variability and change on agricultural and natural resource systems and livelihoods, considering the interaction of climate pressures with other socioeconomic dynamics;

3. Identification and analysis of a menu of adaptation options, taking into consideration uncertainty and different types of adaptation;

4. Prioritization and choice of the most suitable adaptation measures for near-term and medium-term planning horizons (World Bank, 2010).

1. As seen before, problems related to climate variability, climate change and extreme events could strongly impact on the agricultural sector and the natural resource management. In this view it is clear how fundamental a good production and circulation of information related to these issues could be. A good understanding of what is happening and what is forecasted to happen, in the short-medium term, could represent a key to reduce the risks run by the population. A strong link between scientists, advisory agents and final users (farmers or, more in general, population exposed to the risks), is fundamental for the diffusion and the awareness about climate data and information. The most used tools to achieve this goal are seasonal climate forecasts and early warning systems.

The former are crucial considering the limited access to seeds, implements, technologies, labour and credit. A good understanding of what is supposed to happen could increase the adaptive capacity with the implementation of the right coping strategies in a simple and efficient way.

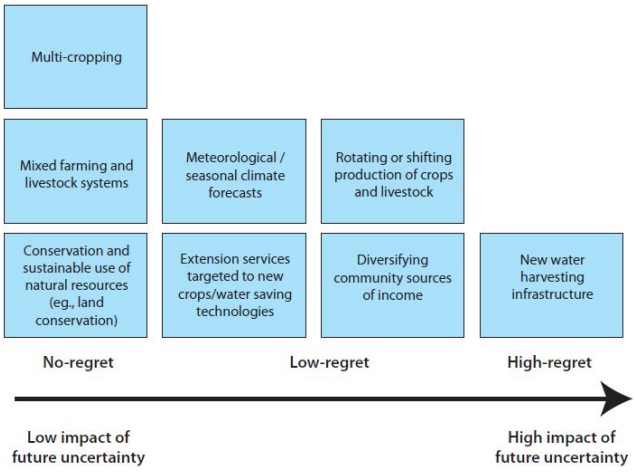
The latter are crucial for what concerns the disaster risk reduction.

2. Impacts on socio ecosystems from climate variability and changes are strongly linked to the rate and magnitude of change in climate variables and the ability of the eco-system to cope with these changes. As more widely explained above (subsection 2.3.1) a good assessment of the current situation and trends and the projection of future

climate variability and the possible impacts on the socio ecosystem have to be considered crucial.

3. In this step it is possible to find the real delineation of the adaptation options. These can be designed considering the various characteristics of the context in which they are supposed to be applied.
The first characteristic that should be considered is the level of possible "*regret*" that the adaptation option could cause. Uncertainty about future climate impacts has a crucial role in the process of decision of the best adaptation option. In this sense the different strategies could be classified like *no regret*, *low regret* and *high regret* (Figure 2.5). A *no regret* measure is a "measure that turns out to be of benefit no matter how or if the predicted climate change impacts materialise" (IPCC, 2001).

Figure 2.5: Consideration of uncertainty in adaptation investments.



Source: World Bank, 2010 (Adapted from Füssel 2007 and UNDP Adaptation Policy Framework (APF)).

"*Low regret* adaptation options are those where moderate levels of investment increase the capacity to cope with future climate risks. Typically, these involve over-specifying components in new builds or refurbishment projects. For instance, installing larger diameter drains at the time of construction or refurbishment is likely to be a relatively low-cost option compared to having to increase specification at a later date due to increases in rainfall intensity" (World Bank, 2010).

"*High regret* adaptation involves decisions on large-scale planning and investments with high irreversibility. In view of the considerable consequences at stake, the significant investment costs and the long-lived nature of the infrastructure, uncertainties in future climate projections play a crucial role when making decisions about whether to implement *high regret* adaptation measures" (World Bank, 2010).

In this sense, *no regret* options are not impacted by uncertainty, whereas *high regret* options should be taken into consideration when the probability that the predicted future changes take place is very high. *Low regret* adaptation options represent the most efficient solutions under a situation of relatively low uncertainty risks. Classification of the various options like *no regret*, *low regret* and *high regret* measures, could be not universal, as it could be influenced by the specific characteristics of the system under consideration. Understanding the level of *regret* of the various options available is to be considered crucial, because a different level of *regret* determines different implications in terms of: climate information, timing of investment, planning horizon, project design, project risk and economic evaluation. Benefits of *no regret* projects are not depending on the magnitude of changes that climate could have; moreover they do not depend on the quality and availability of data and on the accuracy of the projections like *high regret* projects do. *No regret* projects can be implemented even if the data collection process is still ongoing. For *high regret* projects there is the need to wait for the result of the climatic assessments. *No regret* options, generally, show their results in the short term, while *high regret* options could have effect delayed to the distant future. Most of the time, *no regret* projects could be implemented like standard development projects, while *high regret* ones could need a different implementation process. The cost effectiveness of *no regret* options does not depend on the magnitude of the climate changes.

Considering the various adaptation options that could be implemented in a given system under given conditions, there is another aspect that should be taken under consideration: the distinction between "autonomous adaptation" and "planned adaptation".

Autonomous adaptation "involves actions by farmers, communities and others in response to the threats of climate change that they perceive, based on a set of available technology and management options. Autonomous adaptation is implemented by individuals only if considered cost-effective by those implementing it, i.e., when adaptation is in their own interest" (World Bank 2010, adapted from Mendelsohn, 2006). It is a spontaneous adjustment of the socio ecosystem facing changes in climate. However, autonomous adaptation has to be stimulated by correct incentives and policies and, overall, by a good information process. Examples of autonomous adaptation could be: crop calendar shifts; planting and harvesting dates; soil and water management changes; fertilizer use and land-use decisions; water use (irrigation efficiency, amount of water, area/crops irrigated, groundwater vs. surface water); in-farm water storage; crop changes; water intensive vs. non-water intensive; labour intensive vs. non-labour intensive; capital intensive vs. non-capital intensive; high value/exports vs. low value/local consumption (World Bank 2010, adapted from Padgham 2009).

Planned adaptation "requires that the local, regional and/or national government also change behaviour to fit the new conditions and provide the right incentives to the private sector […] This may also require the revision of policies and/or institutions at the national, provincial and local levels" (World Bank, 2010). There could be different kind of planned adaptation solutions: the main distinction is between "hard" and "soft" planned adaptation. Usually interventions of hard planned adaptation entail the use of instruments that have a stronger impact on the socio ecosystem, respect to the autonomous adaptation and the soft ones. Examples of planned adaptation could be:

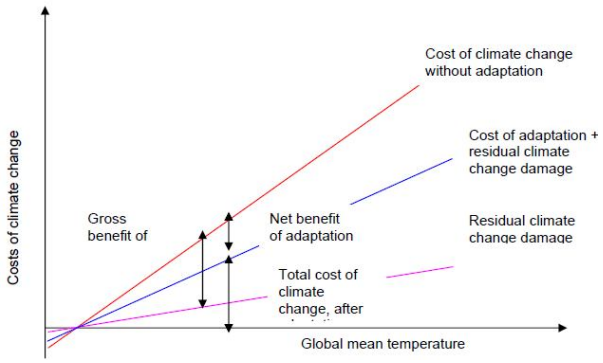
- Soft: generation and dissemination of climate information; seasonal climate forecasts; early warning systems; markets access; land management; water (pricing, transfers); fertilizer; pesticides; seeds; labour; insurance; financial; technology development; crop varieties; irrigation technology.
- Hard: infrastructure; water: transport, storage, dams (hydro), irrigation, desalinization, waste water reuse; agricultural production: storage, transportation (World Bank 2010, adapted from Padgham 2009).

4. In order to choose between different adaptation options, different aspects have to be taken under consideration: the result of the analysis of these characteristics contribute to the prioritization of the different solution prospected. First of all, one should consider the effectiveness of the different options in reducing vulnerability to increase climate variability; the effectiveness in coping with extreme events; the effectiveness under different possible climatic projections. Moreover, the possible consequences of the different options should be considered, such as, positive and negative externalities. Other points that should be considered include: the degree of involvement of the local communities; the sustainability of the adaptation effectiveness in the long run; the physical, legal, technological, financial and institutional barriers; and the economic analysis.

About the economic analysis of the different adaptation options, it is possible to find an active debate in the most recent literature. This subsection will describe the classical approach, suggested by the World Bank (2010), and some of the most important criticisms and alternatives, proposed by the International Institute for Environment and Development (2010).

The classical approach is represented by the Cost-Benefit Analysis. This instrument has been used by institutions, governments, enterprises to evaluate the desirability of a given intervention. The value of an option as compared to another is determined by the possibility of maximization of the difference between the estimated costs and benefits of the option. These variables are determined monetizing the public willingness to pay for achieving the benefits and avoid the costs, and the willingness to accept the degradation caused by climate change. These inputs are measured as opportunity costs. Practically, the first step consists in the estimation of the climate change impact's costs without adaptation. The second step consists in the estimation of the expected damage avoided through adaptation investments. The gross benefit of the adaptation policy is determined calculating the difference between the damages caused by climate change without adaptation and the damages caused by climate change with adaptation (Figure 2.6).

Figure 2.6: The costs and benefits of adaptation



Source: Stern, 2006.

Difficulties of this approach are represented by the reasonability of the approximations of the estimation of costs and benefits. It is not a simple work to reasonably estimate the expected local impact of climate change in absence of adaptation, the so called "baseline" scenario, and the expected benefits derived by uncertain results of adaptation practices.

The evaluation of the impacts in the baseline scenario should consider the autonomous adaptation. The evaluation of the planned adaptation is the most difficult part, especially in the case of soft adaptation. It has to be considered easier to estimate costs and benefits of the construction of a huge dyke, than to estimate costs and benefits of a weather forecasts system. Moreover, especially in the cases of projects in which adaptation strategies are integrated with development strategies, there could be difficulties in estimating only the effects of the adaptation side of the project.

Another two aspects could contribute to complicate the estimations of these variables: the strong uncertainty linked to climate changes and the time horizon of the adaptation investments.

The economic evaluation of investments characterized by a strong degree of uncertainty often relies on probability distribution models, such as probabilistic cost-benefit analysis. In these cases, the relevance of the variable uncertainty into the model is strongly influenced by the level of *regret* of the different options.

Adaptation projects are usually characterized by a financial time horizon of several years. In such cases the evaluation of costs and benefits of a project are determined using an appropriate discount rate. This discount rate could be relatively easily determined in cases of a short time horizon, 20 to 30 years; while it represents a harder

work to determine a proper discount rate for investments characterized by a time horizon of 50-100 years: in these cases the choice of an incorrect discount rate could completely influence the choice of the option to be implemented and could bring to the choice of the solution that is not the best.

The most used tools to analyse the impact of climate change adaptation to the agricultural sectors, are traditionally the agronomic models and the Ricardian model. Agronomic models are biophysical representations used to estimate the impact of climate change and adaptation strategies on the agricultural production. Ricardian models are econometric tools used to evaluate the impact of climate change and adaptation options on land's value, considering the assumption that land's productivity is function of land's value.

The main perplexities related to the use of cost-benefit analysis to evaluate climate change adaptation options are related to the monetization of all the values involved in the analysis. Most of the time the benefits supplied by an adaptation option, especially talking about community level adaptation, are not related only to economic richness. Final goal of the cost-benefit analysis is the maximization of the richness, mainly from an economic point of view. The use of Gross Domestic Product (GDP) to measure the richness impacted by climate change and by adaptation projects is also criticized. Most of the adaptation options are voted to the achieve win-win outcomes, both for local communities and for the ecologic system, that are hardly expressible in monetary terms. This implies variables that, often, are not economically valuable: most of them are represented by "intangible goods" like health, environmental degradation, social wealth. The cost-benefit analysis has been defined too much "all-encompassing": it has been considered not possible conduce a total analysis that cover all the different aspects with a homogeneous measure that is represented by the economic value (IIED, 2010). These are the reasons why, especially in the recent past, other kind of analysis have been used to evaluate the different options of adaptation investments.

One of the most important tools to choose between the various adaptation options is the Cost-Effectiveness Analysis. This analysis brings to the identification of some indicators that are considered important for the evaluation of the projects under consideration: the comparison is no longer between monetary costs and monetary benefits, but between monetary costs and physical benefits. For instance, in the

evaluation of different projects that try to reduce the mortality rate of the livestock under extreme events, the cost-effectiveness analysis investigates the cost of saving a single unit of livestock for the different adaptation options. In this sense, it is possible to find two different ratios: the cost per unit of outcome and the outcome per unit of cost. Cost-effectiveness analysis presents many advantages if compared to the cost-benefit one. It is characterized by a more simple use and it is possible to include in the evaluation all the variables that are considered important, even if they are not expressible in monetary terms.

2.3.3: Implementation.

The implementation of the project is the most practical part of the entire process. After choosing the best option available, the implementation on the field must be strictly corresponding with the general and specific outlines of the project itself. In this step there is no possibility to design a standardized procedure: every project has to be threaten in a different and specific way.

2.3.4: Supervision, monitoring and evaluation.

The process consisting in the monitoring and evaluation activities and the definition of the indicators should be clearly derived from the project development goals and from the logical framework that should characterize the project, divided into its components: inputs, activities, outputs, outcomes and impacts.
The goals of a project could be different considering the specificity of the activity. Usually, operations and projects aimed to the achievement of adaptation to climate change have two important objectives: to increase the level of resilience of the community with respect to the climate variability; and to increase the adaptive capacity of the system under the pressure of present and expected future climate variability. These two main development objectives could be translated in a particular project or activity goals, such as: increase resilience of the vulnerable socio ecosystem managed; enhance the adaptive capacity of the vulnerable natural system; reduce or eliminate the

causes of the increasing vulnerability of the system; improve social awareness and preparedness to climate variability.

Depending on the specific goal of a project, there are different indicators that could be chosen as significant to monitor and evaluate the activity under consideration. The World Bank study (2010), suggests the distinction between "process indicators" and "long-term effect indicators": the first set is represented by the indicators that permit the evaluation of the outcomes of the particular project, while the second set is represented by the indicators that permit the evaluation of the sustainability and the effectiveness of the adaptation strategies adopted in the long run. There is not a clear classification that permits to distinguish between the process and long-term effect indicators: their definition depends on the specificity of the projects and on the goal that the project is supposed to achieve.

In order to monitor and evaluate different aspects of the project, it is possible to classify different categories of indicators: since the adaptation activity is implemented in a socio ecosystem, the indicators should help to consider the impact caused by the project on the environment, on the society, on the institution and on the economy of the system. In the tables 2.1 – 2.4 it is possible to find the most common indicators for each of these categories.

Table 2.1: Social Indicators

SOCIAL		
Theme	**Sub-theme**	**Indicator**
Equity	Poverty	Percent of Population Living below Poverty Line
		Gini Index of Income Inequality
		Unemployment Rate
	Gender Equality	Ratio of Average Female Wage to Male Wage
Health (6)	Nutritional Status	Nutritional Status of Children
	Mortality	Mortality Rate Under 5 Years Old
		Life Expectancy at Birth
	Sanitation	Percent of Population with Adequate Sewage Disposal Facilities
	Drinking Water	Population with Access to Safe Drinking Water
	Healthcare Delivery	Percent of Population with Access to Primary Health Care Facilities
		Immunization against Infectious Childhood Diseases
		Contraceptive Prevalence Rate
Education (36)	Education Level	Children Reaching Grade 5 of Primary Education Adult
		Adult Secondary Education Achievement Level
	Literacy	Adult Literacy Rate
Housing (7)	Living Conditions	Floor Area per Person
Security	Crime (36, 24)	Number of Recorded Crimes per 100,000 Population
Population (5)	Population Change	Population Growth Rate
		Population of Urban Formal and Informal Settlements

Source: United Nations Conference on Environment and Development (UNCED), 2003.

Table 2.2: Environmental Indicators

ENVIRONMENTAL		
Theme	**Sub-theme**	**Indicator**
Atmosphere	Climate Change	Emission of Greenhouse Gases
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas
Land (10)	Agriculture (14)	Arable and Permanent Crop Land Area
		Use of Fertilizers
		Use of Agriculture Pesticides
	Forest (11)	Forest Area as a Percent of Land Area
		Wood Harvesting Intensity
	Desertification (12)	Land Affected by Desertification
	Urbanization (7)	Area of Urban Formal and Informal Settlements
Oceans, Seas and Coasts (17)	Coastal Zone	Algae Concentration in Coastal Waters
		Percent of Total Population Living in Coastal Areas
	Fisheries	Annual Catch by Major Species
Fresh Water (18)	Water Quality	Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water
	Water Quality	BOD in Water Bodies
		Concentration of Faecal Coliform in Freshwater
Biodiversity (15)	Ecosystem	Areas of Selected Key Ecosystems
		Protected Area as a % of Total Area
	Species	Abundance of Selected Key Species

Source: United Nations Conference on Environment and Development (UNCED), 2003.

Table 2.3: Economic Indicators

ECONOMIC		
Theme	**Sub-theme**	**Indicator**
Economic Structure (2)	Economic Performance	GDP per Capita
		Investment Share in GDP
	Trade	Balance of Trade in Goods and Services
	Financial Status (33)	Debt to GNP Ratio
		Total ODA Given or Received as a Percent of GNP
Consumption and Production Patterns (4)	Material Consumption	Intensity of Material Use
	Energy Use	Annual Energy Consumption per Capita
		Share of Consumption of Renewable Energy Resources
		Intensity of Energy Use
	Waste Generation and Management (19-22)	Generation of Industrial and Municipal Solid Waste
		Generation of Hazardous Waste
		Generation of Radioactive Waste
		Waste Recycling and Reuse
	Transportation	Distance Traveled per Capita by Mode of Transport

Source: United Nations Conference on Environment and Development (UNCED), 2003.

Table 2.4: Institutional Indicators

INSTITUTIONAL		
Theme	**Sub-theme**	**Indicator**
Institutional Framework (38, 39)	Strategic Implementation Of SD (8)	National Sustainable Development Strategy
	International Cooperation	Implementation of Ratified Global Agreements
Institutional Capacity (37)	Information Access (40)	Number of Internet Subscribers per 1000 Inhabitants
	Communication Infrastructure (40)	Main Telephone Lines per 1000 Inhabitants
	Science and Technology (35)	Expenditure on Research and Development as a Percent GDP
	Disaster Preparedness and Response	Economic and Human Loss Due to Natural Disasters

Source: United Nations Conference on Environment and Development (UNCED), 2003.

To establish a good process of monitoring and evaluation, a two steps activity should be conducted: collection of baseline data, and evaluation of the impact of the adaptation project (World Bank, 2010).

Project's performances are assessed comparing the values of the chosen indicators at the initial step and the data collected after the implementation. The collection of baseline data and constant monitoring of the values assumed by the indicators during and after the implementation, permits to the organization that has to evaluate the project to compare: the situation after the project impact with the initial situation; the situation after the project impact with the estimation of what could have happened without the implementation of the adaptation project (baseline scenario).

The kinds of data that should be collected are strictly linked with the indicators judged significant for the evaluation of the project: climatic and environmental data; socio-economic data; ecosystem services data; institutional and policy process data.

Sometimes it could happen that the data are not available and the process of assessment of the initial situation and the creation of a baseline scenario is not possible. In these cases, in order to evaluate a project, there are several possible solutions:

- Compare the values of the indicators in the project area with the values of the same indicators of similar areas immediately outside the project area;
- Monitor the value of the principal indicators during the implementation of the project in order to monitor and evaluate the trends;

- Compare the value of the principal indicators with the official statistics (when available), or statistics created by other organizations (NGOs, International organizations…).

Monitoring and evaluation activities could provide the proof of the proper implementation of the project; the possibility to scientifically show the validity of the specific adaptation strategy to contrast the specific situation; the availability of data that allow to study the replicability of the adaptation strategy: all these aspects contribute to define the importance of this part of the project implementation process.

Chapter 3: "Top-Down" and "Bottom-Up" approaches in adaptation to climate change. The insurgence of Community-Based Adaptation strategies.

Introduction

As discussed in the previous chapter, the involvement of the local communities has to be considered crucial for the success and the efficient implementation of most of the adaptation strategies. In the past, this aspect has been overlooked too many times. This chapter will discuss the two possible approaches that could be adopted in decision-making about adaptation and development strategies. These two different approaches are linked to the different contribution of the stakeholders involved in the issue: they will be defined "top-down" and "bottom-up" approaches.
After an introduction about this topics, one of the project implemented by the United Nations Environment Programme (UNEP) will be examined as an example of a strategy that will be considered mainly "top-down". Afterwards, the Community-Based Adaptation strategies will be taken into consideration: in this case the approach ro be analysed will be considered, mainly, "bottom-up".

3.1: "Top-Down" vs. "Bottom-Up" approach: two different ways to think about adaptation and development.

As analysed in the previous chapter, the stakeholders involved in the decision making process are various and belong to different institutional and geographical levels. Climate change is a complex phenomenon; it causes many consequences in different parts of the globe. Most of the problems related to climate change affect entire regions. These represent trans-boundary problems that are more efficient to face with the cooperation of international and national institutions together with the different stakeholders involved. Due to the supranational relevance of these phenomena, it is easy to understand the strong role assumed by the international organizations in coping with climate change related problems.

In the past thirty years, most of the actions that aimed at raising the decision maker's attention on the climate problems have been taken by international organizations. The dynamic that was developed could be represented by the following steps:

- Scientific debate;
- International organizations and Intergovernmental institutions;
- Governments and national institutions;
- National agencies;
- Local institutions;
- NGOs and local practitioners;
- Local communities.

Traditionally, the standard process has been developed in this way: scientific debate started to highlight the phenomenon of climate change; the pressure that came from the scientists pushed the international organizations to improve the awareness about these issues. The actions of the international organizations have been geared to focus the public opinion on environmental topic, in order to create a political debate about the issue. In this sense, it is interesting to read some of the official documents of the United Nations (UN), such as the Resolution 38/161 about the institution of the so-called "Brundtland Commission" passed by the UN General Assembly in 1983:

"…suggests that the Special Commission, when established, should focus mainly on the following terms of reference for its work:

(a) To propose long-term environmental strategies for achieving sustainable development to the year 2000 and beyond;

(b) To recommend ways in which concern for the environment may be translated into greater co-operation among developing countries and between countries at different stages of economic and social development and lead to the achievement of common and mutually supportive objectives which take account of the interrelationships between people, resources, environment and development;

(c) To consider ways and means by which the international community can deal more effectively with environmental concerns, in the light of the other recommendations in its report;

(d) To help to define shared perceptions of long-term environmental issues and of the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long-term agenda for action during the coming decades, and aspirational goals for the world community, taking into account the relevant resolutions of the session of a special character of the Governing Council in 1982" (UN, 1983).

Another important international meeting which aimed to focus the decision makers' attention on the environmental and social problems was the "United Nations Conference on the Environment and Development (UNCED)" that took place in Rio de Janeiro in 1992. Outcome of this work is the "Rio Declaration on Environment and Development". This declaration consists in 27 principles that should guide the world towards the achievement of a sustainable development.

Once that the political awareness has been created, the role of the international organizations has been geared to the official assumption of responsibility by the national governments. The coordination of these international strategies has been motivated by the efficiency of a participated action to cope with the climate issues, trying to avoid the possibilities of opportunistic behaviours. One of the most famous examples of this practice has been the international agreement to save the Ozone Layer, which is considered one of the greatest successes among the UNEP activities. This treaty, known as "Montreal Protocol on Substances that Deplete the Ozone Layer", was signed between 1987 an 1989 by 196 countries from the entire globe (UNEP, 2006). The aim of this treaty was the protection of the ozone layer by the phasing out of the production of substances responsible for ozone depletion, such as Chlorofluorocarbons (CFCs).
The process of implementation of this environmental strategy is a good example of what is defined a "top-down" approach. The flow of information started from the scientific community when, in 1973, the chemists Rowland and Molina showed that the release of CFCs in the atmosphere was extremely harmful for the ozone layer that protects the

Earth from solar radiations (UNEP, 2006). The second step was represented by the political debate fostered by the international organizations that brought the issue to the Vienna Conference in 1985. The outcome of this conference was the "Vienna Convention for the Protection of the Ozone Layer", a Multilateral Environmental Agreement, which established a framework for negotiating international regulations on ozone-depleting substances, and that later brought to the above mentioned treaty. By signing this agreement the local governments committed themselves to ban the production and the use of these substances in their territories. The effects of this agreement and the information related to this issue were diffused from the local governments to the national stakeholders and the local communities.

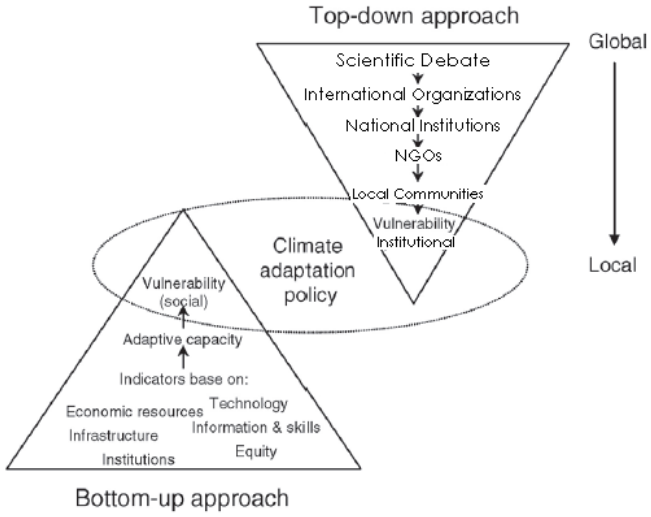
The peculiarity of this process has been the approach, which could be considered totally "top-down": the flows of information and decision process were following the steps represented by the succession: scientific debate; international organizations; local governments; industrial sector; local institutions; local communities; down to the single user of the substances under consideration.

The approach described above has been used for more than thirty years and has brought to different results, sometimes great successes and some other times incredible failures, depending on the environmental issues under consideration and the procedure of implementation of the possible actions.

The "bottom-up" approach in coping with climate change related issues is a relatively new entry in the scientific debate on the topic. The main aspects of this approach are represented by the involvement of the local communities on the decision making process and the practical implementation of the environmental strategies. In this case the flow of information and the study of the practices to cope with the problems are coming from the local to the national and international levels. There is more interaction between the local community and the scientific debate - with the collaboration of international, national and local institutions - and an active participation of the locals for the efficient application of the strategies designed to cope with the problems under consideration. In this process the role of NGOs and local practitioners assumes a great relevance, while is only marginal in the "top-down" approach.

Especially when addressing the topic of adaptation to climate change, the combination of the "top-down" and the "bottom-up" approaches has to be considered fundamental (Figure 3.1). As already mentioned in the second chapter, climate change adaptation is a strategy that tries to reduce the impact of climate change to the local socio ecosystem. In this case, the deep knowledge of the territory and of the social and economic dynamics of the local system provides crucial variables that have to be considered for the adaptation decision process. Another important aspect is the mutual reliability between the scientific world and the local community.

Figure 3.1: "Bottom-up" and "Top-down" approaches.



Source: Adapted from Dessai and Hulme, 2004: "Does climate adaptation policy need probabilities?".

In the past, the application of climate change adaptation strategies that were designed using the "top-down" approach showed not to be really efficient, and in some cases has brought to phenomena of "mal-adaptation". The reasons that brought to these problems could have been different:

- Lack of communication between local communities and scientific debate/decision makers:
    - Scarce knowledge related to the particular territory;
    - Scarce knowledge of the social and economic dynamics inside the local community;
    - Lack of credibility of the scientific tools among the locals;

    - Scarce understanding of the actions to implement on the field level by the local practitioners.
- Inefficiency of the institutional machine at the national and local level:
    - Inefficient allocation of resources;
    - Scarce understanding of the actions designed at the supra-national and national level;
    - Scarce technical and scientific knowledge at local level;
    - Lack of coordination and control;
    - Scarce reliability of the local institutions at the grassroots level.

These aspects have to be particularly considered for the stimulation of autonomous adaptation and for the strategies that mainstream adaptation to climate change into development. In these cases, the knowledge of the particular dynamics of the socio eco-system under consideration is crucial. The "bottom-up" approach is important also, when strategies have to be designed using "soft" planned adaptation tools.

3.2: Managing knowledge for adaptation to climate change: a good combination of top-down and bottom-up approach? The case of the "Regional Climate Change Adaptation Knowledge Platform for Asia (AKP)".

In the discussions above, the importance of the knowledge management has been highlighted when there is the necessity to drive the adaptation to climate change. The AKP has been developed by the collaboration of UNEP (United Nations Environment Programme), AIT (Asian Institute of Technology)/UNEP RRC.AP (Regional Resource Centre for Asia and the Pacific) and SEI (Stockholm Environment Institute) in 2009, "to respond to demand for effective mechanisms for sharing information on climate change adaptation and developing adaptive capacities in Asian countries, many of whom are the most vulnerable to the effects of climate change" (AKP, 2010).

Looking at the goals of the Platform, it is possible to gather that the approach used to design this strategy, at least in its intentions, is a combination of the "top-down" and "bottom-up":

"Through its work the Adaptation Knowledge Platform is working towards building bridges between current knowledge on adaptation to climate change and the governments, agencies and communities (especially the poor and most vulnerable segments of society) that need this knowledge to inform their responses to the challenges that climate change presents to them" (AKP, 2010).

The goals that the AKP wants to achieve in practice are the sum of three components:

"a) Regional knowledge sharing system: a regionally and nationally owned mechanism to promote dialogue and improve the exchange of knowledge, information and methods within and between countries on climate change adaptation and to link existing and emerging networks and initiatives.

b) Generation of new knowledge: to facilitate the generation of new climate change adaptation knowledge promoting understanding and providing guidance relevant to the development and implementation of national and regional climate change adaptation policy, plans and processes focused on climate change adaptation.

c) Application of existing and new knowledge: synthesis of existing and new climate change adaptation knowledge to facilitate its application in sustainable development practices at the local, national and regional levels" (AKP, 2010).

From this point of view the implementation of this project could produce excellent results for the diffusion of good practices to achieve adaptation to climate change while working for development. However, this tool, that the mentioned organizations have been developing, is showing some inefficiency. The relations created with international organizations and members of the scientific debate are consolidated, as is also the effective cooperation with national governments in the region under consideration. The problem that is emerging is the scarce participation of the local communities: there is not a real involvement of the grassroots. The communication practices adopted are effective in the involvement of the governments and the institutions, but the process of

diffusion and acquisition of knowledge is not able to reach the local communities and the field level practices. The reasons are several and different:

- Lack of communication drivers with the grassroots;
- Impossibility for the local communities to access the information;
- Scarce education and diffusion of technological apparatus in the rural areas;
- Scarce understanding by rural communities of the knowledge shared;
- Scarce availability of data for assessing the impact at the field level;
- Scarce awareness of the environmental issue in the rural areas.

In order to avoid these problems, the international organizations and the scientific debate involved in this project have been trying to use the national and local institutions as a driver to reach the local communities. The level of cooperation between the AKP and the institutions is fully developed in most all cases. However, in general national and local institution have been showing to be inefficient in covering the important role designed for them, especially for what concerns the practical application of the knowledge about adaptation theories and practices.
This trend, also, has several causes:

- Inefficient organization of the institutional apparatus;
- Lack of specific knowledge;
- Short run vision of the decision makers;
- Scarce cooperation of the local institutions with the local communities;
- Evident cases of corruption.

In this context, the role of local and international NGOs and Foundations assume large importance. In some of the cases, the no-profit sector showed to be able to repair the inefficiencies of the institutional apparatus.

3.3: Community-Based Adaptation and Participatory approach.

In this section some of the theories related to the community-based adaptation strategies and the participatory approach to climate change and development will be examined. The information at the base of this section and following subsections are mostly taken from the work published by the International Institute for Environment and Development (IIED) in 2010.

The literature about this topic is based on the new approaches to adaptation to climate change that have been emerging in the recent past. These consist in community-based and participatory approaches that want to achieve adaptation and development building strategies basing on the priorities, knowledge and capacities of local people. The studies about this topic started with the approaches and methods developed for acting on disaster risk reduction and community development.

3.3.1: Community-based adaptation, an overview.

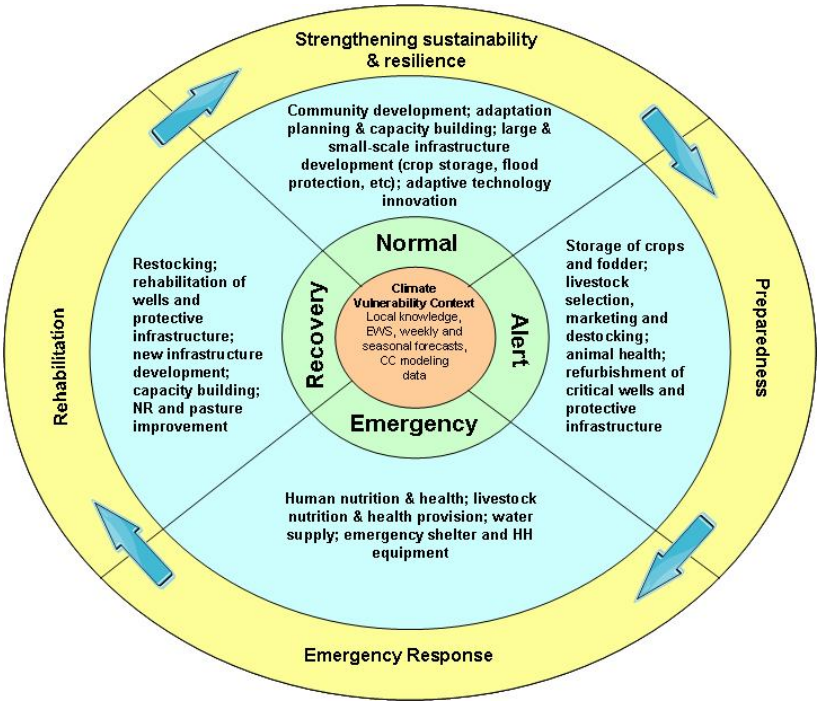
"Community-based adaptation to climate change is a community-led process, based on communities' priorities, needs, knowledge, and capacities, which should empower people to plan for and cope with the impacts of climate change" (IIED, 2010).

The assumption from which this process started is the observation that local communities, especially for what concerns agriculture and water management, are the most experienced in adapting to their complex, different and risk prone environments. This is an observation that is particularly true when we consider the fact that vulnerability to climate change is not only depending from environmental variables, such as geographical position, water availability, fertility of the soil, natural resources, etc. but is depending also on social, economic and political dynamics that influence the different groups. The study of the autonomous adaptation of a local community is important to determine its vulnerability to climate threats. In almost all the cases the local resilience is not enough to cope with the impacts that climate issues could have in the next future. The most efficient way to reduce the vulnerability is a good combination of community development and adaptation to climate change strategies.

The actions in which the involvement of the local communities is considered crucial are represented by the stimulation of autonomous adaptation and the implementation of planned adaptation options, especially the "soft" and "no regret" ones.

Community-based adaptation strategies start with the study of local needs and perceptions and want to achieve poverty reduction and livelihood benefits, as well as vulnerability reduction to climate change and extreme events. The study of this approach started with the discussion about disaster risk reduction strategies. There are different frameworks that study how to manage climate change risks with the same procedures studied for disasters (Figure 3.2).

Figure 3.2: Climate risk cycle management.



Source: Christian Aid, 2009: "Christian Aid Adaptation Toolkit: Integrating adaptation to climate change into secure livelihoods".

Sometimes community-based adaptation projects look like development projects and it is very hard to identify an action that is completely aimed to achieve adaptation. In these cases the action of mainstreaming adaptation to climate change into development is fully obtained.

One of the main characteristics of the community-based adaptation is that these strategies, aimed to cope with the potential impact of climate change on livelihoods and

with the vulnerability to extreme events and natural disasters, are designed using a combination of local and scientific knowledge. The incorporation of scientific and local information about climate change is fundamental to design good strategies. In this regard the IIED study reports:

"CBA [Community-Based Adaptation] work needs to incorporate information on climate change and its impacts into planning processes. This includes:

- scientific information (e.g. long-term predictions from climate change models, seasonal forecasts, information on trends based on data collected at nearby weather stations);

as well as

- local knowledge about trends and changes experienced by communities at a local level and strategies these communities have used in the past to cope with similar shocks or gradual climatic changes" (IIED, 2010).

The drivers used by international organizations and donors to design and implement adaptation and development activities with the participation of the local community are represented mainly by local partners, such as NGOs, local practitioners, foundations and community groups.

3.3.2: Participatory methods for community-based adaptation. Aspects of the communication issue.

There are different tools used in managing community based adaptation strategies that are similar to the ones used for the disaster risks reduction. Other tools have been developed specifically for the adaptation to climate change. Some of these are used for the process of co-learning about adaptation and climate change. As discussed above, the availability of information and knowledge is crucial in creating awareness about climate change issues. Sometimes, communication between communities, development workers and scientists is not simple: some of these tools have been developed to try to avoid communication problems. The diffusion of information and knowledge is crucial to create awareness about climate change issue.

Local people, usually, have a good level of awareness about changes in their environment, but they almost completely ignore the global causes and effects of climate change. The communication tools are designed in order to combine local and external knowledge using the language that the community speaks and a terminology that local people can understand. Different tools and strategies are used depending on the specificities of the community under consideration. For example, in some cases children have been used like a driver to diffuse information about climate change and its impacts within the community.

The process of communication follows the process of collection of information. Local knowledge about climate change is collected through the interaction with the community members. Local knowledge about the trends in climate variability is combined with scientific observations and forecasts.

In order to obtain higher effectiveness, the planned adaptation strategies should be designed respecting the priorities of the local communities and trying to prefer methods that have already been used by the locals in implementing autonomous adaptation.

3.3.3: Lessons and challenges about local and scientific knowledge and participation.

- Scientific knowledge.

Local communities, often, have problems with the scientific data. The scientific studies about climate change and the climate models can help to identify macro-areas in which it is more probable to have strong impacts, but are of little use if applied to the micro geographic scale of the local communities. The scientific community should produce models and forecasts modelled at the local scale. Another problem is related to the weather forecasts: especially in the most remote areas, meteorological stations -if present- are not well equipped nor properly managed. These facts deprive the local communities of important data that could strongly influence their decisions. Due to the lack of communication systems, in some areas, even when data are available, they are not easily accessible by local communities.

In some cases, it could happen that the total lack of education jointly with the strength of the traditions inside the local community make the locals not trust the information supplied by the scientific community.

- Local Knowledge.

The last problem exposed above is true for the scientific side also. Sometimes communities show little confidence in the reliability of the information received by scientists. In the same way, scientists are often reluctant to trust local knowledge, because of its empiricism the total lack of scientific rigour.
In some cases it has been shown that climate data collected by locals were fitting with the data collected by the meteorological stations in the same areas for the same period (Gill, 1991). Some communities have developed a traditional system to forecast the coming weather. Farmers from some regions in South-Asia, for instance, use cloud formation, wind pattern, animal behaviour and rainbows' position to predict the coming season (IIED, 2010). Another traditional weather forecasting system studied is based on lunar cycles and it is used to assist in choosing the best moment to plant the crops. Even if in some cases they have shown to be almost completely reliable, the scientific world however indicates that all these traditional methods will almost completely loose their accuracy because of the changes in climate (IIED, 2010).

- Participation

There are many occasions and many levels in which is possible to enforce the participation of the local community into the development and adaptive process. The main are identified in the IIED study with their characteristics:

- "**Passive participation**: People participate by being told what is going to happen or has already happened. It is a unilateral announcement by an administration or project management without listening to people's responses. The information being shared belongs only to external professionals.

- **Participation in information giving**: People participate by answering questions posed by extractive researchers using questionnaire surveys or similar approaches. People do not have the opportunity to influence proceedings as the findings of the research are neither shared nor checked for accuracy.
- **Participation by consultation**: People participate by being consulted, and external people listen to their views. These external professionals define both problems and solutions, and may modify these in the light of people's responses. Such a consultative process does not concede any share in decision-making, and professionals are under no obligation to take on board people's views.
- **Participation for material incentives**: People participate by providing resources, for example labour, in return for food, cash, or other material incentives. Much on-farm research falls into this category as farmers provide the fields but are not involved in the experimentation or the process of learning. It is very common to see this called participation, yet people have no stake in prolonging activities when the incentives end.
- **Functional participation**: People participate by forming groups to meet predetermined objectives related to the project, which can involve the development or promotion of externally initiated social organisation. Such involvement does not tend to happen at early stages of project cycles or planning, but rather after major decisions have been made. These institutions tend to be dependent on external initiators and facilitators, but may become self-dependent.
- **Interactive participation**: People participate in joint analysis, which leads to action plans and the formation of new local institutions or the strengthening of existing ones. It tends to involve interdisciplinary methodologies that seek multiple perspectives and make use of systematic and structured learning processes. These groups take control over local decisions and so people have a stake in maintaining structures or practices.
- **Self-mobilisation**: People participate by taking initiatives independent of external institutions to change systems. They develop contacts with external institutions for the resources and technical advice they need, but retain control over how resources are used. Such self-initiated mobilisation and collective

action may or may not challenge existing inequitable distributions of wealth and power" (IIED, 2010).

It has been discussed how a good level of participation of rural community is crucial to achieve effectiveness and sustainability of adaptation strategies. These have to be designed on the knowledge and the priorities of the local people, on their abilities, and on their potential development. Experience shows that decision makers are often reluctant to let their professional activity become so strongly influenced by local communities' opinions. This aspect highlights how the process of participation is gradual over time.

Other important aspects about the issue of community participation are linked to the socio-economic dynamics inside the community. Sometimes it is possible to find different groups that live different lifestyles within the community. These differences could be characterized by: gender, age, social structure. These aspects could determine strong intra-community power differentials. In these cases, it is crucial to be aware about the differences in priorities, needs and vulnerability of the different groups. Ignoring these aspects, there could be the risk to favour the wealthiest part of the community members to the detriment of the poorest and most vulnerable one.

Chapter 4: Agri-Nature Foundation and the Sufficiency Economy principle.

Introduction

From the analysis conducted in the previous chapters the need to find an efficient way to implement adaptation and development activities emerges, and especially in the agricultural sector. This chapter examines the reaction of Thailand to the problems exposed in the analysis above. It describes the Sufficiency Economy (UNDP, 2007) principle that inspired the strategies adopted in the country to reduce the economic, social and environmental vulnerabilities. In the following pages, the Agri-Nature Foundation of Thailand is presented, an organization that is acting at the grassroots level applying the Sufficiency Economy principle in the agricultural sector and in the rural community organization. Aim of the qualitative analysis, proposed to examine the Foundation and the methodology adopted, is to understand how local communities are managing issues related to the consequences of climate change in a contest of general underdevelopment, and what are the main actions to improve the resilience and to reduce the vulnerability of the local socio ecosystems. This analysis also aims to find a solution to the problem of communication between the debate at the higher level and the view of the local stakeholders: to improve the diffusion of the scientific knowledge in developing community based strategies and to improve the information flow from the base to the scientific debate.

During the preparation of this study, visiting some of the learning centres of the Foundation, and especially the Maab Eueang one, in the Chonburi Province, attention has been caught by the strong pro-activeness of the locals in enforcing climate change adaptation strategies and by the efficient use of the ecosystem resources to improve the resilience towards a sustainable development and to reduce the risk of disasters. Before analyzing in further details the structure and the activities of the Foundation, it is interesting to examine the principles that inspire its strategies.

4.1: The Sufficiency Economy principle.

As discussed in the first chapter, economy of Thailand registered a considerable growth in the last 50 years. In this period, the technological and technical inputs, as well as financial inputs, were coming eminently from outside the country and following a top-down dynamic. These phenomena, and the strong inclination to exports, characterized the strong dependence of the Thai economy to the international market. The financial crisis of 1997 had strong consequences in the country (UNDP, 2007). For the first time, Thai people realized that their economy and their wealth could be extremely vulnerable and not under their control: a strong sense of powerlessness became source of anxiety and discontent. The strongest impact affected the most vulnerable part of the population: the farmers and the rural areas. The reaction of the country has been determined by the intense debate within the population on the themes inspired by the King of Thailand, H.M. Bhumibol Adulyadej – Rama IX, a figure positively and intensely trusted by the population. The debate brought to a series of strategies that combines moderation, local traditions and beliefs driven by wisdom and rationality, that is called Sufficiency Economy. A deep analysis of this theory and its application on the productive sectors, is provided by the UNDP (2007) and by Kauffman (2008, 2009); most of the information discussed in this section and in the following subsections refer to those studies.

The strategies to solve the spreading discontent have been founded in action aimed to:

- rebuild a sense of community, in order to enforce the cooperation and reduce the vulnerability;
- re-acquire, at least in part, self-reliance in order to reduce the possible impacts of international phenomena;
- avoid to align the idea of well-being with the maximization of growth and consumerism through the restoration of the traditional wisdom and moderation typical of the Buddhist culture;
- organize horizontal networks to disseminate among the population updated technologies and techniques.

These themes brought to the introduction of new ideas at the national level, such as: rice and cattle banks, micro-saving schemes, forest management projects and self-reliant farms.

4.1.1: Definition and characteristics

The ideas behind the development and the practical application of the Sufficiency Economy could be summarized reporting the words pronounced directly by the Monarch in the occasion of official pronouncements, during the period 1973-1974:

"Development of the country must proceed in stages. First of all, there must be a foundation with the majority of the people having enough to live on by using methods and equipment which are economical but technically correct as well. When such a secure foundation is adequately ready and operational, then it can be gradually expanded and developed to raise prosperity and the economic standard to a higher level by stages. It is especially important to first build a foundation in which people have an occupation and the ability to make a living, as those who have an occupation and a reliable living can then progress upwards to higher levels of prosperity. The promotion of progress must proceed in stages with care, economy, and foresight to prevent mistakes and disasters… if one focuses only on rapid economic expansion without making sure that such a plan is appropriate for our people and the condition of our country, it will inevitably result in various imbalances and eventually end up as failure or crisis as found in other countries. (Khon Kaen University, 20 December 1973; Dusit Palace, 4 December 1974)".

Further clarification about the aim and the main characteristics of this theory could be provided by the analysis of other quotations taken from different public speeches:

"A self-sufficient economy doesn't mean that each family must produce its own food, weave and sew its own clothes. This is going too far, but I mean that each village or district must have relative self-sufficiency. Things that are produced in surplus can be

sold, but should be sold in the same region, not too far so that the transportation cost is minimized.
(Dusit Palace, 4 December 1997)

I may add that full sufficiency is impossible. If a family or even a village wants to employ a full sufficiency economy, it would be like returning to the Stone Age…
This sufficiency means to have enough to live on. Sufficiency means to lead a reasonably comfortable life, without excess, or overindulgence in luxury, but enough. Some things may seem to be extravagant, but if it brings happiness, it is permissible as long as it is within the means of the individual … Some people translate 'sufficiency' from the English as: to stand on one's own feet … This means standing on our own two legs planted on the ground, so we can remain without falling over, and without asking others to lend us their legs to stand on… If everyone has enough to live on, everything will be all right. Furthermore, if the whole country can subsist, the better it would be.
(Dusit Palace, 4 December 1998)"

The discussion that followed these themes brought to the definition of this theory as:

"The Sufficiency Economy is an approach to life and conduct which is applicable at every level from the individual through the family and community to the management and development of the nation. It promotes a middle path, especially in developing the economy to keep up with the world in the era of globalization. Sufficiency has three components: moderation; wisdom or insight; and the need for built-in resilience against the risks which arise from internal or external change. In addition, the application of theories in planning and implementation requires great care and good judgement at every stage. At the same time, all members of the nation – especially officials, intellectuals, and business people – need to develop their commitment to the importance of knowledge, integrity, and honesty, and to conduct their lives with perseverance, toleration, wisdom, and insight, so that the country has the strength and balance to respond to the rapid and widespread changes in economy, society, environment, and culture in the outside world".

Following this definition, the principle of Sufficiency Economy is then based on three main components, such as: moderation, reasonableness and self-immunity. These are defined as:

1) "**Moderation** is closely linked to the idea of sufficiency. In Thai as in English, the word for sufficiency has two meanings: enough in the sense of not too little, and enough in the sense of not too much. It conveys the idea of a middle way between want and extravagance, between backwardness and impossible dreams. It implies both self-reliance and frugality" (UNDP, 2007).

2) "**Reasonableness** or means both evaluating the reasons for any action, and understanding its full consequences – not only on oneself, but on others, the society, and the environment; and not only in the short term, but the long also. This idea of reasonableness thus includes accumulated knowledge and experience, along with the analytic capability, self-awareness, foresight, compassion and empathy" (UNDP, 2007).

3) "**Self-immunity** means having built-in resilience, and the ability to withstand shocks, to adjust to external change, and to cope with events that are unpredictable or uncontrollable. It implies a foundation of self-reliance, as well as self-discipline" (UNDP, 2007).

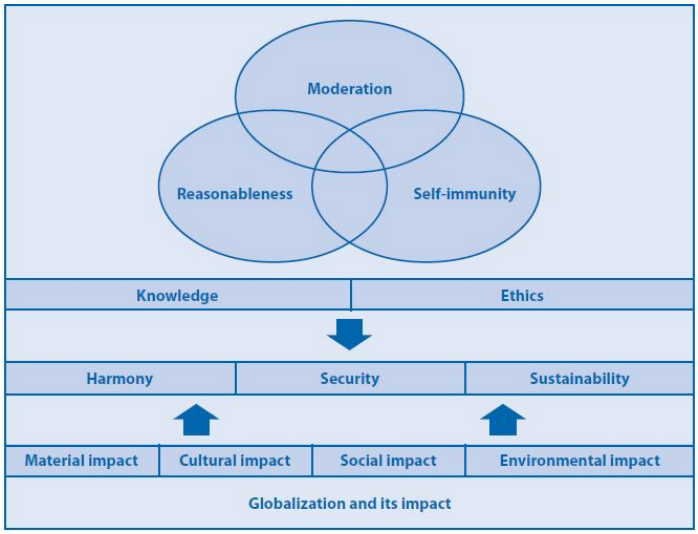
Besides these three components two other aspects are to be defined, which are knowledge and integrity:

1) "**Knowledge** means something close to wisdom in English as it encompasses accumulating information with the insight to understand its meaning and the care or prudence needed to put it to use" (UNDP, 2007).

2) "**Integrity** means virtue, ethical behaviour, honesty and straightforwardness, but also tolerance, perseverance, a readiness to work hard and a refusal to exploit others" (UNDP, 2007).

The application of the principles defined above aims to increase the resilience of the socio ecosystem and to reduce vulnerability towards external impacts (Figure 4.1).

Figure 4.1: Sufficiency Economy and Globalization



Source: UNDP, 2007.

An important aspect to highlight is that the Sufficiency Economy principle could not be defined a proper economic theory, but it could be more easily classified as a behavioural model that could be applied at different scales to drive the economic choices of the singles or the communities toward a rational risk management and sustainable development. The Sufficiency Economy principle stresses the need to protect the people from external shocks of different origins. At the local level, for instance for agricultural sectors, communities need a base of self-resilience to be able to cope with the external market and, at the same way, a nation needs a strong internal foundation to cope with the volatility of the globalized economy.

National economists believe that this behavioural model could have protected the Thai economy from the impact of the financial crisis in 1997 (UNDP, 2007). They concluded that moderation in consumption could have avoided the national reliance on foreign debt and improved the internal savings. Self-immunity of the corporations could have avoided the over-exposure to the external financial market. Reasonableness could have directed the incentive systems designed by the government in a more efficient way, especially towards Research & Development. A good foundation in self-reliance of the

decision-makers could have permitted to develop internal specific competencies and technologies, avoiding the total technological and technical dependence from the outside. The Sufficiency Economy principle provides a framework to think about the balance between efficiency and growth on one side, and security and stability on the other.

4.1.2: Practical application of the Sufficiency Economy principle: agriculture.

The first practical application of the Sufficiency Economy principle has been developed in the agricultural sector, which, as discussed above, concerns the most vulnerable part of the population. In this case, the application of this theory has been not only on the behaviour of the farmers and the rural communities, but it has been applied on the radical change of the organization of the farm, of production modalities and of the relations inside and outside the community. The application of the Sufficiency Economy theory in agriculture has been called in Thailand New Theory Agriculture programme:

"In Thailand, a recent initiative under the Sufficiency Economy programme described as New Theory Agriculture (NTA) has supported many successful initiatives which fall within an eco-agriculture framework. NTA farms are divided into the following ratio: 30/30/30/10, the first part is for growing rice, the second for vegetables, the third for water retention and/or a fish pond, the remainder for housing and other uses" (Kaufman, 2008, from Sathirathai and Priyanut, 2004).
"Eco-agriculture means to increase agricultural production and simultaneously restore biodiversity and other ecosystem functions, in a landscape or ecosystem management context" (Kaufman, 2008, from McNeely and Scherr, 2003).

The programme started in the early 1990s with the creation of a self-reliant family farm model in the centre of Thailand. A small plot of land, sized around 2.5 hectares, was divided in four parts:

- 30% for digging a pond to store water for irrigation and aquaculture;
- 30% rice production;

- 30% for the plantation of other crops, trees for fruit and other products;
- 10% for housing, animal husbandry and other uses.

The fertilization of the soil and the control of pests and parasites have been ensured by the use of organic and natural methods only. Productive process has been developed in order to maximize the synergies between livestock and crops, in order to ensure self-reliance.

This organization technique was born in response to the trend of the previous decades, which saw the diffusion in the country of cultivations mainly characterized by chemical-dependent monocultures.

Self-reliance at the farm level is only the first stage to achieve. As specified above, the Sufficiency Economy principle does not mean isolation: it does not reject the market. Farmers are extremely encouraged to trade the surplus beyond household consumption.

The second stage of development takes place at the community level. In this stage the farmers are encouraged to improve the productive capacity through cooperation within the community: the idea is to achieve economies of scale and scope. To achieve this goal the cooperation within the community is crucial. The forms of cooperation could be represented by: cooperative production; community saving groups; community forms of health security, social welfare and mutual assistance. Exchanges outside the community are encouraged, but first of all the self-reliance of the group before has to be guaranteed.

The third stage is represented by the interaction of the community with the national and international market. In this stage the use of all the economic systems and services is allowed. Improving commerce, the members of the community could improve their technological endowment and access the financial market.

Under this view, the development is seen as a process that has to be achieved by stages with the involvement and the cooperation of the entire community. The capitalistic idea of the farmer that invests in a chemical-intense monoculture and accesses the international market to sell his product is overcome. The maximization of the profits of

the classical economic model is replaced by the prudential development of the entire group.

4.1.3: Impaeng network experience: development in the rural area.

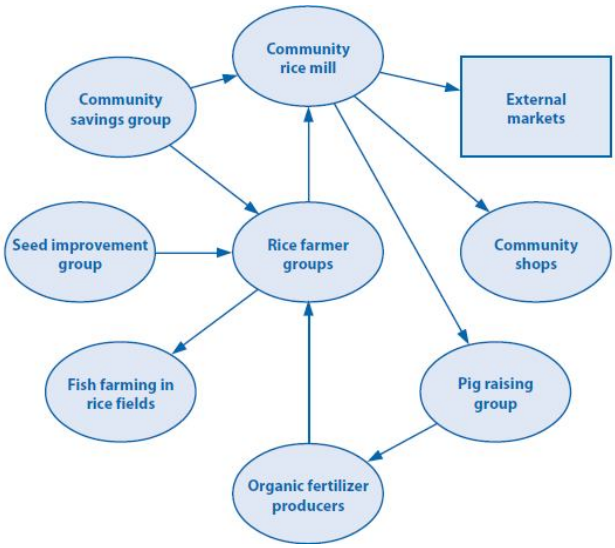
The first communities that experienced the spontaneous and complete application of the three stages of the New Theory Agriculture were the Inpaeng network (UNDP, 2007). Inpaeng is a network that nowadays comprehends 900 villages with more than 100,000 inhabitants in the Northeast of Thailand, the poorest part of the country. During the 1950s, farmers in this region started to practice monoculture. The main product was represented by cassava, destined to the European market for animal feed. The second source of income was represented by the natural forest that surrounded the area. After some years the price of cassava collapsed, the soil was eroded by overexploitation, chemicals contaminated soil and water, food security was linked to the national market, due to over-exploitation the forest started to decline, and in a few years the economic losses dissolved savings and increased debts. The change was started by one of the communities, Ban Bua, when it decided to turn back to an organic farming which was oriented towards the satisfaction of the local needs. The strategy applied was characterized by the Sufficiency Economy principle. In a few years, the production of each farm was represented by rice, different kinds of fruits, vegetables and medicinal herbs. The production rate rose faster than the consumption, and soon the self-reliance of the community was ensured. The community started to trade again and to restore the local economy.

The following step was represented by the creation of the network, in order to develop community enterprises. The success of the pioneer communities captured the interest of the other villages and the network started to grow. The cooperation between the communities brought to the development of efficient technologies and techniques. The restoration of the natural biodiversity of the area, joined with the restoration of the natural forest, brought to the sustainable exploitation of renewable organic resource, largely available in the territory. Plants and other local materials were used to produce

organic fertilizer, insecticide, soaps, slack, herbal medicines and other important products.

The third step of development was represented by the cooperation of the entire network to improve product diversification and increase food and economic security. The common investments brought to the first food processing industries for the production of juices and alcoholic derivates of fruits. In this stage it is also possible to assist to the birth of the service sector. This cooperation strategy was not only implemented within the network, it was also represented by the collaboration of the network with international organizations, national and local institutions and NGOs. At this stage it was also possible to witness the creation of strong linkages with other similar networks that had started to grow all over the country. Networking activities gave to Inpaeng the possibility to acquire better technologies and knowledge. The model was diffused by the creation of learning and demonstration centres.

Figure 4.2: Inpaeng rice network.



Source: UNDP, 2007.

UNDP (2007) report concludes in this way the analysis about Inpaeng:

"The success of the Inpaeng Network is based on the elements and conditions of the Sufficiency Economy. The first seed of the Inpaeng Network began from the need for greater self-reliance to cope with global forces beyond communities' control. The

participants used local knowledge and insight to expand the local economy. They have moved ahead in stages, always building on their inner resources, carefully appraising their options, and always choosing the middle way marked by moderation. A straightforward, ethical attitude was the necessary foundation for mutually beneficial forms of cooperation. The network built resilience against shocks by investing in social capital, accumulating knowledge, and cultivating a future generation of leadership. After all, this prudence is a product of the harsh environment, codified in the folk poems and proverbs of the region, such as *Before heading further, always look back and make sure every step you have taken and will be taking are clear to you*. Linkages anchored firmly in the communities gradually expanded within the Network and then outward to market and institutions within Thailand and beyond.

In their own definition, the Sufficiency Economy means eight points:

- having a secure living with enough food;
- having enough to give to relatives and friends;
- having enough to contribute for charities and needy people;
- having clean and safe food to eat and be healthy;
- living in harmony with nature and other people;
- accumulating knowledge and wisdom;
- developing community-based enterprises;
- having community-based welfare schemes and safety nets.

They have come a long way by moving gradually in pace with their own capability" (UNDP, 2007).

4.1.4: Application of Sufficiency Economy in business.

As analyzed in the first chapter of this work, agriculture employs a large part of Thai population, but the incidence of this sector on the whole economy of the country is representing no more than 15%. The analysis of the Thai economists' opinions, exposed above, about the pro-activeness of the application of the Sufficiency Economy principle to business in situations like the financial crisis, can better clarify how the industrial and business sectors have been pushed towards this direction. The object of this study is

eminently geared to the analysis of rural areas and community based adaptation strategies. However, it is interesting to quickly explore how the business sector is adopting the Sufficiency Economy.

For this reason, it is interesting to analyze the main strategies adopted by the most important companies before and after the application of the new principle. The business strategy was mainly geared to the growth and profit maximization. After the adoption of the new principle there has been the introduction of strategies that included corporate good governance, innovation, massive investment on R&D and development of techniques and technologies. The Human Resource strategy has been driven towards the development of the internal resources, the creation of professional figures inside the corporations, the maximization of the talent management. The members of the corporations were put at the centre of the investments; there was the development of multi-skill employees, the organization of trainings and the cooperation between companies and universities.

The common elements that can be highlighted among the changes in the strategy of the main companies have been developed respecting the main components of the Sufficiency Economy principles:

- Moderation

It is possible to highlight the general trend to assume a long-term perspective. Business has been designed in order to be sustainable in the future and short-term speculations have been generally avoided. The level of profits given to the shareholders has been reduced with respect to the past and the surplus has been destined to constructive investments. The growth of the companies has been monitored and planned in order to be gradual and based on the development of the internal competencies.

- Insight

Corporate Social Responsibility has been adopted and generally developed. Companies have been more active in the collaboration with all the stakeholders, including workers, suppliers and costumers. The investments on the development of the internal human capital have been extensive.

- Resilience

A strong combination of self-reliance and risk management has been used as the foundation to design business strategies. The investments have been characterized by

prudence. The macroeconomic management has been characterized by an increase in immunity.

- Knowledge

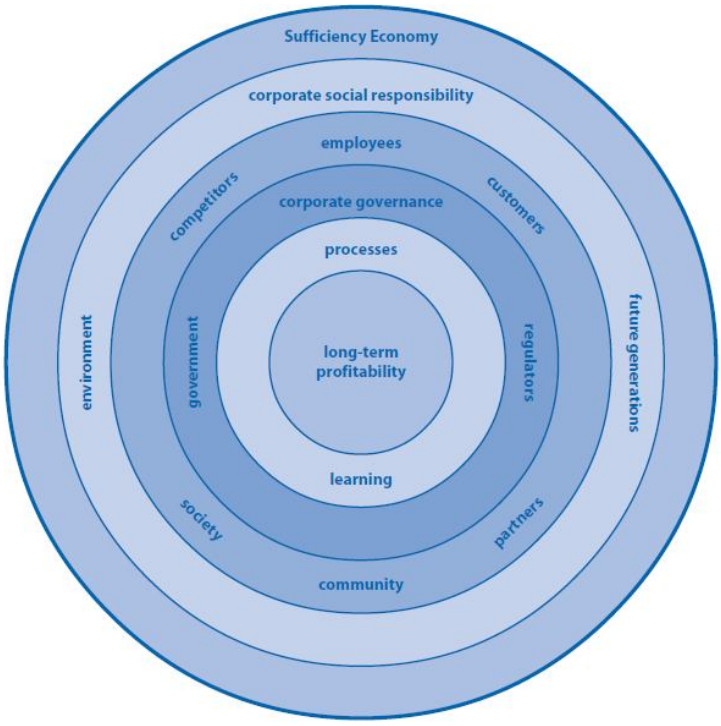
The growth of the technical and technological capacity of the main corporations has been obtained by the large investments on their internal capabilities: human capital and internal technologies.

- Integrity

The conduction of the business has been characterized by the frequent adoption of more ethical practices especially for what concerns its impact on society and environment. There has been a general adoption of Corporate Social Responsibility (UNDP, 2007).

A balanced strategy scheme, that could be representative of the inclusion of the Sufficiency Economy principle, is represented in the figure 4.3.

Figure 4.3: Balanced strategy for long term growth.



Source: UNDP, 2007.

4.2: Development policies in Thailand: Sufficiency Economy-driven strategies.

The principle examined in the section above has had a great success in Thailand. Decision makers at national and local level are trying to design new development strategies using the Sufficiency Economy.

The analysis conducted by UNDP about this principle reports that the ideas behind the development agenda of the international organization share a lot of perspectives with the ideas behind the Sufficiency Economy (UNDP, 2007). The Sufficiency Economy perspective could constitute the method to design and implement development strategies, especially in the rural areas with the collaboration of local communities.

Following the analysis conduced by UNDP (2007), the adoption of the principle by the Thai decision makers is bringing to design strategies and actions that could be summarized in several main areas strongly linked to each other.

- Sufficiency Economy and eradication from poverty: reducing the vulnerability of the poor.

The first step to achieve development is characterized, following the exposed principle, by self-reliance, which is the possibility to relatively rely on the one's own resources. To achieve this goal, the principle has been integrated in the national anti-poverty strategies. The actions are geared to: build local capacity for self-reliant production, discipline expenditure and prudently manage the risk. Other strategies are represented by: the possibility for the poor to receive the right to cultivate some plots of land owned by the government; the assumption of legal responsibility for the local communities about the efficient and sustainable use of the natural resources; the more efficient administration of the funds allocated for development.

- Sufficiency Economy and the development of rural community.

The main activities are represented by: increasing of building capacity for spontaneous and sustainable economic activities; increasing of the local capability in managing finance and investments; increasing of the participation of the locals to the local institutions' decisions; stimulation of cooperation activities.

- Sufficiency Economy and corporate responsibility.

The strong dissemination of Corporate Social Responsibility and Sufficiency Economy principle among the companies operating in the country is considered crucial for the future sustainability of the economic development.

- Sufficiency Economy and governance in public administration.

To achieve a good level of development it is important to maximize the efficiency of the national and local institutions. Corruption and general inefficiency are quite common in the country. Some of the moral values of the Sufficiency Economy principle are exactly designed to cope with this situation. There is the need to immunize from political influence the institutions that monitor corruption phenomena in public services. To improve the control on the decision makers, and to ensure a larger freedom of information.

- Sufficiency Economy and sustainable development.

The intervention on the national policies is geared to improve the resilience of the national economic system, reducing the vulnerability to the volatility of the international market. In the same way the local economies have to be designed in order to be self-reliant and to prudentially manage the risks. The energy policy has to be redesigned in order to be more consistent; the environmental impact of the economic activities has to be reduced in order to achieve sustainability and efficiency in the use of the environmental resources.

- Sufficiency Economy and human development.

The need to upgrade the country's education quality has been highlighted, especially for the rural areas. The strategy to develop the human capital is inspired also by the principles that constitute the Sufficiency Economy.

4.3: The Agri-Nature Foundation

The information contained in this section are mainly taken from the direct interview of the managers of the Foundation, met during some visits at the Maab Eueang learning village on November 2010.

Literature from the Agri-Nature Foundation describes a rapidly growing organization which originated from a single project intent on demonstrating the significance of H. M. the King's New Theory Agriculture methods. This innovative organization provides training in organic agriculture and permaculture methods to both farmers and civil society. The Foundation has been highly successful at developing new centres throughout Thailand through a train-the-trainer program. After passing a rigorous certification process, trainers are encouraged to establish new centres in the surrounding areas. The Foundation is now active in over eighty centres in almost all the different Thai provinces and has recently built up a centre in Cambodia.

The following is a selection of their key objectives:

1. To promote organic food production, without chemicals, for the good of humanity.

2. To support training, research and development of organic technologies for agriculture, aquaculture, animal husbandry, medication, energy resources and manage the environment through the balanced use of ancient local wisdom and modern technology and knowledge.

3. To support the communities to help themselves to live in a symbiotic and sustainable relationship with nature. To follow the Sufficiency Economy and New Theory principles.

4. To support farmers, communities, and business organizations to manage and develop organic production methods to subsidize the elimination of chemicals or toxic substances in agriculture

In 2008, the Agri-Nature Foundation extended its training program to civil society throughout the country with support from the Thai government.

Agri-Nature Foundation has established a network of 80 natural agriculture learning centres across Thailand. Main activities of these centres are aimed at:

- disseminating sustainable farming practices;
- offering aid to the local communities giving the possibility to develop a more efficient agricultural sector;
- giving to locals the possibility to offer their work in change of food;
- helping local communities to reach the self-sufficiency.

These centres encourage small farmers to use local wisdom and organic agriculture to meet their basic needs: food, shelter, household products such as herbal medicine, and a healthy local environment.

At the base of the creation of the integrated farm is the cultivation of a variety of trees and plants to provide food, shelter and housing, healthcare products, and biodiversity in order to create a resilient local environment, reducing the vulnerability of territory and community. A fundamental principle is that the farmers must abandon the use of all toxic chemicals and replace it with a combination of traditional practices and ancestor's wisdom, together with modern knowledge on soil biological and ecological management.

The Foundation also produces a wide variety of multimedia products and offers short courses to young students as well. In 2008, the Agri-Nature Foundation was entrusted with a contract from the Ministry of Agriculture (through the Bank of Agriculture and Cooperatives) to train several thousand farmers under a debt-restructuring program.

The economic model adopted inside the villages is not respecting the neoclassical concepts of property and economic growth. The village is a sort of common good: all the members of the community receive the satisfaction of the basic needs in exchange of their work. Everybody is allowed to become part of the community. Trade and monetary flows are used only for the relation between the village and the external economy.

The economic organization of the community, which is the same taught to the local economic actors that benefit from the knowledge disseminated by the learning centres, is inspired by the philosophy of Sufficiency Economy. Sufficiency Economy principles plan the development of local poor communities following several steps:

- Ensuring the global self-sufficiency of the community for what concerns basic needs: shelter, food security, household security and sustainability for the environment;
- When enough resources are produced to meet household needs, some surplus is given for charity and for helping friends and relatives.
- Additional surplus is then extended to the neighbourhood, local community and people in need.
- Any further resources surplus is stored and preserved for times of need.
- Economic gain is only sought if there is a surplus after these steps. This surplus food supply is taken out to the market for ethical trading. Local co-operatives are formed at this stage.
- Use of the surplus to promote an effective networking where the Sufficiency Economy philosophy is instilled, fostered and nurtured among the people, especially the youth, for long-lasting sustainability and resilience.

Adaptation and development strategies are designed according to the local needs and characteristics. The actions adopted can usually be considered ecosystem based. They are designed and implemented with the full participation of the local community. The communication and decision making processes are developed with the strong coordination of local pressures and needs, and national principles of development. The actions of the Agri-Nature Foundation take place in strong coordination with the national and local institutions. The organization of the farm reflects the main characteristics of the New Theory Agriculture. For the production of rice, the local staple food, 30% of the farm area is reserved. A further 30% is reserved to the water storage and treatment, with an efficient production of fish and other aquaculture products. The efficient water management permits to cope with the periodicity of the rainfalls. Another 30% of the farm is used for the restoration of the original local biodiversity. The creation inside the farm of the reproduction of the traditional forest, which completely respects the characteristics of the natural one, gives several benefits. The first is represented by the products that the forest spontaneously offers: fruit, vegetables, wood. Further advantages are represented by the use of the local flora to implement anti-pests and fertilization techniques. The forest products are used, also, to create other goods necessary for the satisfaction of the basic needs: charcoal, organic

soaps, cosmetics, fruit juices, oil, and bio diesel. The remaining 10% is used for livestock, housing and other uses.

The communication process is implemented using a farmer to farmer technique: the Foundation's trainers deeply analyse the local knowledge and needs. After studying the local techniques, the integration of the scientific knowledge and the Sufficiency Economy principle with the local practices takes place, to achieve development and adaptation to climate change. At this step the training process starts: the farmers receive an intensive learning programme that allows them to achieve a good mastery of the most effective procedures to improve the productivity and the sustainability of their activities. Practical application of the new techniques is ensured by the constant supervision of the Foundation on the local actions and the integration of the community into the Agri-Nature network.

Figure 4.4: Farm's structure model. Maab Eueang village, November 2010.

Source: Fabio Farinosi, November 2010.

Figure 4.5: Training programme for the installation of a photovoltaic system. Maab Eueang village, November 2010.

Source: Fabio Farinosi, November 2010.

Figure 4.6: Charcoal production centre. Maab Eueang village, November 2010.

Source: Fabio Farinosi, November 2010.

Figure 4.7: Water Storage and aquaculture. Maab Eueang village, November 2010.

Source: Fabio Farinosi, November 2010.

Figure 4.8: Traditional housing. Maab Eueang village, November 2010.

Source: Fabio Farinosi, November 2010.

Chapter 5: Qualitative analysis and practical application of the Agri-Nature Foundation's model.

Introduction

The previous chapter examined the response that local communities and local institutions in Thailand gave to the impacts caused by the inefficiencies and the unfairness of the development process in the country jointly with the consequences of globalization. The underdevelopment of the rural areas increases the vulnerability of the communities that populate this socio ecosystem to every possible impact, especially those related to climate change. In order to increase the resilience of the poorest part of the population and to ensure an increased sustainability of the human activities in the country, the gap between urban developed areas and rural developing ones should be filled up. The country is trying to solve the problems adopting strategies inspired by the Sufficiency Economy principle. For what concerns the rural communities, the most important area of intervention is represented by the agricultural sector. This sector is the most vulnerable to climate change and other possible impacts. It is evident how a good intervention on the agriculture could increase the resilience of the rural communities improving the possibilities to achieve a development that could be fully sustainable. In this sector, due to the empirical observation of their activities, the methodology adopted by the Agri-Nature Foundation could be considered efficient for the achievement of development and adaptation to climate change. The problem encountered analysing the activities of this organization are related to the total lack of quantitative data. The uncertainty about the degree of effectiveness and replicability of this method in different contexts does not allow affirming with certainty that this strategy could lead to a solution to the exposed problems. This chapter will describe a qualitative analysis of the Agri-Nature methodology, in order to highlight the main positive and negative aspects. The noted data from the previous experiences of the implementation of Agri-Nature methodology does not allow producing a quantitative and more accurate analysis. Following the model explained in the second chapter of this work, a project proposal will be designed, making it possible to monitor and evaluate the results. In this way a

series of studies could be produced to prove the efficacy and effectiveness of the method, in order to offer a new instrument to cope with development and adaptation capacity building in the rural areas.

5.1: Qualitative Analysis of Agri-Nature's model.

As discussed above, the noted data from the previous experiences of the implementation of Agri-Nature's model does not allow producing a quantitative analysis. The concreteness of the model adopted could be deduced by the empirical observation of the successful activities of the numerous centres, but it is not corroborated by a scientific evaluation of the evolution of the principal indicators adopted to monitor the success of the implementation of these kinds of activities. The analysis proposed in the following pages is based on the qualitative evaluation of the Agri-Nature's model produced with the collaboration of experts that operate in this sector. The instrument used to evaluate the model is the SWOT Analysis.

5.1.1: Methodology and instrument used for the qualitative analysis: SWOT analysis.

The Strengths Weaknesses Opportunities and Threats (SWOT) analysis is a strategic planning method used in strategic management to help in considering long term decisions in business (Hill, 1997). It aims to examine the internal and external factors that could impact on the realization of an objective or to achieve a desired state (Figure 5.1). Obviously, the first step of the analysis is the definition of a desired state end or an objective.

Considering the objective, this method consists in examining the characteristics of the organization or of the product that is involved in the supposed business venture or in the project, identifying the internal and external factors that could impact in the success of the operation.

Figure 5.1: SWOT Analysis.

Source: http://it.wikipedia.org/wiki/File:SWOT_en.svg.

This strategic planning model verifies:

- **Strengths**: internal characteristics of the company, product or organization that could give an advantage to the success of the operation.
- **Weaknesses**: internal characteristics that could be considered a disadvantage to the success of the operation.
- **Opportunities**: external characteristics that could be favourable for the activity proposed.
- **Threats**: external characteristics that could constitute barriers to the success of the operation.

The aim of the analysis is to identify the internal and external factors that could determine the possibilities for the organization to successfully achieve the objective fixed in advance. Internal factors are divided into strength and weaknesses; external

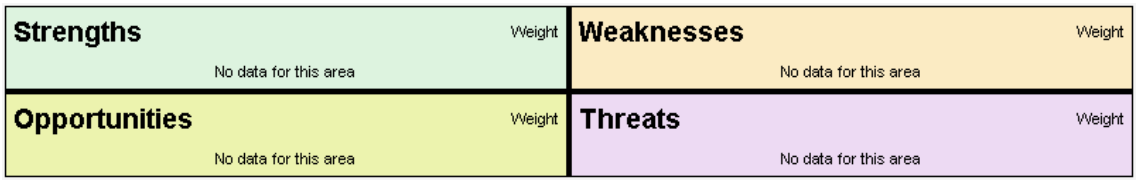
ones into opportunities and threats. Obviously, the characteristics of these factors depend on the objective that the organization wants to achieve. Some aspects that could represent strength for an objective could be weaknesses for another (Hill, 1997).
The SWOT analysis is not used only for the businesses, it is a logical instrument that may be used in any decision making situation when a desired state has been identified. In the case of the analysis carried out in this work, it was decided to use the SWOT analysis in order to examine the methodology used by the Agri-Nature Foundation of Thailand. The determined objective is to reproduce the activities of the Foundation in different areas to implement strategies of Community Driven Development and Community Based Adaptation to climate change adopting the Sufficiency Economy principle and the New Theory Agriculture.

The methodology used to conduct this analysis saw the production of a questionnaire (Annex 2) aimed to highlight the main characteristics of the Foundation's model and the influence of these in the achievement of the objective. This questionnaire was submitted to professionals operating in the sectors of Climate Change Adaptation and Development that were involved in the discussion about the efficiency and effectiveness of the Agri-Nature methodology. The professionals that participated to this analysis belong to different organizations: United Nations Environment Programme – Regional Office for Asia and the Pacific (UNEP ROAP) located in Bangkok, Thailand; Asian Institute of Technology/United Nation Environment Programme – Regional Resource Centre for Asia and the Pacific (AIT/UNEP - RRCAP) located in Bangkok, Thailand; and the Bangkok Office of the Institute of Global Environment Strategies (IGES), an agency of the Japanese Government located in Bangkok, Thailand.

The debate between the professionals mentioned above, highlighted several aspects that have been considered for the evaluation of the Agri-Nature Foundation model. These aspects have been discussed and evaluated in order to consider their importance as strengths, weaknesses, opportunities or threats.

For the practical preparation of the analysis, it has been used a free software available on the web ("Inghenia :: SWOT" Software. http://www.inghenia.com/gadgets/swot/swot_en.php). The characteristics highlighted by the professionals have been classified in the four categories proper of the SWOT, as in figure 5.2.

Figure 5.2: SWOT Analysis "Inghenia :: SWOT"- free software.



Source: "Inghenia :: SWOT" Software.
http://www.inghenia.com/gadgets/swot/swot_en.php

The second step of the analysis is represented by the assignment of a weight to each of the internal and external factors. After populating the list of the main aspects to be taken under consideration for the analysis of the model, it has been asked to the professionals that took part to the study, to assign a weight to each of the characteristics highlighted. The final weight has been given calculating the average of the weight assigned by the professionals to each of the aspects put in evidence.

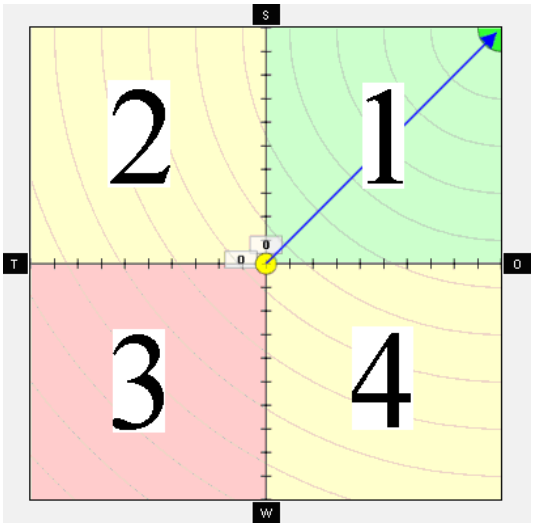
The software used give to possibility to design a graphic representation of the result obtained. The chart is presented as a Cartesian coordinate system (Figure 5.3). The X axis represents Opportunities and Threats, the external factors. The Y axis represents Strength and Weaknesses, internal factors of the object of the examination. The algorithm used by the software, permits to locate the object of the study in the Cartesian coordinate system in base of the weights assigned to each of the characteristics.
The coordinates are calculated Depending on the number of characteristics put in evidence and the corresponding weight assigned.
The procedure is illustrated as follow:

- First of all, the weights assigned are considered positive for Strength and Opportunities, negative for Weaknesses and Threats;

X axis value = [Σ(Opportunities' weights) + Σ (Threats' weights)] / [number of Opportunities + number of Threats]

Y axis value = [Σ(Strengths' weights) + Σ (Weaknesses' weights)] / [number of Strengths + number of Weaknesses]

Figure 5.3: SWOT Analysis Chart "Inghenia :: SWOT"- free software.



Source: "Inghenia :: SWOT" Software.
http://www.inghenia.com/gadgets/swot/swot_en.php

The final graphical location of the object of the analysis gives the idea of the problems that affect the strategy under consideration.
The chart is divided in four sectors.

- Sector 1 – This sector has to be considered the best result that the analysis could provide. The best position is located in the top right corner, indicated by the blue arrow in the figure 5.2. If the result is located in this sector, the analysis suggests that the internal and external factors are globally favourable to the success of the strategy under consideration.

- Sector 2 – This sector suggest that the internal factors are favourable to the success of the strategy under consideration, but there are problems related to the

external conditions. This result should suggest a further analysis of the external factors, aimed at the elimination of the external barriers.

- Sector 3 – This represents the worst result that the SWOT analysis could give. In this case both internal and external factors have to be considered unfavourable to the success of the strategy under consideration.

- Sector 4 – This represents the case of a situation in which the external factors are favourable to the success of the strategy under consideration. The problems are linked to the internal characteristics.

5.1.2: SWOT analysis of the Agri-Nature's model.

In the case of the Agri-Nature's model the factors put in evidence by the discussion with the experts are reported in the figure 5.4.

Figure 5.4: SWOT Analysis Agri-Nature Foundation ("Inghenia :: SWOT"- free software elaboration).

Strengths	Weight
Mainstreaming of Adaptation into Development Strategies	8
Socio Eco-system Vulnerability Reduction	8
Science-Grassroots Communication	7
Long term Sustainability	7
Food Security Improvement	7
Diffuseness in the territory	6
Costs of the implementation of the method	6
Bio-diversity Improvement	5
Water management Improvement	2
Total	**56**

Weaknesses	Weight
Quantitative demostration of the effectiveness	8
Quantitative demostration of the replicability	8
Long time to obtain tangible results	6
Knowledge and Human resources are mainly local oriented	5
Uncertainty on the amount of the investments	5
Economic growth orientation of the method	2
Total	**34**

Opportunities	Weight
Acceptability of the method in the rural areas	8
Previous experiences in cooperation with institutions	8
Cultural acceptability	7
Institutional accaptability of the method	6
Rate of acceptability of the method to implement development plans	6
Sufficiency Economy outside Thailand in similar cultures	6
Total	**41**

Threats	Weight
Cultural Barriers	7
Institutional Barriers	6
Sufficiency Economy outside Thailand in different cultures	6
Acceptability of the method outside Thailand	5
Linguistic Barriers	5
Lack of scientific background	4
Total	**33**

Source: Author's elaboration using "Inghenia :: SWOT" Software.
http://www.inghenia.com/gadgets/swot/swot_en.php

- Strengths:

First of all, it has been highlighted the importance of the farm's organization for the reduction of vulnerability to climate and economic threats for the rural community. The restoration of the natural forest and the reduction of the use of chemicals in each village in which Agri-Nature methodology has been applied, could improve the biodiversity, which in the rest of the country has been threatened by the intensive adoption of monocultures. Restoring the traditional agricultural activities in combination with the adoption of the most advanced technologies and techniques could improve production diversification and the level of food security of the local community. The system developed for the water management could improve quality and availability of this important resource for agricultural and aquaculture purposes. The success of this methodology has been empirically demonstrated by the previous successful experiences: the Agri-Nature network comprehends more than 80 villages in all the country. These villages and the integrated farming systems are economically efficient and do not receive any contribution from the Government. The diffusion of the methodology in different areas of Thailand, without any incentive from the Government, could be considered an empirical proof of the replicability and the cost-effectiveness of this methodology in this specific territory. Nowadays members of the International Organizations are debating about the communication problems with the grassroots, as discussed above. Under this consideration, the Foundation has proven itself to be fundamental for mainstreaming properly the communication between the scientific debate and local communities throughout the country. This organization could be considered a driver to spread knowledge about development and adaptation strategies at the local level in this country. The organization of its training activities, following the formula "farmer to farmer", excludes any form of resistance from the local community. The organization of the villages, farms, and rural economic activities following the principle of the Sufficiency Economy could improve social, economic and environmental conditions of the rural communities, offering the possibility to achieve sustainable development of the socio ecosystem, and reducing vulnerability to external threats. The process of education and training offered to the locals by the Foundation's activities could increase the chances to implement a process of development that is

sustainable in the long term. The use of the Agri-Nature methodology has been considered more than useful to stimulate autonomous adaptation and to implement planned adaptation to climate change, especially considering the *no regret* and *low regret* forms.

- Weaknesses:

On the other hand, the lack of data regarding the previous applications of the methodology taken into consideration for this analysis has been considered an important weakness. The efficiency and the replicability of the methodology have been only empirically proved, and other factors could have been crucial for the success of the previous experiences. Another aspect that could be recognized as a problem for the successful application of this methodology, and which is a problem common to other development strategies, is represented by the long time needed by this model to be implemented in practice. An obstacle for the replicability of the Agri-Nature methodology could be represented by the specificity of the resources, such as staff and skills: the previous application of the methodology has taken place in only one country with specific conditions (geographic, environmental, institutional, cultural…) that could be considered almost completely homogeneous.
The previous experiences suggest empirically that this methodology could be cost-effective. However the total lack of economic data gives huge uncertainty about the amount of investments needed to implement the methodology in a specific context and about the economic assessment of the strategy under consideration. In the previous experiences it has been reported that the implementation of the methodology has been modelled taking into consideration the economic efficiency achieved step by step in specific situations. The implementation of the strategy has been modelled on the base of the responsiveness of the socio ecosystem under consideration. A good economic assessment has to be considered crucial for the successful application of this methodology in a different context.

The considerations mentioned above could be considered the main aspects representing strengths and weaknesses of the Agri-Nature methodology. The analysis of the

opportunities and threats are, of course, strongly linked with the context in which it is decided to replicate the model. However there are some general aspects that could be evaluated in order to delineate the main characteristics that have to be taken into consideration in assessing the possibilities for a successful application of the methodology in a different geographic and cultural context.

- Opportunities:

Generally, the methodology under consideration could be easily accepted by rural communities: strategies are studied respecting the characteristics of the specific socio ecosystem. The model aims to allow the community to achieve development through the implementation of its own activities and traditions. There is no imposition of a new and completely different model that would imply the radical change of the community's lifestyle.

Furthermore, from a political point of view, the acceptability of this development model for the rural areas could be quite high. There is no evidence of aspects that could cause institutional resistance against the adoption of this model. The application of the model in the previous experiences in Thailand has been characterized by a strong cooperation between national and local institutions. This aspect is of course strictly linked with the acceptance of the Sufficiency Economy principle by the Thai institutions. In other contexts this methodology could be integrated with the national strategies to achieve development and adaptation to climate change.

An important aspect to take into consideration while assessing the replicability of the methodology examined, is represented by the cultural background of the community in which the strategy has to be implemented. The Sufficiency Economy principle, in many aspects, reflects the main characteristics of the Thai society, strongly influenced by the Buddhist culture. This principle, in some cases, reminds some of the characteristics highlighted by Schumacher in his main work "Small is Beautiful" (1973), talking about what he defined "Buddhist Economics". From the Buddhist point of view, the consideration of consumption like end and purpose of the economic activity is quite irrational: since the material consumption is only one of the aspects that could contribute to increase general well-being, the aim should be the maximization of well-

being with the minimum consumption. Moreover there are several similarities to be found while analyzing the role of the worker in the production cycle and the rational use of the natural resources.

- Threats:

Most of the aspects behind the Sufficiency Economy and the Agri-Nature methodology are easily accepted by communities used to the same cultural background. In a different culture there might be the chance that the methodology could be misunderstood or wrongly put in practice. The cultural acceptability is one of the main uncertainties that should be carefully analyzed in assessing the replicability of this development model. A cultural background in which the individual is exalted could represent an obstacle for the correct implementation of a model in which cooperation and solidarity among the community members is crucial.

It is possible to highlight that most of the aspects that could negatively influence the successful application of this model depend on the geographical and cultural background of the community in which the model has to be replicated.

What emerges from the SWOT analysis of the Agri-Nature methodology is graphically represented in figure 5.5. The general consideration of the aspects highlighted by the professional's debate gives a positive result: the development model under consideration seems to have characteristics that could determine the successful replicability.

The coordinates are determined as follow:

X axis value = [Σ(Opportunities' weights) + Σ (Threats' weights)]/ [number of Opportunities + number of Threats]

That is:

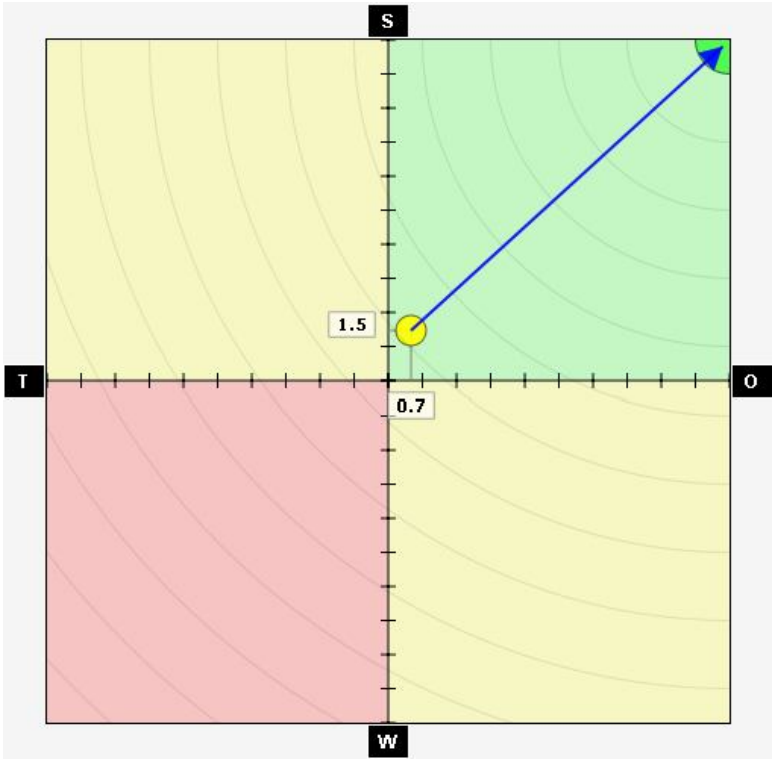
X axis value = [41 – 33] / [6 + 6] = 8/12 = 0.667 , rounded up to 0.7

Y axis value = [Σ(Strengths' weights) + Σ (Weaknesses' weights)] / [number of Strengths + number of Weaknesses]

That is:

Y axis value = [56 – 34] / [9 + 6] = 22/15 = 1.467, rounded up to 1,5

Figure 5.5: Graphical output SWOT Analysis Agri-Nature Foundation ("Inghenia :: SWOT"- free software elaboration).



Note: The chart shows the average of all the factors of the Weaknesses-Strengths axis (vertical axis) and the Threats-Opportunities axis (horizontal axis).The blue arrow indicates the strategic vector towards the ideal situation, which is represented by a green circle located at the upper right angle of the chart. The organization's current situation is shown with a yellow circle. The concentric circles are there to help show the advance towards the ideal situation as time passes.

Source: Author's elaboration using "Inghenia :: SWOT" Software.

http://www.inghenia.com/gadgets/swot/swot_en.php

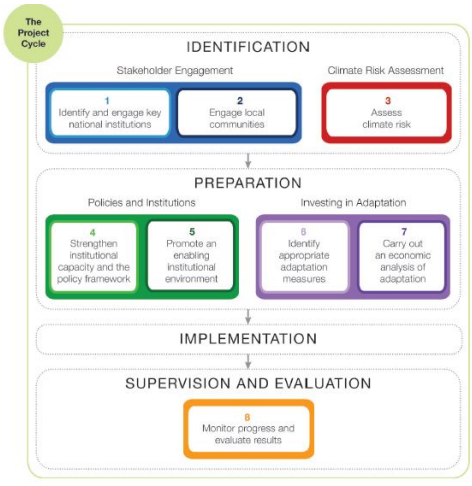
The opinions about the use of the methodology under consideration result, in general, positive. The final result is located in the most favourable sector of the Cartesian coordinate system: this means that internal and external factors could be considered globally favourable to the successful replication of the model proposed.
The aspects that more negatively impact on the result are linked to the uncertainty represented by the characteristics of the community in which the model has to be replicated. It is possible to affirm that cultural difference is the most relevant threat to the successful replicability of the development model under consideration.

5.2: Project proposal.

Following the results emerged from the SWOT analysis that was undertaken in order to better study the characteristics of the development model used by the Agri-Nature Foundation of Thailand, this study considers the possibility to adopt the model to implement development and adaptation strategies in areas that present similar characteristics of the country in which the model has been designed.

The proposal follows the project cycle presented by the World Bank in 2010, already mentioned in this work. The logical process is exposed in the figure 5.5.

Figure 5.5: Adaptation Project Cycle – World Bank.



Source: World Bank,2010. http://beta.worldbank.org/climatechange/content/mainstreaming-adaptation-climate-change-agriculture-and-natural-resources-management-project

The steps could be summarized as:

1) Identification: geographic area; main stakeholders; institutions; climate risk assessment.
2) Preparation: study of the strategies to adopt in order to face the situation identified in the previous stage; economic analysis.
3) Implementation: practical application of the strategies chosen as the most effective to cope with the specific problems of the socio ecosystem under consideration.
4) Supervision and Evaluation: monitoring of the evolution of the situation obtained through the constant control of the main indicators; final evaluation of the effectiveness and efficacy of the strategies adopted.

5.2.1: Identification: Stakeholder Engagement and Climate Risk Assessment.

The project could be implemented in areas of the Indochinese peninsula: this area could be considered quite homogeneous for what concerns cultural background and traditions. The social structure is quite similar and the organization of the communities could be also considered comparable. The agricultural and environmental characteristics are homogeneous. The threats derived by the changes of climate are expected to be comparable in all the area.

Another important area in which the model could be implemented is represented by the other parts of the South-East Asia region. This area is composed mostly by islands: in this case some of the elements mentioned above could differ in a more substantial way from the conditions that the methodology studied is facing in Thailand. Environmental problems are different as well as the threats derived from the changes in climate. Nevertheless the similarities are consistent and this area could be also favourable to the application of the Agri-Nature methodology.

In South-East Asia, is it possible to highlight the consistent presence of some major International Organizations: their presence on the territory is widespread and the cooperation with national governments is more than well-established. This area could be considered largely favourable for the implementation of adaptation to climate change

practices jointly with development strategies, combining the "bottom-up" with the "top-down" approaches relying on the cooperation and coordination between International Organizations, national Government and local communities. The cooperation is already active at the institutional level and the general availability of data and studies to assess the climatic situation and the risks derived by climate variability and underdevelopment is quite large. The methodology studied could be integrated in the national programmes which aim to the achievement of adaptation to climate change and development. Some of the countries in the area under consideration have prepared a National Strategic Development Plan (NSDP), a National Sustainable Development Strategy (NSDS), or a National Adaptation Programme of Action (NAPA); most of the times in collaboration with International Organizations.

The collaboration with the International Organizations could easily ensure the political and institutional acceptability of the development and adaptation practices within the local communities. In this way there is the possibility to reduce the efforts in the stakeholders' engagement process and in the redaction of the institutional and national climatic risk assessments. The first activities of the project could be easily oriented towards the engagement of the local community and the study of the specific characteristics of the specific socio ecosystem.

As mentioned in the second chapter of this study, the process should comprehend:

- Identification of the nature and extent of current and future climate risks in the area of interest. Identification of the degree of uncertainty;
- Identification of the principal climate variables that could influence agriculture and natural resources management in the area under consideration;
- Identification of the activities already put into practice in the area and the adaptation gaps in relation with current trends and future projections;
- Identification of sensitivity and vulnerability of the different sectors that characterize the area under study in the period under consideration;
- Identification of vulnerability determined by non climatic factors;
- Identification of different options to achieve sustainable adaptation to climate related changes.

The process of identification could be simplified by the analysis of the studies already conducted by national institutions and International Organizations.

5.2.2: Preparation.

The preparation of the project should respect the main characteristics of the Agri-Nature methodology and the Sufficiency Economy principle, in combination with the specific characteristics of the local community.

In order to maximize the efficiency and the effectiveness of the adoption of the Agri-Nature model for the development of the local communities, a series of activities should be designed, in which *no regre*t or *low regret* adaptation options should be implemented in a larger context of implementation of planned adaptation practices. The activity at the local level should be integrated into the general programmes at the national level. The low level of *regret* could allow to better cope with the implications in terms of: climate information, timing of investment, planning horizon, project design, project risk and economic evaluation. As it has been highlighted by the SWOT analysis conducted in the section above, lack of data and uncertainty represent the weakest point of the adoption of the methodology under consideration.

As mentioned above, the Agri-Nature methodology could represent the winning strategy to stimulate the autonomous adaptation of the local socio ecosystems to climate related risks.

At this stage it could also be crucial to prepare an economic and financial assessment about the adoption of this strategy.

The adoption of this methodology for the implementation of development and adaptation strategies at the local level could be proficient for the upgrading of knowledge and awareness levels and for the improvement of the communication between stakeholders at local and national/international levels.

The development project has to follow the general ideas of the Sufficiency Economy principle. The development should be pursued following the three stages:

- Self-reliance at the farm level;

- Cooperation and collaboration within the community;
- Interaction with external markets.

5.2.3: Implementation.

The implementation of the project within the local community should be conducted by the Foundation following the aspects highlighted during the preparation stage and considering the previous experiences acquired practicing this methodology in Thailand. The project should be implemented following the strategies inspired by the Sufficiency Economy principle in combination with the directions given by the scientific debate, under the supervision of the International Organization involved in the preparation of the project and in close collaboration with the local institutions.

Particular attention should be given to the improvement of the resilience of the farms, with the general reduction of the vulnerability to the climate change.
The organization of the farms respects the indications given by the New Theory Agriculture:

- 30% of the surface is used for the infrastructures destined to water management, treatment and storage;
- 30% of the surface is used for the restoration of the traditional biodiversity;
- 30% of the surface is used for the cultivation of crops;
- 10% of the surface is used for housing, animal husbandry and other uses.

The agricultural practices should be designed in order to introduce scientific technology and techniques to the traditional production process proper of the communities involved.

5.2.4: Supervision and evaluation.

The preparation of the project should take into consideration the identification of the main indicators that should be used for the evaluation of the activities. The process of monitoring and evaluation of progresses and results should start before the real implementation of the project. Starting from the assessment redacted in the first stages of the preparation of the activity, a series of data should be collected. The second stage is represented by the production of a baseline scenario: a projection of the situation of the socio ecosystem in case of non intervention. The information needed to produce this scenario is provided by the preparatory studies. The indicators that should be monitored - ex ante, on going and ex post – are chosen taking into consideration the specificity of the action in the particular contest under examination.

The indicators should help to consider the impact caused by the project on the environment, on the society, on the institution and on the economy of the system.

The importance of the data collected is easily demonstrated taking into consideration the need of the production of a quantitative analysis to prove the effectiveness and the efficiency of the project implemented in the specific socio ecosystem. This activity of monitoring and evaluation should be conducted in close collaboration with the international organizations and with the institutions involved in the project.

Final considerations

The elaboration of this work started from a direct observation of the state of human and economic development and climate change adaptation in Thailand. Through the direct experience, the frequent contact with the locals, the interviews of professionals that work with the local communities in the rural areas of the country, it has been observed how the dynamic development process, that took place in the past decades, presents several problems of unfairness and inequality. The empirical observation highlighted how the central government appears more efficient in assisting the development of the urban and industrial areas overlooking the difficulties of the rural communities. The agricultural sector, traditional engine of the economic structure of the country in the past, has been almost completely overlooked by the institutional agenda as well as the communities involved in these activities. The lack of control and assistance by the institutions saw the general failure of the introduction of the industrial techniques in the traditional agriculture, with the consequent degradation of the rural communities. This sector still represents an occupation for a large part of the population of the country and represents the main economic activity in the rural areas. The degree of food security for this country is also ensured by the well-being of the rural areas. The high vulnerability of the rural communities to every possible impact could compromise the general well-being of the whole country. The analysis conducted on the climatic conditions and trends of the region, highlights the several changes that, in the recent past, threatened substantially the life conditions of the weakest part of the population. The number of extreme events increased as well as the economic losses caused by these natural catastrophes. The analysis of the possible climatic scenarios for the future highlights the concrete possibility of a general worsening of the situation with a consequent increase of strong impacts on the life of the population, with devastating effects on the life conditions of the part of population characterized by the largest vulnerability. The need of an enhancement of the strategies aimed at the reduction of the general vulnerability of these populations has been immediately highlighted. The strategies adopted by the Thai government are inspired by the Sufficiency Economy principle. For what concerns the agricultural sector, the Sufficiency Economy principle inspired a series of strategies that determined the New Theory Agriculture. The practical

application of this theory has been verified in the work of the Agri-Nature Foundation of Thailand: an organization that put in practice the New Theory Agriculture, the specific strategy of the Sufficiency Economy for the reduction of vulnerability of the agricultural sector in the rural areas.
The analysis conducted in this work produced the following results:

- The process of development in Thailand has been fast and successful from several points of view, but the differences among the population have been increased by the inequalities and unfairness. The conditions of the weakest part of the population, that resulted to be the rural communities that live almost completely of agriculture, have been worsened by the opening of Thai economy to the globalized market.
- The analysis of the past and present climatic conditions gives the evidence of big changes in temperature and rainfall, with the increasing of extreme events' number. The analysis of climate scenarios and future projections suggests the possible exacerbation of these trends.
- The impacts of climate change on the, mainly rain-fed, agriculture is causing huge economic problems to the rural communities. This trend could worsen, increasing the impacts and their effects in the next future with devastating consequences on life conditions and with strong impact on the traditional social structure of the local communities.
- The vulnerability to climate and economic impacts of the weakest part of the population is extremely high: actions are needed to enhance the resilience of the rural socio ecosystems.
- From literature review it has been shown how the local communities and the rural areas in which are located, with all the social, economic and ecological implications could be analysed as a Complex System.
- It is also possible to conclude that, in order to reduce vulnerability and improve the resilience of the complex socio ecosystem under consideration, it has to be considered crucial the adoption of a good combination of development and adaptation to climate change strategies. How it is possible to verify by the most recent literature, International Organizations and practitioners in development

and climate change adaptation are more and more focusing their attention in mainstreaming adaptation into development strategies. Especially for the rural communities in the rural areas it could be very difficult to achieve adaptation without enhancing human and economic development.

- From the literature review, it has bees presented a series of indications to design activities that combines adaptation to climate change and development strategies. It has been also shown how the direct participation of all the stakeholders to the decision making process and to the practical implementation of the activities could determine the success of the adaptation and development strategies. The decision making process should involve local and national institution as well as local communities.
- It has been analyzed the different approaches used for the implementation of the adaptation and development strategies: the "top-down" and the "bottom-up" approaches. In this contest, it has been highlighted how the correct combination of the two approaches could maximize the possibilities of success of the adaptation and development strategies. Especially during the past decades, the approach adopted to design activities aimed at the achievement of development and adaptation to climate change has been eminently "top-down": this approach showed its weakness in the implementation inside the rural communities. In the recent past, the scientific debate has been focused on the community-driven strategies and on the "bottom-up" approach. The combination of "top-down" and "bottom-up" could be effective and efficient especially in case of activities that have to be implemented in context of rural communities that operate in the agricultural sector. In this cases the most important strategies for the achievement of adaptation to climate change have been considered the autonomous adaptation, that should be stimulate with an efficient development process, and the soft adaptation practices, especially *no regret* or *low regret* ones.
- The research on the field in Thailand, aimed to find good examples of community based adaptation and development strategies, brought to the discovery of the Sufficiency Economy. This principle is structured on the right combinations of elements of the local cultural background that, if applied in the

economic sectors, could help to reduce the vulnerability to the external impacts. The principle suggests to adopt in the every day life, and especially in the economic context, a combination of Reasonableness, Moderation, Self-Immunity, Knowledge and Integrity in order to cope with globalization and its impacts, such as economic impact, social impact, cultural impact and environmental impact.

- This principle suggests a series of strategies that could be adopted for the reduction of vulnerability in the rural areas, where the communities are occupied in the agricultural sector. The organization taken under examination in this work is aimed to put in practices the directions given by the Sufficiency Economy and the New Theory Agriculture. It has been analysed the methodology adopted by the Agri-Nature Foundation and the model used to organize the villages in cooperation with the local communities and the institutions. This model has been found very useful to enhance climate change adaptation and human and economic development in the local context. Another aspect highlighted is linked to the efficiency of the communication "farmer to farmer" adopted for the implementation of the model.
- The model has been examined eminently from a qualitative point of view. In this work, it has been suggested the replication of the studied model in a larger context of national or international strategy aimed to achieve development and climate change adaptation in underdeveloped areas. The instrument represented by the Agri-Nature's model could be useful for the involvement of the rural communities in the national or regional development process, especially for the implementation of activities in which the participation of the local communities is crucial.
- For what concern the replicability of the model in different geographic areas, the cultural acceptability aspect has been highlighted as one of the most important problems.

Further research should be considered strongly desirable in order to demonstrate the effectiveness and the efficiency of the model under consideration with the elaboration of quantitative analysis.

Annex 1

Statistics for Thailand.

Source: World Bank, 2010. "World Development Report 2010: Development and Climate Change"

Table A1.1: Key Indicators of Development in Thailand.

Population	Millions	2008	67
	Average annual % growth	2000/2008	1,0%
	Density people per sq. Km	2008	132
Population age composition	% ages 0–14	2008	22,0%
Gross national income (GNI)	$ billions	2008	191,7
	$ per capita	2008	2.840
PPP gross national income (GNI)	$billions	2008	403,4
	$ per capita	2008	5.990,0
Gross domestic product per capita	per capita % growth	2007/2008	2%
Life expectancy at birth	Male Years	2007	66
	Female Years	2007	72
Adult literacy rate	% ages 15 and older	2007	94,0%

Source: World Bank, 2010.

Table A1.2: Economic Activity in Thailand.

Gross domestic product	Millions of dollars	2008	260.693
	Average annual % growth	2000/2008	5,2%
Agricultural productivity	Agricultural value added per worker 2000 $	1990/1992	497
	Agricultural value added per worker 2000 $	2003/2005	624
Value added as % of GDP	Agriculture	2008	12,0
	Industry	2008	46,0
	Services	2008	43,0
Household final consumption expenditure	% of GDP	2008	51,0%
General government final consumption expenditure	% of GDP	2008	13,0%
Gross capital formation	% of GDP	2008	28,0%
External balance of goods and services	% of GDP	2008	8,0%
GDP implicit deflator average annual	% growth	2000/2008	2,4%

Source: World Bank, 2010.

Table A1.3: Poverty in Thailand.

Population below national poverty line	National %	1994	9,8%
	National %	1998	13,6%
International poverty line	Population below $1.25 a day %	2002	< 2,0%
	Poverty gap at $1.25 a day %	2002	< 0,5%
	Population below $2 a day %	2002	15,1%
	Population below $1.25 a day %	2004	< 2,0%
	Poverty gap at $1.25 a day %	2004	< 0,5%
	Population below $2 a day %	2004	11,5%

Source: World Bank, 2010.

Table A1.4: Natural Disaster in Thailand.

Mortality (number of people)	Droughts	1971/2008	0
	Floods and storms	1971/2008	95
People affected	Droughts	1971/2008	618
	Floods and storms	1971/2008	929
	Share of population (%)	1971/2008	2,2%
Economic losses	Droughts (thousands of US$)	1971/2008	11.166
	Floods and storms (thousands of US$)	1971/2008	132.709
Coastline	kilometres	2008	3.219
Population in low-elevation coastal zones	%	2000	26,3%
Area in low-elevation coastal zones	%	2000	6,9%

Source: World Bank, 2010.

Table A1.5: Total Primary Energy Supply in Thailand.

Total Primary Energy Supply	Annual Total (tons oil equivalent) - millions	1990	43,9
	Annual Total (tons oil equivalent) - millions	2006	103,4
	Coal	2006	12,1%
	Natural Gas	2006	25,8%
	Oil	2006	44,4%
	Hydro, solar, wind, and geothermal	2006	0,7%
	Biomass and waste	2006	16,6%
	Nuclear	2006	0,0%
Electricity consumption	Total kilowatt/hours per capita	2006	2.080
	% change	1990/2006	181,4%
	Elettrification rate	2006	99%

Source: World Bank, 2010.

Table A1.6: Land, Water and Agriculture in Thailand.

Arable land	hectares (millions)	2005	14,2
Share irrigated land	% of cropland	2003	28,2%
Aquaculture production	$ (millions)	2007	2.432,8
Projected physical impacts by 2050	Change in temperature (°C)	2000/2050	1,2
	Change in heat wave duration (N. of days)	2000/2050	8,1
	Precipitation (% of change)	2000/2050	2,7%
	Precipitation intensity (% of change)	2000/2050	2,2%
Projected agricultural impacts	Agricultural output (% of change)	2000/2080	-26,2%
	Agricultural yield (% of change)	2000/2080	-15,9%

Source: World Bank, 2010.

Table A1.7: Wealth of the Nation Thailand.

Total wealth	$ per capita	2000	35.854
Produced capital and urban land	$ per capita	2000	7.624
Intangible capital	$ per capita	2000	24.294
Natural capital	$ per capita	2000	3.936
Pastureland	$ per capita	2000	96
Cropland	$ per capita	2000	2.370
Protected areas	$ per capita	2000	855
Non-timber forest resources	$ per capita	2000	55
Timber resources	$ per capita	2000	92
Subsoil assets	$ per capita	2000	469

Source: World Bank, 2010. Note: The aggregate wealth nations have produced in the past, reflecting the value of all goods, resources, and services, including natural, produced, and intangible capital. Sub-categories of natural capital include forest, soil, and agricultural resources, which are indicative of a country's reliance on natural resources and vulnerability to climate change.

Table A1.8: Millennium Development Goals: eradicating poverty and improving lives in Thailand.

Eradicate extreme poverty and hunger	Share of poorest quintile in national consumption or income %	1990/2007	6,1%
	Vulnerable employment % of employment	2007	53%
	Prevalence of child malnutrition % of children under 5	2000/2007	7%
Achieve universal primary education	Primary completion rate %	2007	100%
Promote gender equality	Ratio of girls to boys enrolllments in primary and secondary school %	2007	104%
Reduce child mortality	Under-five mortality rate per 1,000	2007	7
Improve maternal health	Maternal mortality rate per 100,000 live births	2005	110
Combat HIV/AIDS and other diseaes	HIV prevalence % of population ages 15–49	2007	1,4%
	Incidence of tuberculosis per 100,000 people	2007	142
Ensure environmental sustainability	Carbon dioxide emissions per capita metric tons	2005	4,1
	Access to improved sanitation facilities % of population	2006	96,0%
Develop a global partnership for development	Internet users per 100 people	2008	20

Source: World Bank, 2010.

Annex 2

SWOT Analysis questionnaire

In the following tables it is possible to find a series of sentences in relation with the internal and external characteristics of our product.

Please, considering what has been highlighted during the meeting with Agri-Nature and the information acquired later, give a grade to the relevance of the following aspects.

Note: Score level – 1 not relevant/ not important for our scope – 10 extremely relevant/important

Strengths:	**Weight**
The Agri-Nature's method, if well applied, could reduce the vulnerability of the rural community to climate change threats.	
This method could improve the biodiversity.	
This method could improve the level of food security.	
This method could improve the practices in water management.	
The Foundation could be a good driver for the communication between the scientific debate and the grassroots.	
Empirical demonstration of the efficiency of the method.	
Empirical demonstration of the replicability of the method in homogeneous territories.	
Diffuseness of the organization in the territory (80 centres, but just in Thailand).	
The method could increase social, economic and environmental conditions. Improve resilience of the socio eco-system and reduce vulnerability.	
The method doesn't require huge investments to be applied in practice.	
The method offers a long-term strategy to cope with local problems towards sustainability.	

Weaknesses:	Weight
Due to the lack of data, there is not a scientific analysis that gives a proof of the efficiency of the method.	
Replicability is not tested, also.	
The method needs to be applied for a long time to be efficient.	
Since the maximization of the self-reliance is preferred to the maximization of the profits, the method could be not efficient to achieve economic growth.	
The local oriented resources (staff and skills) could represent an obstacle to the replicability.	
Particular philosophy and culture oriented method, it doesn't deserve scientific relevance.	
Uncertainty about the amount of the investments required to reproduce the method.	

Opportunities:	Weight
The method could be easily accepted in rural areas where development strategies are needed.	
Political acceptability by the institution in different countries.	
Good cooperation with national and local institutions in the past experiences (but just in Thailand).	
This method could be integrated into other development- oriented activities.	
High possibility of successful implementation of the method in areas characterized by a similar cultural background.	

Threats:	Weight
Scarce possibility to persuade institutional and political stakeholders due to the lack of scientific analysis.	
The success of this method depends on the cultural background of the community where it is applied.	
The method needs a cultural background already present in the local community to be successful.	
Linguistic barriers outside Thailand.	
Lack of scientific background of the members of the foundation.	
Uncertainty about the acceptability of the Sufficiency Economy principle outside Thailand.	

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Università Ca' Foscari - Venezia

ESTRATTO PER RIASSUNTO DELLA TESI DI LAUREA E DICHIARAZIONE DI CONSULTABILITA'(*)

Il sottoscritto/a **FABIO FARINOSI**

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ECONOMIA

Titolo della tesi (**): **CLIMATE CHANGE AND DEVELOPMENT: COMMUNITY BASED REACTIONS. THE CASE OF AGRI-NATURE FOUNDATION AND SUFFICIENCY ECONOMY IN THAILA**

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This work carries out an analysis of the state of development and climate change adaptation of the rural communities in Thailand. It includes the analysis of the impacts that climate change could have on the population, especially rural communities involved in the agricultural sector. The dissertation illustrates the dynamics of a complex Socio ecosystem and it analyses strategies that integrate climate change adaptation into development. The analysis then focuses on the top-down and bottom-up approaches that are used to implement actions on the territory. The dissertation also depicts the community-driven strategies and the participatory process, and it illustrates the Sufficiency Economy principle that is driving the development strategies in Thailand. The practical application of this principle in the agricultural sector is also taken into consideration, with the concept of New Theory Agriculture. The dissertation continues with the introduction to the Agri-Nature Foundation of Thailand and its model of development, examined through some instruments taken from the strategic management. The analysis ends with the proposal for the implementation of a project aimed to test the reproducibility of the model presented.

(*) Da inserire come ultima pagina della tesi. L'estratto non deve superare le mille battute

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