Hungarian University of Agriculture and Life Sciences

LOCAL ECONOMIC DEVELOPMENT POLICIES TO ADAPT CLIMATE CHANGE HAZARDS IN EGYPT

Doctoral (Ph.D.) Dissertation

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1. INTRODUCTION

1.1. Background of the study

Climate change as an additional stress is threatening habitats, ecosystems and land globally. The effects of climate change are projected to have adverse effects on developing countries and Egypt in not an exception. Additional to the current global situations concerning the impacts of long-term climate variability and extreme weather events, continued heatwaves and increasing sea level rise are dominating across Egypt. The Paris Agreement (2015) (UNITED NATIONS, 2015) delineates the importance of greenhouse gases (GHGs) emissions mitigation and adaptation measures, which should be officially implemented by 2020. Egypt is among the pioneer countries that ratified the accord in its preliminary stages. This was a significant milestone in committing towards combating climate change across the country. Despite, Africa being rated the least among the continents contributing to the atmospheric pollution, it continues to be responsible for the least global emissions (estimated at 4%). Although they contributed to anthropogenic emission slightly, Egypt and the rest of the continent are highly vulnerable to the impacts of long-term climate variability and extreme weather events. Increased water shortages, changing rainfall patterns, sea level rise, desertification and frequent heatwaves are some of the challenges associated with climate change presently being experienced across Egypt putting the countries development path at risk.

Developing countries are the most vulnerable to climate change impacts because they have fewer resources to adapt socially, technologically and financially. Climate change is anticipated to have far reaching effects on the sustainable development path of these countries, including their ability to attain the United Nations Sustainable Development Goals (SDGs) by 2030 (UNITED NATIONS, 2016). Many developing countries' governments have given adaptation action a high, even urgent, priority. Consequently, those countries need international assistance to support adaptation in the context of national planning for sustainable development, more capacity-building and transfer of technology and funds. Systematic planning and capacity-building are also needed to reduce the risk of disasters and raise the resilience of communities to increasing extreme events such as droughts, floods and tropical cyclones. Funding for adaptation in developing countries must be sufficient and sustained. Least Developed Countries (LDCs) and Small Island Developing States (SIDS) need special consideration due to their extreme vulnerability.

Likewise, developing countries have very different individual circumstances and the specific impacts of climate change on a country depending on the climate, it experiences as well as its geographical, social, cultural, economic, and political situations. As a result, countries require diverse adaptation measures depending on individual circumstances. However, there are

crosscutting issues which apply across countries and regions. The same sectors are affected by climate change, albeit to differing degrees. These main sectors include agriculture, water resources, human health, terrestrial ecosystems and biodiversity and coastal zones.

Likely to trigger species migration and lead to habitat reduction. Up to 50% of Africa's total biodiversity is at risk due to reduced habitat and other human-induced pressures (MOHAMMED, 2020). Therefore, it is important to research initiating some policy notes; recommendations investigate proper environment policies to mitigate the degree of hazard in different regions of natural hazards.

Regional Development Policies (RDPs) target all regions (urban, rural and undeveloped areas) and cities in order to support job creation, business competitiveness, economic growth, sustainable development, and improve citizens' quality of life. This can be seen as a general effort to reduce regional disparities by supporting (employment and wealth-generating) economic activities in the regions. Previously, regional development policies tended to try to achieve these objectives by means of large-scale infrastructural development through increased inward investment. Awareness of the need for a new approach is driven by the observation that past policies have failed to reduce regional disparities significantly and have not been able to help individual lagging regions to catch up, despite the allocation of significant public funding. The result is under-used economic potential and weakened social cohesion. Also, it is reflected in the country competitive dynamic regions aiming to achieve their economic, social and environmental objectives. RDPs complement national macroeconomic and structural policies. In this context, the regional outputs aim at helping countries get regions and cities "right" through the adaptation of policies to the specificities of where people live and work thus improving their well-being.

Local economic development (LED) offers local government, the private and not-for-profit sectors, and local communities the opportunity to work together to improve the local economy. It focuses on enhancing competitiveness, increasing sustainable growth and ensuring that growth is inclusive. LED encompasses a range of disciplines including physical planning, economics and marketing. It also incorporates many local government and private sector functions including environmental planning, business development, infrastructure provision, real estate development and finance (IBRD, 2016).

1.2. Statement of the Problem

Considering the vulnerability of climate change hazards and its massive contribution to the socio-economic development of many nations including Egypt. The research tries to provide some applicable proactive policies which can deal with one of the most difficult problems in the future by developing countries in general and for Egypt in practice. The problem concerns the threats

that climate change might have to developing countries' development potentials and natural resources. The research aims to utilize the **spatial map for LED policies and projects for providing adaptation, monitor and control the risk level for climate change hazards in Egypt**.

1.3. Relevance of the topic

- Climate change continues to compound stress to already threatened habitats, ecosystems and land uses in all over the world.
- The current global situations concerning the impacts of long-term climate variability and extreme weather events.
- Many of the investments to achieve SDGs will take place at the sub national level and be led by local authorities.
- LED offers local government, the private and not-profit sectors, and local communities the opportunity to work together to improve the local economy.

2. OBJECTIVES OF THE RESEARCH

2.1. Research objectives

The main objective of this dissertation aims at **inventing a LED policies and projects for providing an adaptation framework and allocating them spatially,** this has the ability to monitor and deals with the climate change on the regional level.

- Defining the relation between the LED policies and the climate change hazards.
- Studying the applicability of the LED policies on the climate change hazard and regional development.
- Studying international case studies dealing with climate change adaptation.
- Testing the efficiency of the policies within the limitation of the Egyptian context.

2.2. Research hypotheses

- The application of LED is more likely to be the most appropriate approach to adapt climate change.
- Applying LED is not the only proper answer to climate change but also to improve solving the social-economic problem and sustainable development.
- There is likelihood that Egypt has no LED policies currently applicable to combat climate change hazards.
- There is a higher likelihood that Egyptian institutional/ governmental systems have not been ready for handling the complexity of climate change hazards.

2.3. Research Questions

Why the local economic development is the best approach to achieve the development across regions while adapting climate change hazards?

- What are the kinds and types of climate change hazards experienced Egypt?
- What are the local economic development policies that provide the regional competitiveness?
- How to develop the LED process to achieve a real development in the regions?
- How conceived policies can deal with the regional and territorial development planning of the Egyptian contexts?

2.4. Structure of the dissertation

To achieve the above-mentioned objective, this research is divided into:

Part I: Introduction

This part defines the importance of the topic, problems to solve.

Part II: Objectives to achieve

This part defines and explains the research problem, questions, hypothesis, and their search methodology to investigate and test the hypothesis, the research data, and the research techniques.

Part III: Literature Review

This section elaborates on the necessary background of the research, which helps to develop the theoretical background of the research, based on an intensive literature review of the local economic development and the climate change hazards in Developing Countries. It is organised in five Chapters as follows:

Chapter 3.1: explores and defines the kinds and types of climate change hazardous in global context. In addition to the theories and scenarios plus the sustainable development aspects.

Chapter 3.2: explores and defines the kinds and types of climate change hazardous in Egypt.

Chapter 3.3: defines the Local Economic Development at all levels from the supranational level till municipality level. In addition to the policies and strategies with introductory and preliminary theoretical reviews aims to study and define the relation between the local economic development and the climate change hazards.

Part IV: Material and Methods

This part offers an intensive discussion on the materials and methods that were used to collect and analyse data on the effects of climatic hazards on LED. The discussion covers the research design of the study area, methods employed to collect data and analyse the data for this research. It discussed the data collection technique, instrument design, data analysis and research limitations.

Part V: Findings, Discussion (Analytical and Practical Applications)

This part covers the research analytical and practical studies, comprising several fields-studies and correlation of analytical studies that aims to examine the research problem based on the research argument and theory, and focus on covering and discussing the research findings.

Chapter 5.1: This chapter is discussing different cases studies for tackling and adapting the climate change hazards from diverse perspectives connected to the physical situation (urban areas, rural communities, land use and land cover changes).

Chapter 5.2: This chapter examine the Egyptian Climate Change Adaption Index (ECCAI) on the governorate level, according to vulnerability and readiness scores.

Chapter 5.3: This chapter illustrate the Egyptian strategic planning framework with the recommended edits to adopt the climate change.

Chapter 5.4: This chapter is related to testing the hypnotises.

Part VI: Conclusion and Recommendations

Chapter 5: This chapter presents the conclusion and recommendations.

Part VII: New scientific finding

Part VIII: Summary.

Part IX: References and Bibliography.

3. MATERIAL AND METHODS

This chapter offers an intensive discussion on the materials and methods that were used to collect and analyse data on the effects of climatic hazards on LED. The discussion covers the research design of the study area, methods employed to collect data and analyse the data. It discussed the data collection technique, instrument design, data analysis and limitations of the study.

3.1. Research Philosophy

In social science, two key philosophies are known, namely: the positivist and interpretivist values (BABBIE, 2013). The positivists claim that reality exists in the world, and this can be observed, measured and described from objective view stand without deducing from the circumstantial evidence and reasoning with the phenomenon under study. However, interpretivists also believe that reality is subjective in the mind of the person, and it is interpreted differently by different people (SARANTAKOS, 2005). This study was situated on the positivist approach of social research. Also, the study used both qualitative and quantitative research approaches. Qualitative research is the "nonnumerical examination and interpretation of observations to discover underlying meanings and patterns of relationships" (BABBIE, 2013). In this case, the study observed the LED projects mitigating the climate change hazards. However, quantitative research is the numerical representation and manipulation of observations to describe the phenomena that those observations reveal. Since the quantitative method can give precise and concise answers to problem statements using numerical values or percentages, it has become more advantageous and common to use.

3.2. Research Design

Descriptive design was employed in this work. This type of design does not allow the key variables to be manipulated, but it describes and interprets what exists in the field of study. According to (CRESWELL, 2009)"*descriptive study design is concerned with conditions or interrelationships that exist, opinions that are held, processes that are going on, effects that are evident and trends that are developing''*. (LENCUCHA, et al., 2010)defines research design as an organized process through which the problem at hand or under study is solved by careful planning, organization, collection and analysing of the available data into synthesised useful information. The research employed a descriptive research design. Descriptive research design is useful in the descriptive process for the phenomenon under observation (MAXFIELD & BABBIE, 2018).

(LENCUCHA, et al., 2010)further adds that elaborative research design provides a description of situations in their natural phenomenon. Descriptive research design was considered suitable in this study since it will help in analysing the effects of hazards from the global and regional scale using secondary data sources.

3.3. Methods description

The research has applied the **deductive approach** to define the local economic development policies to adapt the climate change hazards. Induction is defined as the process of observing phenomena and collecting data about them to arrive at general principles and holistic relationships, and the inductive approach moves from the part to the whole or from the specific to the general, where he begins to identify the particles and generalizes to the whole and the induction is divided into two parts (complete induction and incomplete induction).

Table 1: Research Questions and methodologies Matrix

Hypotheses	Research Questions	Research methodologies	Research Tools	Chapter
Why the local economic development is the best approach to achieve the development in the regions, adapting climate change hazards?				
There is a higher likelihood that Egyptian institutional/ governor systems have not been ready for handling the complexity of climate change hazards.	What are the kinds and types of climate change hazards in Egypt?	Deductive	Theory& Operationalization	2.1 2.2
There is likelihood that Egypt has no LED policies currently applicable to combat climate change hazards.	What are the local economic development policies that provide the competitiveness?	Deductive	Theory& Observation	2.3
The application of LED is more likely to be the most appropriate approach to adapt climate change.	How to develop the LED process to achieve a real development in the regions?	Comparing case studies	Operationalization	5.1
Applying LED is not the only proper answer to climate change but also to improve solving the social-economic problem and sustainable development.	How conceived policies can deal with the current development and planning limitations of the Egyptian contexts?	Analytical	Observation	5.2 5.3

Source: The author's edition

Accordingly, the historical inductive approach is used to present developmental concepts and policies, and it is also used to extrapolate project objectives and applications for different sectoral levels. The deductive approach to derive development policies to adapt to climate change, to deduce the policies pursued through global experiences.

3.3.1. Climate change hazards in Egypt

In the course of elaboration of the present study the research methodology's applied was the interpretation and understanding in a comprehensive way for what are the adaptation policies for climate change hazards in Egyptian regions according to the administrative laws. The novelty as far

as I know it, there has not been any research on this issue to determine the mitigation policies on the Egyptian regions from the legality perspective. The main method was qualitative research study through documents and reports reviews such as the administration laws and environmental reports of Egypt. On the aim of developing and acceptance of adapting inquiry as understanding deepens and situations change; analysing existing data -inductive analysis- involve in the details to discover important patterns, and interrelationships to investigate the effective policies through theoretical perspective. At first, having an overview on the climate change hazards in Egypt. Next, determining the major environmental issues in Egyptian administration levels. Finally, discussing about certain policies to adapt and mitigate climate change within Egyptian regions.

3.3.2. Local Development Economic

The main aim is to find the policies that important for developing the communities. Climate change is not only a global or national challenge, but its consequences will have severe impacts on the socio-economic development of sub-national geographic and administrative structures, such as regions and towns. That means that climate change will also have ramifications on LED initiatives. In this chapter it is investigated if LED stakeholders perceive climate change to be a threat to the socio-economic development of their territories.

3.3.3. Climate change case studies

There are three main categories for the case studies related to the urban/physical status. Therefore, the settlement scale are two main domains which are the rural communities and the urban areas, and for the larger scale and different connections land use change would be the related response.
With the use of analytical tools in the applied part, and the following table shows the research methods and tools used.

3.4. Limitation of the research

Due to the Pandemic Situation, the research design was altered, and the researcher opted for secondary data sources as it was impossible for field data collection as it was originally planned. The secondary data sources used for the descriptive analysis were collected from the IPCC and other secondary literature. Sources of the secondary data were used instead of proposed methodology which aimed to apply the Delphi Method.
The deviation from the original plan of using the Delphi Method resulted in change of the research outcome where the results are presented in the form of good practices and the Egyptian framework for the territorial mitigation and adaptation to the climate change hazards.

4. DISCUSSION AND RESULTS

This chapter presents an elaborate discussion on case studies where adaptation good practices have been successfully taken place at different levels of governance and in different sectors of the economy.

4.1. Case studies

There are three main categories for the case studies related to the urban/physical status. Therefore, the settlement scale are two main domains which are the rural communities and the urban areas, and for the larger scale and different connections land use change would be the related response.

4.1.1. Case studies' Comparison

In the following table there is the case studies simple comparison highlighting the main points in each one.

Table 2: Case studies comparison

Rural communities	Urban areas	Land Use and Land Cover Change
Greater Mekong subregion (May 2014)	Adaptation possibilities and constraints in low- and middle-income nations	emphasis on global and regional landscapes, spatial scales at land-use and climate-change interactions
key messages: • "predict-then act" approach to a "no regret" approach. • Wider socio-economic context understanding for the community. [1] • To guide community development planning. The framework should be accessible to diverse users and applicable to local conditions. (climate projections, crop model outputs, etc.). • Participatory approaches help fill information gaps and inform community concerns about climate and non-climate issues. Community participation offers a collaborative scenarios visualization and a selection of contextual adaptation options with increased interest in implementing adaptation strategies. • Ecosystem-based and community-based approaches required to develop a climate change adaptation strategy for natural resource dependent communities. • The adaptation strategy should be mainstreamed into local development plans.	• There are limits to the damage or devastation that adaptation can prevent and very serious deficiencies in the institutional capacities for urban adaptation in most low/ middle-income nations. This makes it more urgent that global agreements are reached to achieve the needed cuts in greenhouse gas emissions. **Urban vulnerabilities**: Urban populations and economies devastation caused by extreme weather events in recent years highlights their vulnerabilities. Worldwide, there has been a rapid growth in killed people or serious impact on storms and floods and in the amount of economic damage caused; a large and growing proportion in urban areas in low/ middle-income nations. Climate change is likely to have been a factor in much of this, but even if it was not, it is proof of the vulnerability of urban populations to floods and storms whose frequency and intensity climate change is likely to increase in most places. Climate change will also bring other less dramatic stresses such as heat waves	**Effects on communities and ecosystems** 1) Land-use change has had much greater effects on ecological variables than has climate change. 2) The vast majority of land-use changes have little to do with climate change or even climate 3) Humans will change land use, and especially land management, to adjust to climate change and these adaptations will have some ecological effects. **Land-use contributions to climate change** Human activities influence climate change by altering the ecosystems' distribution and associated energy' fluxes. At the landscape scale: changes in land-cover patterns can impact energy and mass fluxes. Increased atmospheric concentration of GHGs because (1) a wealth of data is available and (2) it illustrates how changes in particular land-cover categories can dominate the impact. At the global scale,

[1] Because climate change can change over decades, socio-economic change can have a larger impact on communities in a much shorter period of time, potentially reversing a vulnerable environment.

Rural communities	Urban areas	Land Use and Land Cover Change
	and, for many urban areas, reductions in freshwater availability, also sea-level rise for all coastal cities.	Human activities influence the GHGs into the atmosphere and by changing the patterns of carbon storage through land-use activities (focused on land use than industrial activities) (Carbon dioxide, Methane, Nitrous oxide).
Key Concepts: vulnerability and adaptation, **Exposure, Sensitivity, and Adaptive Capacity** Adaptation measures may be infrastructure-based (such as building a sea wall) and ecosystem-based (such as mangrove restoration to relieve storm surges). "Socioeconomic vulnerability" is an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations, including climate change.	**The direct and indirect impacts of climate change** 1) The scale of the population at risk: 2) The economic costs without adaptation 3) The vulnerability of urban populations to climate change	**Ecological effects of climate change** Global responses: (Vegetation distribution, the biome level and species, plant stress, direct mortality) Landscape responses: (Vegetation's water use, wetlands and Sea-level rise, human activities) **Direct effects:** • Agriculture • Decreasing rainfall • Temperature or rainfall **Indirect effects** • Profitability • Regional productivity costs • Regional and national food production • The number of people at risk of hunger
Assessment Approach Climate Change Impact Adaptation and Vulnerability (CCIAV) assessments: 1) impact assessment. 2) vulnerability assessment. 3) adaptation assessment. 4) integrated assessment. 5) risk management-based assessment. the integrated framework combined the risk management and vulnerability approaches. The integrated approach is a simplified way to understand the current risk and vulnerability of the communities and use climate projections to determine risk and vulnerability. PRA-based approach made a difference recognize the communities' current adapting methodologies and their appropriateness to future climate alter scenarios.	**The local nature of successful adaptation** Building the needed competence, capacity and accountability within local governments in high-income nations was a slow, difficult, highly contested process that did not have to deal with climate change and that was much helped by prosperity and economic stability. The vulnerability of low-income urban dwellers to climate change is often ascribed to their poverty but it is far more the result of failures or limitations in local government. **Building local capacity** "good governance" **Adaptation needs the attention of all sectors:** • Housing and infrastructure policies • Local illustrates possibilities and constraints • important shift underway in many agencies **Global issues** • environmental hazards, including disasters • strongly pro-poor	**Causes of land-use change** The major drivers of land-use changes are human population, affluence, technology, political economics, political structure, attitudes, and values. • Economic incentives set by government policies are a key cause of deforestation. • Climate changes affect the major drivers of land-use change can be answered by postulating many scenarios of the effects of local or regional temperature and precipitation changes on land-use practices. **There are proposed reasons:** • The social reason for the colonization program was to relieve the population growth along the coastal zones of Brazil. • The political reason for settling Rondônia was to encourage Brazilians to settle in the border community that was once a part of Peru. • The economic reason resulting from a recent drought. Individual farmers have specific reasons for migrating to Rondônia, but many of them moved because of the opportunity to work on their own land.
Assessment Steps for integrated approach Step 1: Assessing the current socioeconomic context Step 2: Assessing current risk and vulnerability Step 3: Formulating a plausible future	**Tackling policies** • supports and works with the reduction of risks to other environmental hazards. • builds on the knowledge acquired over the last 20 years on reducing risks from disasters in urban areas.	**Ecological effects of land-use change** • Biodiversity reductions • Habitats • Land-use activities • Soil-quantity and soil-quality changes • The natural and the managed productivity system

Rural communities	Urban areas	Land Use and Land Cover Change
Step 4: Assessing future risk and vulnerability Step 5: Formulating an adaptation strategy Step 6: Identifying options to operationalize the adaptation strategy. **Case's Recommendations** • Strengthen socioeconomic analyses • Apply multiple climate scenarios • Integrate community-based adaptation (CBA) and ecosystem-based adaptation (EBA) approaches • Improve participatory approaches • Integrate site specific crop model simulations where possible • Integrate an economic analysis • Analyse the broader policy and planning environment • Upscale to regional studies.	• is based on and builds a strong local knowledge base of climate variabilities and of the likely local impacts from climate change scenarios. • encourages and supports actions that reduce risks (and vulnerabilities) now to begin the needed long-term changes; urbanization processes have difficult drivers to change. • recognizes that the core is building the competence, capacity and accountability of city and sub-city levels of government, changing the relationship with those living in informal settlements and informal economy. • recognizes government policies must encourage and support the contributions to adaptation of individuals, community organizations and enterprises. • recognizes the key complementary roles required by higher levels of government and international agencies to support this requires major changes in policy for most international agencies that have long ignored urban issues and major changes in how adaptation is funded. • builds into the above a mitigation framework (if successful cities in low- and middle-income nations develop without this, global greenhouse gas emissions cannot be reduced). • builds resilience and adaptation capacity in rural areas given the dependence of urban centres on rural production and ecological services and the importance for many urban economies and enterprises of rural demand for goods and services	• Loss of extractable resources • Water resources • Certain land-use activities <u>At the biological scale</u> <u>At the landscape scale</u> 1) Changes in length of the growing season can be countered with the use of cultivars that require either longer or shorter growing seasons. 2) Photoperiod limitations can be overcome by traditional plant-breeding procedures. 3) Greater warming or desiccation can be dealt with by using drought- and heat-resistant strains of crop species. 4) Moisture-conserving tillage methods can be adopted. 5) Dryland agriculture may no longer be economic in some areas, and demand for irrigation water may decrease; however, demand for irrigation may increase elsewhere. 6) Improvements in irrigation efficiency can compensate some-what for increased water demands.
		Methods for studying interactions between land-use and climate changes future conditions for two reasons: (1) the current size, age, and species composition of temperate forests are unique and have been strongly affected by human activities; (2) global temperatures are predicted to increase at an unprecedented rate. a) Field and greenhouse studies b) Models ▪ Global models. ▪ Regional models. ▪ Landscape-transition models.

Source: The author's edition based on chapter 5.1

4.2. Egyptian Climate Change Adaptation Index (ECCAI)

NDUE and GODA (2021) Defines Composites or indices an outcome of an elaborate sequential long process with steps that need to be followed keenly. They outline that indices or composite development, is guided by principles that are governed by a stepwise approach. In adherence to the outline guidelines, this study adopted the framework by the Organization for Economic Development, the European Joint Research Centre, The Notre Dame Institute and Other scientists who have tried to come up with such indices in various economic sectors. This led to the development of the Egyptian Climate change Adaptation Index (ECCAI)

The methodological process was based on the conceptual framework as presented in table 12 below. Post conceptual building, empirical application of statistical steps such as data selection, aggregation, normalization, and visualization characterised data manipulation. The conceptual framework was developed as a tool for indicator development and determinants development post the literature review. A similar approach was applied by (ACOSTA et al., 2020, NDUE and GODA 2021) in the formulation of indicators for natural capital and Climate change adaptation in the European Agricultural sector respectively. The desirability of the chosen indicators was determined by the reviewed literature and the Egyptian general strategic plan for the Governorates. The Joint Research Centre of the European Union credited the methodology and argued that the subjectivity of indicators formulation is one of its strengths when supported with well-documented evidence (OECD, 2008).

Data for all the indicators were gathered from the Egyptian general strategic plan for the Governorates. Although questions may arise on the constancy and the robustness of the data, (ACOSTA et al., 2020; PEYRIERE & ACOSTA, 2019) proposes further engagement of stakeholders in the process to evaluate their key interests which can play a significant role in weighting the indices. Stakeholder engagement was not part of this study necessitating further research to validate the indices and updating of the subjective indicators. To ensure coherence and completeness of data from the indicators, simple imputation by omitting uncomplete data was selected over the extrapolation and mean imputation due to their limitations of implausible assumption (ZHU et al., 2012). They outlined the challenges of mean imputation on how it reduces variance thus changing the correlation between indicators.

When working with multidimensional indicators with different units and dimensions, its essential to subject the data to the normalization process (POLLESCH & DALE, 2016). Normalisation in composite index development helps in indicator transformation into the uniform scale and unitless numbers that aids in comparison(OECD, 2008). The min-max normalization method(rescaling method) as outlined by (MAZZIOTTA & PARETO, 2013) was applied to align indicators with

both positive and negative relationships to the index thus reducing the effect of extreme values on the index. Rescaling was chosen for its simplicity in application and the ability to eliminate extreme values therefore removing outliers partially. Xi normalised

The min-max transformation method rescales the different indicators (Xi) into an identical range (0-1) based on the minimum (Xmin) and maximum (Xmax) as presented in Equation 1 below.

$$"score" = |"direction" - \frac{"raw" \text{ data} - \text{reference point}}{\text{baseline maximum} - \text{baseline minimum}}|$$

Equation 1

$$ECCAI = (\text{readiness score} - \text{Vulnerability score} + 1) * 50$$

Equation 2

ECCAI can be represented as a scatter plot of readiness against vulnerability. The Matrix provides a visual tool for quickly comparing countries and tracking their progress through time. The plot is divided into four quadrants, delineated by the median score of vulnerability across all the countries and overall years, and median score of readiness calculated the same way. Approximately half the countries fall to the left of the readiness median and half to the right. Similarly, half fall above the vulnerability median and half below.

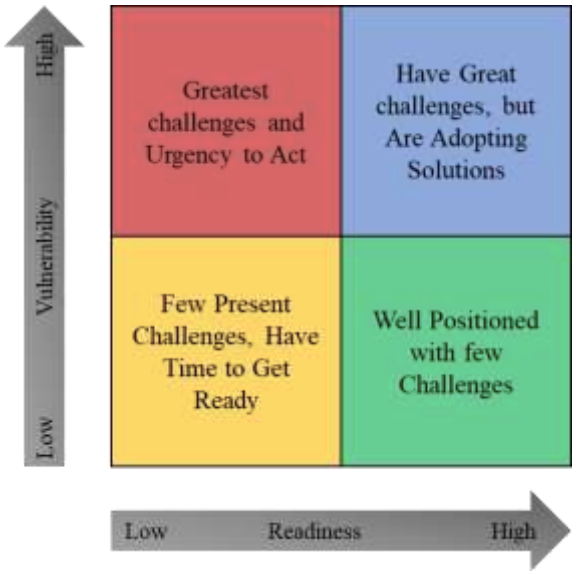

Figure 1 Readiness Matrix

Source: Author's edition based on (CHEN et al.,2015)

Red (Upper Left) Quadrant: Governorates with a high level of vulnerability to climate change but a low level of readiness. These governorates have both a great need for investment to improve readiness and a great urgency for adaptation action.

Yellow (Lower Left) Quadrant: Governorates with a low level of readiness but also a low level of vulnerability to climate change. Though their vulnerability may be relatively low, their adaptation may lag due to lower readiness.

Blue (Upper Right) Quadrant: Governorates with a high level of vulnerability to climate change and a high level of readiness. In these countries, the need for adaptation is large, but they are ready

to respond. The private sector may be more likely participate in adaptation here than in governorates with lower readiness.

Green (Lower Right) Quadrant: Governorates with low level of vulnerability to climate change and a high level of readiness. These countries still need to adapt (none of them have a perfect vulnerability score) but may be well positioned to do so.

ECCAI scales measures using the "proximity-to-reference point" approach, which scores the level of vulnerability and readiness by the distance to the ideal status, (i.e. least vulnerable is 0 and most ready is 1). 0 for vulnerability or 1 for readiness is considered "full score," and measure scores can be used to assess distance from a desired state. Reference points in ECCAI as follow as reference points for individual measures are provided in Table 12 below.

Table 3 Reference points for individual indicators

Sector	Indictor	Reference point	Baseline Min	Baseline Max
Food	Total area of cultivated land (thousand feddans)	20.12	1.3	1929.67
	No. Of livestock farms (farm)	228	1	2408
	Rural population (population)	0	0	5422698
	Total cropped area (thousand feddans)	21.24	1.53	2171.12
	Agricultural land percentage of the total area (%)	0.7%	0.0%	25.3%
Water	Production of potable water (thousand m3/ day)	5748.7	26.6	5748.7
	Per capita water production (litter. Day/ person)	1659.449	1511.378	28171.84
Health	Slum population (thousand person)	311.7708	0	311.7708
	Capacity of sanitation (thousand m3/ day)	3461	9	3461
Ecosystem services	No. Of natural protectorates (protectorate)	2	0	5
	Ecological footprint (gha)	1.36	0.16	6.98
	No. Of air monitoring stations (station)	31	0	31
	No. Of garbage recycling factories (factory)	7	1	7
Human habitat	No. Of civil airports (airport)	1	0	4
	Length of paved roads (thousand km)	29.92	0.99	29.92
	Urban concentration (%)	24.0%	0.1%	24.0%
	Unemployment rate (%)	14.62%	2.17%	29.5%
Infrastructure	Population living under 5m above sea level (thousand population)	0	0	6171.613
	Total amount of electricity used (million million kwh annually)	23993.7	679	23993.7
Economic Readiness	Governorates Performance Index in Empowering Small and Medium Enterprises	6.02	0.00	6.02
Governance Readiness	Political participation in the vote on elections (%)	34.8%	0.00%	38.70%
	governorates abilities to attract domestic capital	0.27	0.00	0.66
	infrastructure and services availabilities for investment attraction for small and medium enterprises	0.26	0.00	0.33
Social Readiness	Human Development Index (HDI)	0.743	0.699	0.794
	Illiteracy ratio (10 years +) (%)	15.2%	4.3%	28.8%

Source: Author, based on the data availability on Egyptian governorate level

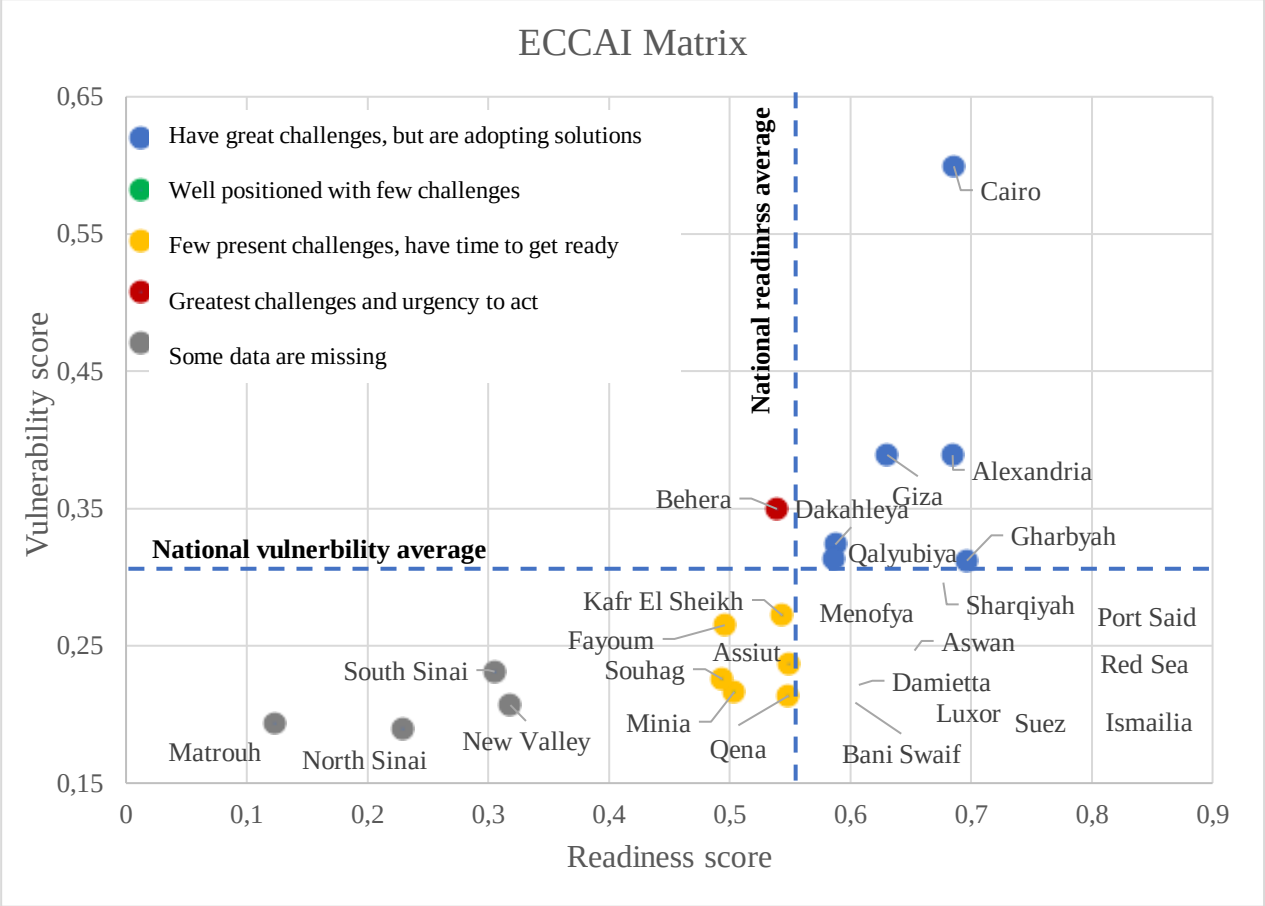

Figure 2 Egyptian governorates distribution in ECCAI matrix

Source: Author's edition

Red (Upper Left) Quadrant (Top priority/ Greatest challenges and urgency to act): Behara.

Yellow (Lower Left) Quadrant (Few present challenges, have time to get ready): Kafr el-Sheikh, Assiut, Fayoum, Minia, and Qena.

Blue (Upper Right) Quadrant (Have great challenges, but are adopting solutions): Cairo, Giza, Alexanderia, Qalyubiya, and Gharbyah

Green (Lower Right) Quadrant (Well positioned with few challenges): Menofya, Sharqiyah, Aswan, Port Said, Damietta, Red Sea, Ismailia, Suez, Bani Swaif, and Luxor.

Grey Some data are missing, For the governorates North Sinai, South Sinai, Matroh, New Valley Their values were not fully presented especially for the readiness indicators.

4.3. Framework recommendations

This part of the research is based on what was previously reached through the previous parts and the chapters it contained, and analyses at all stages of the research, through methodologies and the intellectual framework derived from the analysis of past experiences as pioneering global experiences that achieved tangible successes that were positively reflected on the state of development at regional levels. What has been previously studied, as well as what is related to it with national development trends and the extent of the role that local regional units play in activating these trends and aspirations at the national levels to curb climate changes, the conceptual framework drawn up is dropped through a number of areas: (The study steps follow, methods and measures and clarify the idea of difference, and the output of the stage)

4.3.1. The current Egyptian framework:

Presentation of the conceptual framework applied in the Egyptian case based on the reference guide for preparing the general strategic plan for the governorates prepared by the General Organization for Physical Planning (GOPP), 2011; appears as follows:

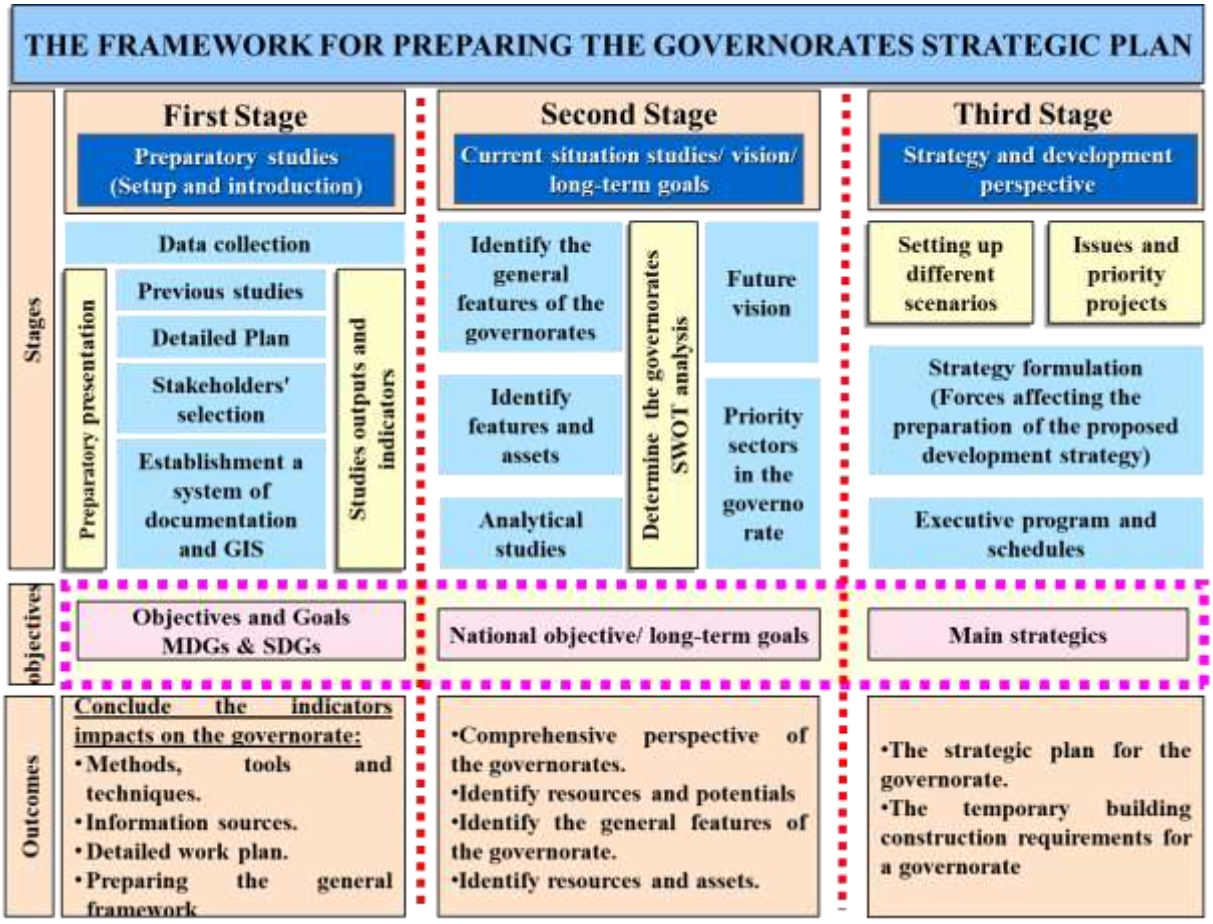

Figure 3: The Current Egyptian framework

Source: The author's edition based on GOPP 2011

4.3.2. General methodology for preparing the strategic plan for the Egyptian governorates

The study steps are followed by the methodology of preparing the strategic plan for the provinces as shown in the following figure

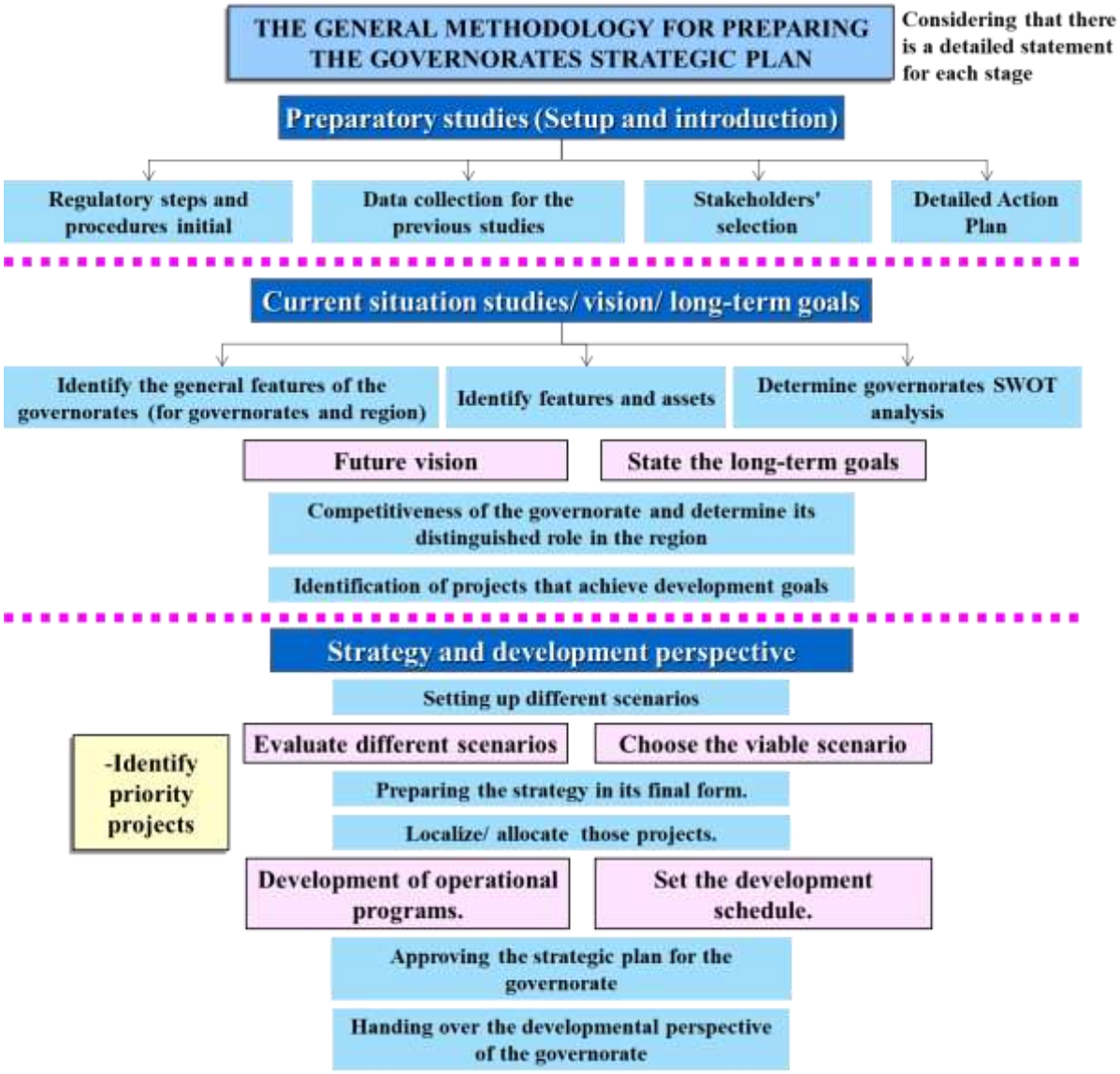

Figure 4: General methodology for preparing the strategic plan for the Egyptian governorates

Source: The author's edition based on GOPP 2011

From the above, we find that there is a difference in the proposed intellectual framework for preparing the strategic plan for the provinces, and the intellectual framework previously discussed through global experiences, for example, we find that the "vision formulation" process is better for it to come at an advanced stage, relying on the national vision to provide the best translation of the national goals at the provincial level.

4.3.1.1. First Stage, Preparatory studies

The following is the detailed methodology for the first stage, and as mentioned earlier, emphasis must be placed on the vision set for the region (the governorate), and emphasis must be placed on formulating and translating the goals that achieve that vision, with an emphasis on the process of community participation among the relevant parties.

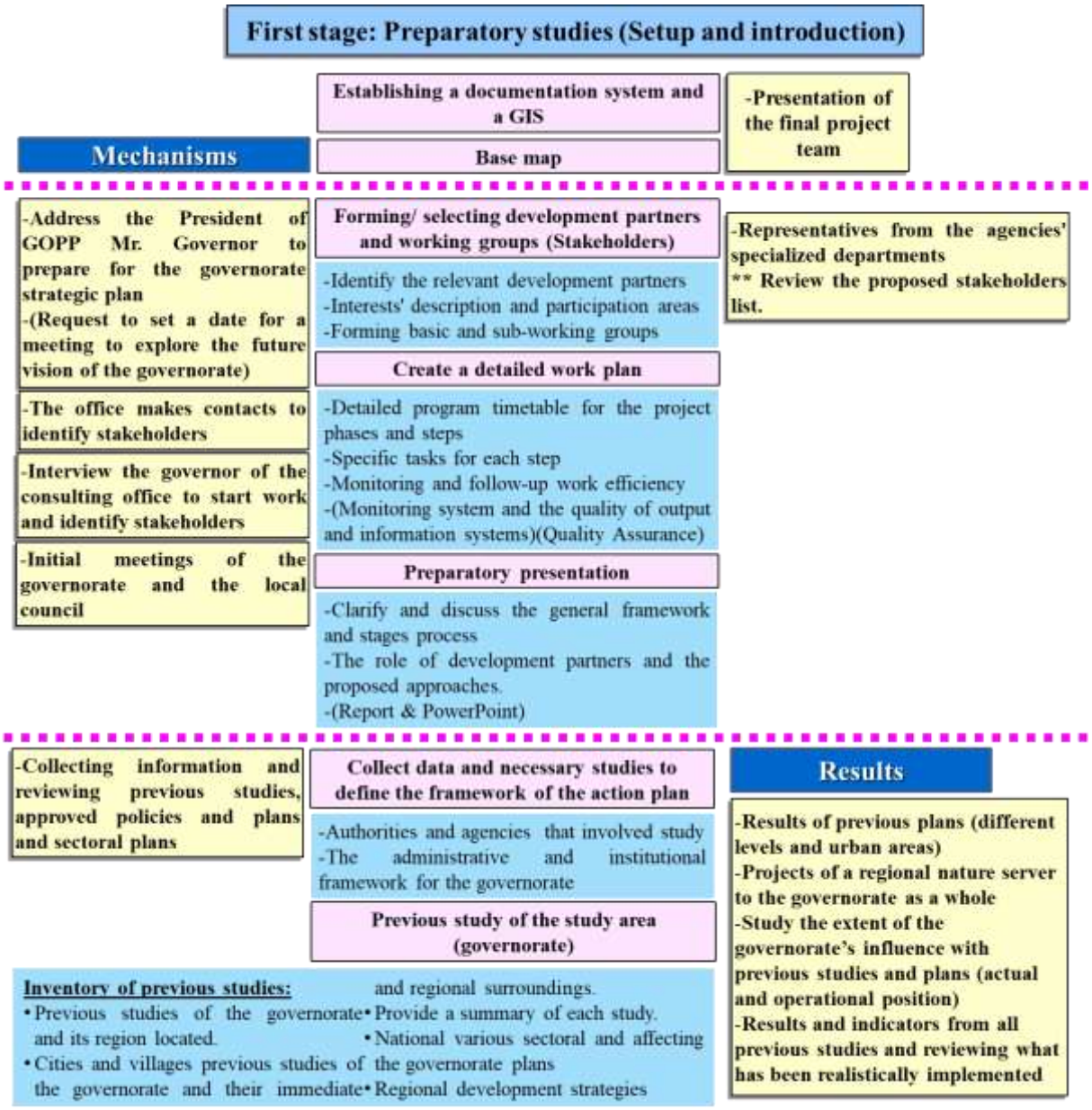

Figure 5: First stage, Preparatory studies

Source: The author's edition based on GOPP 2011

4.3.1.2. Second Stage, Current situation, vision and long-term goals

It is for preparing the strategic plan is the main stage, where studies of the current situation and formulation of the vision and sectoral goals, in order to reach the foundations of the formulation of the strategic plan but based on the proposed scenario after the national vision has been emphasized, appropriate indicators and methods must be used for each region (governorate) separately, based on the region's characteristics. one of the most important steps within the stage is to identify the resources and assets that contribute directly to the formation of priority use areas or specialized areas.

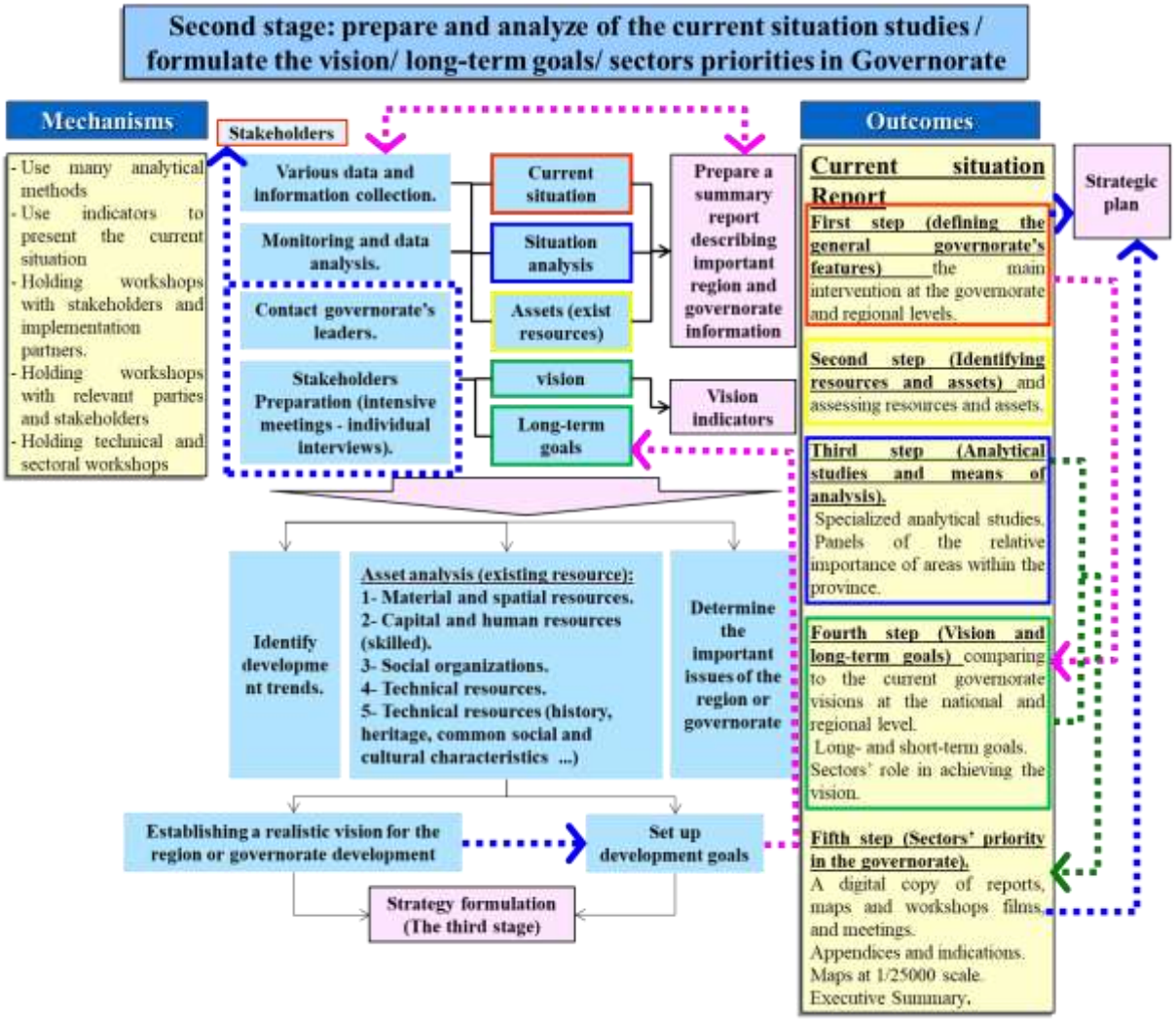

Figure 6: Second stage, Current situation, vision and long-term goals

Source: The author's edition based on GOPP 2011

4.3.1.3. Third Stage, Strategy formulation

This stage requires a reformulation, especially of the outputs, to reach the planned land uses, and not just formulating a strategy to suit the planning level under study.

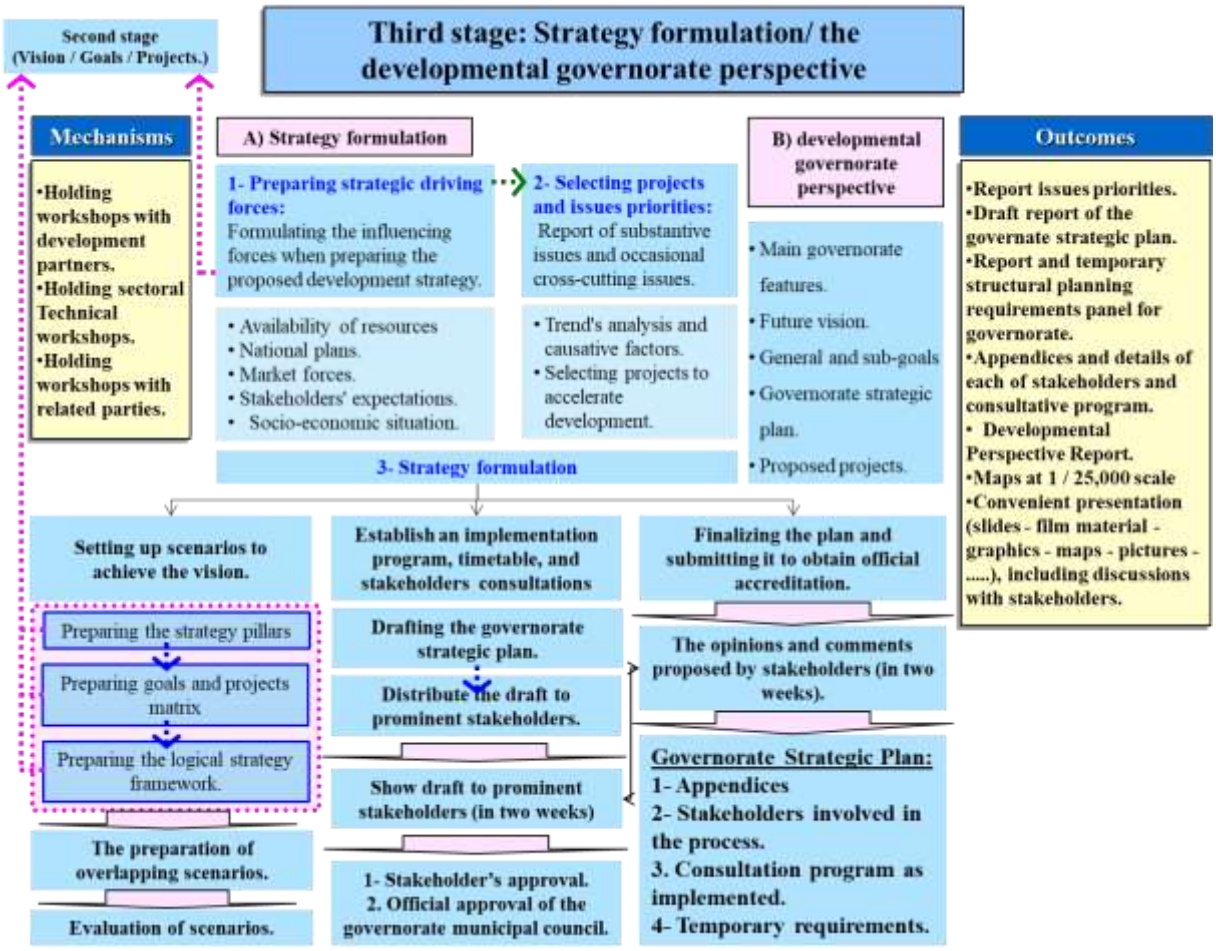

Figure 7: Third Stage, Strategy formulation

Source: The author's edition based on GOPP 2011

4.3.3. Proposed general methodology - modified - for strategic plan for the Egyptian governorates

According to what was previously listed, the amendments requested to be added can be summarized as follows

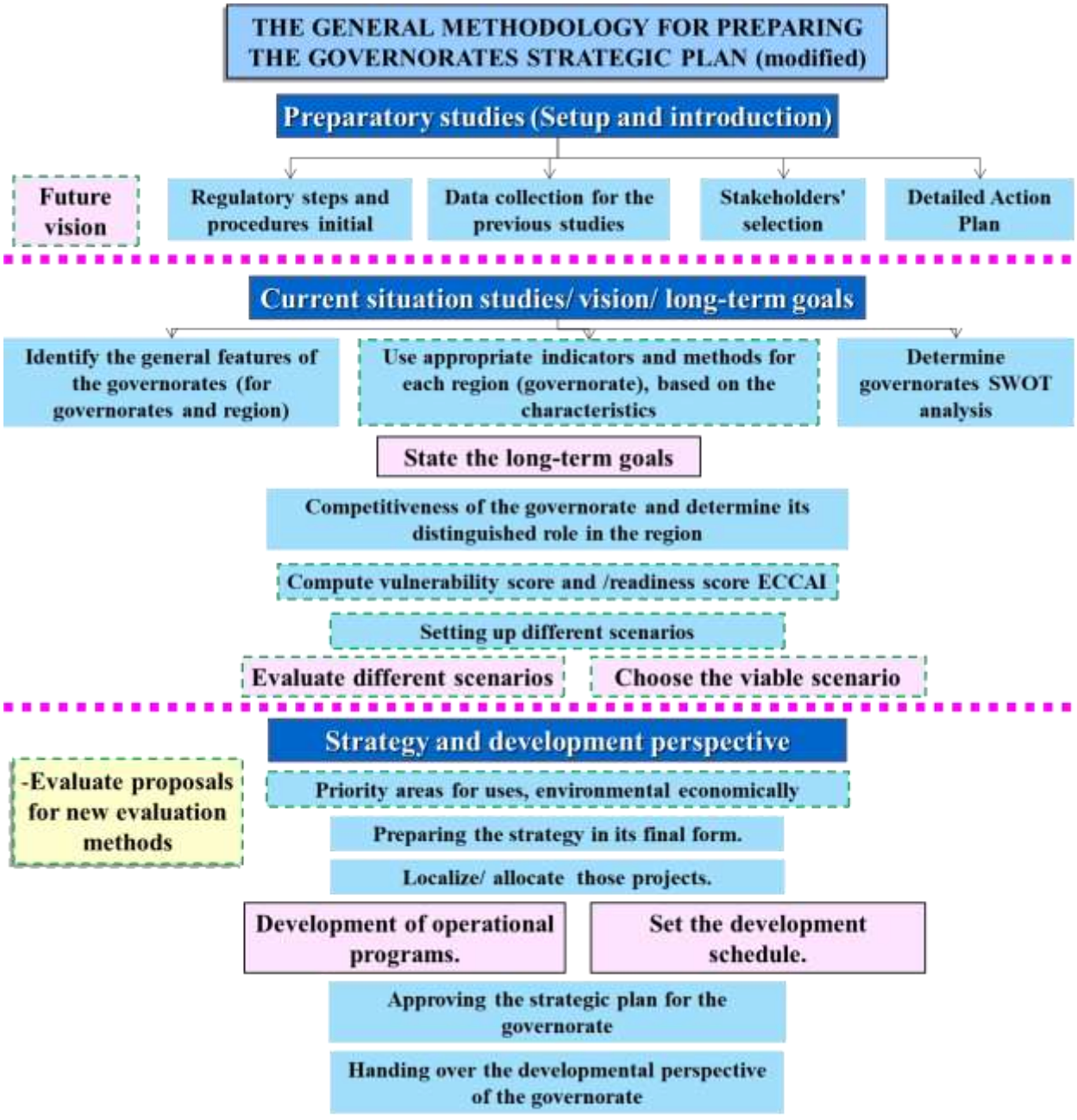

Figure 8 Modified general methodology for preparing the strategic plan for the Egyptian governorates.

Source: The author's edition

4.4. Testing of Hypotheses

Verification of testing of the hypotheses

Four proposed hypotheses were tested in the course of the work, and this section presents the confirmation of the hypotheses. 1) There is a higher likelihood that Egyptian institutional/ governmental systems have not been ready for handling the complexity of climate change hazards; 2) There is likelihood that Egypt has no LED policies currently applicable to combat climate change hazards; 3) The application of LED is more likely to be the most appropriate approach to adapt climate change; 4) Applying LED is not the only proper answer to climate change but also to improve solving the social-economic problem and sustainable development.

Table 4: Hypotheses testing relatives to research questions and methodologies

Hypotheses	Research Questions	Research methodologies	Research Tools	Chapter	Testing of Hypotheses
Why the local economic development is the best approach to achieve the development in the regions, adapting climate change hazards?					
There is a higher likelihood that Egyptian institutional/ governor systems have not been ready for handling the complexity of climate change hazards.	What are the kinds and types of climate change hazards in Egypt?	Deductive	Theory& Operationalization	2.1 2.2	Partly Approved
There is likelihood that Egypt has no LED policies currently applicable to combat climate change hazards.	What are the local economic development policies that provide the competitiveness?	Deductive	Theory& Observation	2.3	Approved
The application of LED is more likely to be the most appropriate approach to adapt climate change.	How to develop the LED process to achieve a real development in the regions?	Comparing case studies	Operationalization	5.1	Approved
Applying LED is not the only proper answer to climate change but also to improve solving the social-economic problem and sustainable development.	How conceived policies can deal with the current development and planning limitations of the Egyptian contexts?	Analytical	Observation	5.2 5.3	Partly Approved

Source: The author's edition

5. CONCLUSIONS AND RECOMMENDATIONS

Part five is the final part of the study, and it highlighted the summary, conclusions and recommendations of the work. It presented the summary and findings based on the objectives of the research. It further stated the policy interventions to adapt the climate change hazards in Egypt.

5.1. Climate change Hazards

Main concept/ policies of adaptation, mitigation is related to the issues in the region mainly the social issues fit more the adaptation concept, but the physical and environmental impact need mitigation approach to make a real effect to achieve the sustainable development.

Table 5: Climate change adaptation /mitigation polices related to the main issues

	Adaptation	Mitigation
Environmental		**Equitable emission targets** • Implies total emission cuts of 30% for developing countries. • Population changes would amount to per capita reductions in developing countries close to those suggested for developed countries. • Larger reductions, which are necessary to ensure that emissions are stabilized at a level that will prevent the global temperature from rising by more than 2˚ C, would leave developing countries with very little room to manoeuvre in terms of increasing their consumption of energy from traditional sources. **Energy transition** • it is responsible for over three quarters of total GHG emissions but is also inextricably linked to economic activity and the fulfilment of human needs. • The Agency maintains that "mobilizing all this investment will be challenging". **Consumption and emission targets** • Using a product life-cycle approach, the environmental repercussions of producing various goods (such as GHG emissions) will need to be incorporated in the calculations of environmental pressures related to the consumption of these goods. Such assessments will have a bearing on the calculation of equitable targets. • Developed countries will become increasingly service-oriented, shifting away from high-emission industries such as iron, steel, aluminium, chemical, glass, and paper production. "Outsourcing" the production of fossil-fuel-intense, high-emission goods to developing countries has been occurring for some time.
Socio-economic	**Poverty and adaptation** • more equitable distribution of economic growth, access to resources, greater equity between genders and social groups, and increased participation in local decision-making (especially by the poor) **Local engagement and adaptive capacity** • resource availability and by access to social and economic networks, entitlements, institutional support, education and technology- are unevenly distributed	**Investment approaches to mitigation** • countries will no longer have the option of following a traditional fossil-fuel-dependent development path • strong win-win possibilities for both developed and developing countries in terms of increased energy efficiency
Legal	**Policy integration and coherence at the national level** • integrated not only into development policy in general but also into policy areas such as	**Mitigation regimes** • the regulation of fuel portfolios as well as emission levels, economic incentives, technological support, and education

	poverty reduction, rural development, disaster risk management, water resources, health, and infrastructure investment	
Physical		**Forestry and land use** • large-scale shift in land use towards the production of biomass for fuel generation, as evidence suggests that there may be significant trade-offs related to food security and food prices. • Issues such as these highlight the importance of using an integrated approach to address challenges linked to climate change.

Source: The author's edition based on chapter 3.1

5.2. Climate change Hazards in Egypt

Climate change impacts through regional development policies target all regions and cities to support job creation, business competitiveness, economic growth, sustainable development, and improve citizens' quality of life. The government adopts its national policies and measures, since these are vital for the protection of existing investments, and simultaneously secures growth and sustainable development.

Related to the National Strategy, it aims to 1) Increasing the flexibility of the Egyptian community in dealing with the risks and disasters; 2) Enhancing the capacity to engage and contain climate-related risks and disasters for adapting temperature increase and water scarcity, and the precipitation and sea level rise; and 3) Reduction of climate change- related disasters; field and theoretical observing the different sectors of the community, appropriate support of the existing projects, locations and designs for new projects.

According to the main environmental issues in Egypt, they are 1) Confusion in the Legal Framework Governing Planning for Regional Economic Development; The legal basis for planning in Egypt stems from two key laws: 1. Planning Law No 70 for the year 1973: The national socioeconomic plan; 2. Strategic Planning According to the building Law No 119 for the Year 2008: The Strategic Plan; 3. The National Centre for Planning State Land Uses (Presidential decree number 153 for the year 2001): Counting and reforming the state lands and preparing the general planning; and 2) Weak Institutional Relationship Between Public Research Institutions and Universities and Regional and Local Actors Engaged in Economic Development; According to the Local Administration Law, the governor shall act to support cooperation between the governorate institutions and universities and research institutes which are located within the governorate area, to serve the environment and promote the local society. However, the governor role in practice is very limited in the economic development at the local level that efforts are predominately either executed at or planned by the central level.

Sectoral impacts of climate change: Climate change - with its many dimensions (social, environmental, economic and political) - is expected to lead to multiple impacts at various scales and levels. The impacts on natural ecosystems will be reflected on all socioeconomic levels, affecting livelihoods and human well-being. The prevailing climatic conditions in the Arab region have highly significant impacts on the different components of the ecosystems. Major impacts could be attributed to the inherent fragility of the dominating arid ecosystems of the region. These arid ecosystems are generally characterized by inferior physiochemical properties, the weak resilience of soil resources and relatively limited availability of surface/ground-water resources. According to administration levels and their relation to adopt the climate change hazards, the following Table .5 illustrate how could adaptation policies work by the regions.

Table 6: Adaptation policies for climate change hazards along economic regions

Region	**Climate Change Adaptation Policies**		
	Water resources	**Agriculture and food security**	**Sea level rise, coastal inundation and erosion**
1) Cairo	– Water recycle usage for garden irrigations		
2) Alexandria	– Water recycle usage for garden irrigations		– Rocky barriers, sea walls, wave barriers – Beach maintenance
3) Delta	– New irrigation techniques – Water recycle usage	– Use different water resources – Develop the crop cycles – Use the new agriculture techniques	– Rocky barriers, sea walls, wave barriers
4) Suez Canal	– Water recycle usage for garden irrigations		– Rocky barriers, sea walls, wave barriers
5) Northern Upper Egypt	– New irrigation techniques – Water recycle usage	– Use different water resources – Develop the crop cycles – Use the new agriculture techniques	– Create bumpers in the highlands
6) Asyout	– New irrigation techniques – Water recycle usage	– Use different water resources – Develop the crop cycles – Use the new agriculture techniques	
7) Southern Upper Egypt	– New irrigation techniques – Water recycle usage	– Use different water resources – Develop the crop cycles – Use the new agriculture techniques	– Create bumpers in the highlands

Source: The author's edition based on chapter 3.2

5.3. Local Economic Development

As mentioned, LED stakeholders should believe that climate change activities have a potential for economic development. Therefore, the stakeholders should support mitigation and adaptation initiatives contribute to local economic development. As they uphold the potential of mitigation and adaptation initiatives. Additional qualitative data should be obtained through stakeholder interviews. For example, 1) Mitigation and adaptation initiatives were both perceived as a potential for economic development by all stakeholders; 2) Stakeholders of the same stakeholder group did

not differ between the perceived potential for mitigation and adaptation; 3) LED consultants perceived the potential for adaptation higher than other stakeholder groups; 4) Stakeholders within the energy sector did not distinguish between mitigation and adaptation; 5) LED consultants did not care about distinguishing mitigation from adaptation initiatives as long as they contribute to the objectives of LED; 6) Mitigation and adaptation were considered to have an impact on job creation, skills development, and inventiveness; and 7) Stakeholders could identify the economic development potential for mitigation more easily than for adaptation.

5.4. Case studies

There are three main categories for the case studies related to the urban/physical status. Therefore, the settlement scale are two main domains which are the rural communities and the urban areas, and for the larger scale and different connections land use change would be the related response.

5.4.1. Rural communities

The main focus highly dependent upon natural resources, face particular obstacles in responding to climate change that increase their vulnerabilities to its impacts. Therefore, Climate change planning requires a shift from a "predict-then act" approach to a "no regret" approach. It requires an understanding of vulnerabilities and investments in resilience. The vulnerability of communities to climate change must be considered within a wider socio-economic context. Because climate change can change over decades, socio-economic change can have a larger impact on communities in a much shorter period of time, potentially reversing a vulnerable environment. It is essential for climate change vulnerability assessments to analyse socioeconomic dynamics.

5.4.2. Urban Areas

Two main points related to the climate change adaptation into the urban areas are: 1) Within discussions on climate change adaptation, there is too much focus on trying to calculate the funding needed for adaptation without recognizing the political and institutional constraints on adaptive capacity and without discussing the institutional mechanisms to get the needed funding for adaptation to those who can use it well – including community-based or grassroots-led initiatives. 2) Almost all adaptation is local and, to be effective, needs strong local knowledge and strong local adaptive capacity. Certainly, for urban areas, there need to be CAPAs and, very often, smaller-scale LAPAs – especially for the settlements or areas most at risk. These, in turn, can also promote learning and innovation on how public policies and investments can work best with community-

based adaptation. They also provide the practical experience on which NAPAs can be much improved**….those systems are often connected to rural locations at great distance from urban centre.**

5.4.3. Land use and land cover change

There are two aspects to considering impacts of land use: effects of land use on climate change and the effects of human-induced climate change on land use. The direct ecological effects of the land-use and climate change are dominated by the land-use change effects, at least over the period of a few decades. Because climate-change effects are largely determined by land-cover patterns, land-use practices set the stage on which climate alterations can act. Determining the effects of climate change on land use involves resolving direct biophysical effects as well as management responses to climate impacts. Climate change might constrain or mandate particular land- management strategies (e.g., irrigation); however, these options will be different for each case.

5.5. Egyptian Climate Change Adaption Index (ECCAI)

According to the previous calculations and the scattered diagram for the Egyptian governorates are distributed as follow: Red (Upper Left) Quadrant (Greatest challenges and urgency to act): Behara; Yellow (Lower Left) Quadrant (Few present challenges, have time to get ready): Kafr EL Sheikh, Assiut, Fayoum, Minia, and Qena; Blue (Upper Right) Quadrant (Have great challenges, but are adopting solutions): Cairo, Giza, Alexanderia, Qalyubiya, and Gharbyah; Green (Lower Right) Quadrant (Well positioned with few challenges): Menofya, Sharqiyah, Aswan, Port Said, Damietta, Red Sea, Ismailia, Suez, Bani Swaif, and Luxor; and Grey Some data are missing, For the governorates North Sinai, South Sinai, Matroh, New Valley Their values were not fully presented especially for the readiness indicators.

5.6. Egyptian Framework recommendations

Hybrid the ECCAI into the strategic plan framework to enhance the vision and built-up reliable scenarios dealing with the stakeholders to activate Local Economic Development principles.

6. NEW SCIENTIFIC FINDINGS AND THEIR UTILIZATION

The study finds that there are advanced developments in climate hazards modelling where scholar is performing extremely well in expressing new skills in finding sustainable solutions. On the other hand, policy makers are at advanced stages with coming up with the best policies for mitigating and adapting these hazards. Albeit of these developments, a wide gap exists between the two groups. Reducing the nature of the gap between policy makers and researchers or scientists is a plausible pathway towards sustainable climate change hazards adaptation. Therefore, this study recommends the adoption of transdisciplinary approach towards climate change hazards adaptation through adoption of measures that transcends beyond the respective disciplines and specializations to ensure a hybrid-model for solving the hazards is arrived at and designed.

6.1. New Scientific Achievements/Observations

6.1.1. Developing the climate change policies implementations for adaptation

- Proposed future directions in exploring the interactions between land-use change and climate change.

  1) Transdisciplinary studies of land-use and climate-change effects are necessary. For example, economic, political, and social changes must consider ecological responses, and vice versa. Also, biologists need to work with climatologists to develop climate models at spatial scales that are useful in assessing the state of the biotic system. Scientists need to be aware that many problems are not solvable based on a single-discipline approach.

  2) Spatially explicit models at local and regional scales are necessary to relate land-use changes to climate change. Many management questions are at the landscape or regional scale, and land management tends to occur at these scales. If these models have biologically relevant and socioeconomically meaningful interfaces and outputs, then these models can meet many of the management needs.

- Proposed new climatic and ecological inputs into the developmental process, the strategic plan framework updates.
- Developed the adaption index to classify the Egyptian governorates based on ECCAI. As shown in the following figure

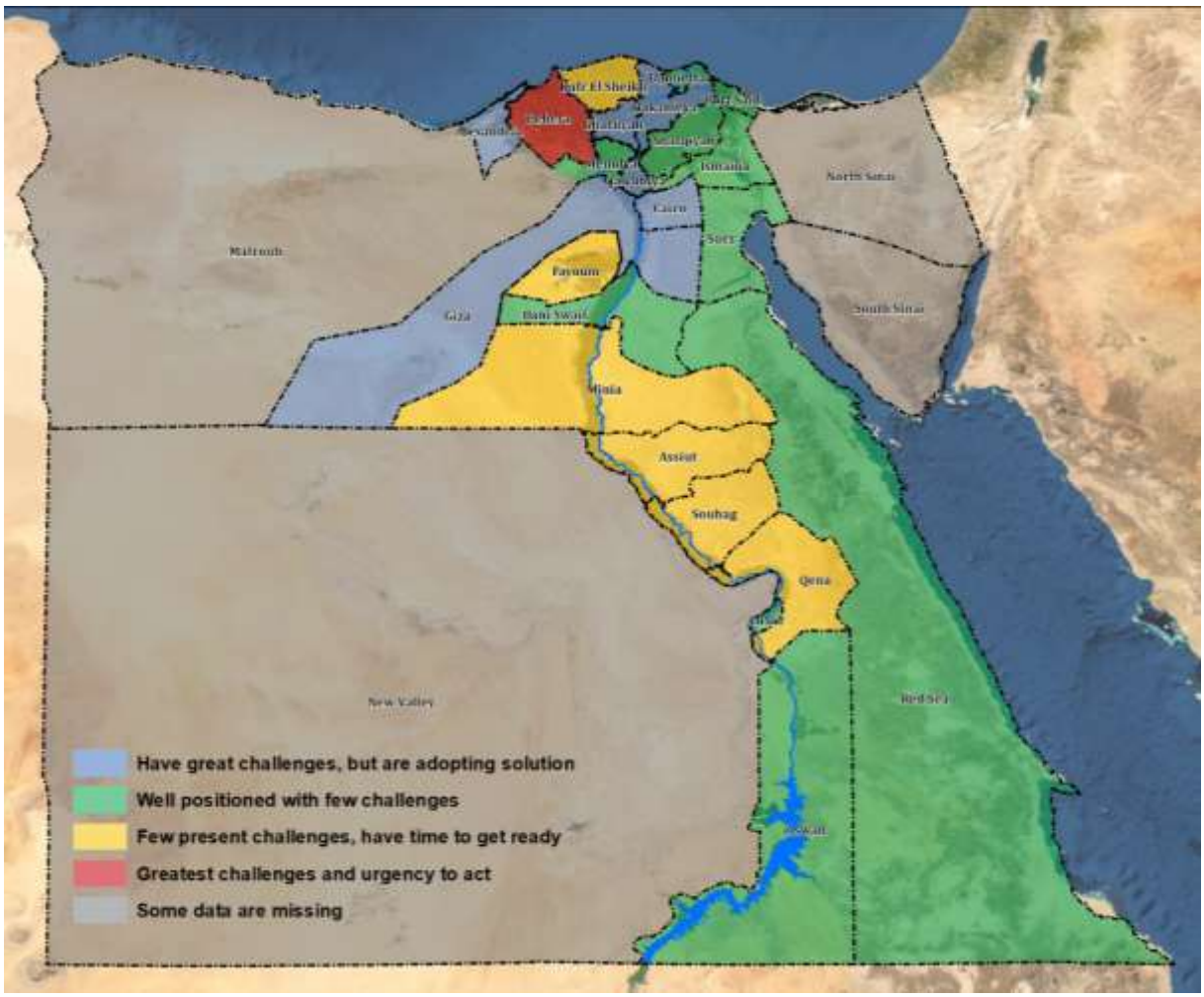

Figure 9 Egyptian adaption index visualisation on the governorate level
Source: Author's edition made by GIS 10.7

6.1.2. Developing the tasks of the executive institutions Sector

- Establishment of strong and joint cross-sectoral taskforces for developing and editing the plans methodology for implementing the new economic projects and their allocation based on the climate change adaptation policies.
- Information needs to be collected on how climate change (as compared to other confounding factors, e.g., land-cover change) will affect.
  - The spatial distribution of natural vegetation (particularly rare species or those at the edges of their ranges), human population, land-use practices, and land-cover types.
  - The distribution of natural and human-induced species movements (including movements of humans).
  - The distribution and frequency of disturbances (e.g., hurricanes, tornadoes, fires, and insects) and the responses of organisms to disturbance.
  - Changes in patterns of economic growth and the resulting need for land-use change (e.g., for agricultural expansion).

- There is a need for developing a framework embracing for open sharing if the collected climate data for the different stakeholders and experts and the public. This will increase the reliability, accessibility and availability of the information.
- Establishing a multiagency governorate teams for monitoring, reading and validation of the climate change adaptation in line with the general development agenda remains imperative for the whole Egypt in pursuit for achieving SDGs.

6.1.3. Developing the higher education

- Develop some courses and curriculums for the ecological planning, hazards management, and economic approaches to adapt climate change hazards.
- Focus on the local communities and stakeholders power techniques, Scientists need to assist policy makers, stakeholders, and the public by:
  - Providing information linking climate change and land use.
  - Defining what climate change would mean (in an ecological, social, health, political, and economic sense); and
  - Relating people's lifestyles and energy choices to environmental consequences (e.g., demonstrating the effects of automobile and other energy use on climate change, pointing out the repercussions of local and regional land-use activities on the global environment, and identifying the per capita impact of human population and consumption).

6.2. Policy Implications and Recommendations

To achieve the Paris Agreement together with the SDGs, countries must accelerate their level of commitment whether at the National, regional, or local level. This is achievable through establish of government mechanisms those shall oversee a coherent development and climate change hazards control framework in place. A framework that is defined by sustainability at its core. To develop such a framework, interdisciplinary research is not enough especially in those issues that interferes with different stakeholders' interests. Therefore, in coming up with sustainable policy directions and guidelines territorial development, adopting a transdisciplinary approach would be a potential solution for future developers.

6.3. Future Research areas (Fundamental research)

- Relation between causes of land-use and actual land-cover changes-How can the causes and effects of these relations be clarified?
- Paleoecology-How have species and ecosystems responded to climate changes in the past? Note that predicted changes are different from past climate alterations.

- Agriculture- What are best land-use practices on tropical and temperate soils? Can use of native species offset climate-change effects on agriculture? Can use of species from warmer environments offset effects of temperature increases?
- Testing the stakeholders and the expertise knowledge in the applicable adaption policies in different settlements status.

7. SUMMARY

Climate change as an additional stress is threatening habitats, ecosystems and land globally. The effects of climate change are projected to have adverse effects on developing countries and Egypt in not an exception. Additional to the current global situations concerning the impacts of long-term climate variability and extreme weather events, continued heatwaves and increasing sea level rise are dominating across Egypt. The Paris Agreement (2015) delineates the importance of GHGs emissions mitigation and adaptation measures, which should be officially implemented by 2020. Egypt is among the pioneer countries that ratified the accord in its preliminary stages. This was a significant milestone in committing towards combating climate change across the country. Despite, Africa being rated the least among the continents contributing to the atmospheric pollution, it continues to be responsible for the least global emissions (estimated at 4%). Although they contributed to anthropogenic emission slightly, Egypt and the rest of the continent are highly vulnerable to the impacts of long-term climate variability and extreme weather events. Increased water shortages, changing rainfall patterns, sea level rise, desertification and frequent heatwaves are some of the challenges associated with climate change presently being experienced across Egypt putting the countries development path at risk.

Considering the vulnerability of climate change hazards and its massive contribution to the socio-economic development of many nations including Egypt. The research tries to provide some applicable proactive policies which can deal with one of the most difficult problems in the future by developing countries in general and for Egypt in practice. The problem concerns the threats that climate change might have to developing countries' development potentials and natural resources. The purpose of the study was to invent a LED policies and projects for providing an adaptation and allocating them spatially, this has the ability to monitor and deals with the climate change on the regional level in Egypt. Specifically, the study aimed at: Defining the relation between the LED policies and the climate change hazards; Studying the applicability of the LED policies on the climate change hazard and regional development; Studying international case studies dealing with climate change adaptation; and Testing the efficiency of the policies within the limitation of the Egyptian context. The research has state four hypotheses: 1) The application of LED is more likely to be the most appropriate approach to adapt climate change; 2) Applying LED is not the only proper answer to climate change but also to improve solving the social-economic problem and sustainable development; 3) There is likelihood that Egypt has no LED policies currently applicable to combat climate change hazards; and 4) There is a higher likelihood that Egyptian institutional/ governmental systems have not been ready for handling the complexity of climate change hazards.

According on that, the main adaptation and mitigation policies are related to the issues in the region mainly the social issues fit more the adaptation concept, but the physical and environmental impact need mitigation approach to make a real effect to achieve the sustainable development. However, Climate change impacts through regional development policies in Egypt target all regions and cities to achieve general development goals and objectives. The government adopts its national policies and measures, since these are vital for the protection of existing investments, and simultaneously secures growth and sustainable development. The National Strategy aims at achieving the following goals: 1) Increasing the flexibility of the Egyptian community in dealing with the risks and disasters; 2) Enhancing the capacity to engage and contain climate-related risks and disasters for adapting temperature increase and water scarcity, and the precipitation and sea level rise; and 3)Reduction of climate change-related disasters; field and theoretical observing the different sectors of the community, appropriate support of the existing projects, locations and designs for new projects.

For the environmental issues in Egypt, Clarify the planning approach that will be adopted at the regional level: The different institutional actors, will have different roles in the planning process. The reforms' goal to lead the planning for economic and urban development, in accordance with the state general policies and a framework for regional planning drafted by the central government. Climate change - with its many dimensions (social, environmental, economic and political) - is expected to lead to multiple impacts at various scales and levels. The impacts on natural ecosystems will be reflected on all socioeconomic levels, affecting livelihoods and human well-being. Major impacts could be attributed to the inherent fragility of the dominating arid ecosystems of the region. These arid ecosystems are generally characterized by inferior physiochemical properties, the weak resilience of soil resources and relatively limited availability of surface/ ground-water resources.

LED stakeholders should believe that climate change activities have a potential for economic development. Thus, the stakeholders should support adaptation initiatives contribute to local economic development. Additional qualitative data should be obtained through stakeholder interviews as: adaptation initiatives were both perceived as a potential for economic development by all stakeholders; that the energy sector did not distinguish between mitigation and adaptation; Most of them rated the potential based on a gut feeling rather than on knowledge; they could identify the economic development potential for mitigation more easily than for adaptation; Stakeholders believed that fire management, replacing flaming light bulbs with energy efficient lighting systems and solar power usage have the highest potential for economic development; LED consultants perceived the potential for adaptation higher than other stakeholder groups; both of them with a background in the energy sector provided more qualified answers; The generally high

ratings suggested that stakeholders overrated the economic potential and did not differentiate much between initiatives; and that rating was based on the stakeholders' level of knowledge, their priorities, and especially their personal motives and experiences.

There are three main categories for the case studies related to the urban/physical status. Therefore, the settlement scale are two main domains which are the rural communities and the urban areas, and for the macro scale and different connections land use change would be the related response. Rural communities are mainly focus highly dependent upon natural resources, face particular obstacles in responding to climate change that increase their vulnerabilities to its impacts. And for the urban areas that inappropriate to conceive of "the problem" as mainly one of a lack of funding. And those systems are often connected to rural locations at great distance from urban centre.

Land-use changes are having major ecological repercussions at a variety of biological scales. Being able to project effects of particular land-management strategies requires an understanding of the socioeconomic and biological aspects of land-use decisions. Such research will involve interdisciplinary efforts and will provide a better understanding of potential impacts of global change. The study finds that there are advanced developments in climate hazards modelling where scholar is performing extremely well in expressing new skills in finding sustainable solutions. Therefore, this study recommends the adoption of transdisciplinary approach towards climate change hazards adaptation through adoption of measures that transcends beyond the respective disciplines and specializations to ensure a hybrid-model for solving the hazards is arrived at and designed. And the study has examined the adaption index by calculating the ECCAI on Egyptian governorate level, and combine the results to update the strategic plan framework.

Proposed future directions in exploring the interactions between land-use change and climate change. 1) Transdisciplinary studies of land-use and climate-change effects are necessary to develop climate models at spatial scales. 2) Spatially explicit models at local and regional scales are necessary to relate land-use changes to climate change. Many management questions are at the landscape or regional scale, and land management tends to occur at these scales.

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